

CUMBERLAND COUNTY IMPROVEMENT AUTHORITY

745 Lebanon Road • Millville, NJ 08332

ISSUED FOR BID

NJ STATE POLICE BARRACKS BUILDING COMMERCIAL TOWNSHIP, NJ

MARCH 6, 2024 1:00 P.M.

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INVITATION TO BID NOTICE TO CONTRACTORS

The Cumberland County Improvement Authority ("Authority") shall receive sealed bids at 745 Lebanon Road, Millville, New Jersey 08332 until 1:00 P.M. on Wednesday, March 6, 2024, to be publicly opened, and read aloud for:

NJ STATE POLICE BARRACKS BUILDING COMMERCIAL TOWNSHIP, NJ

There will be a Pre-Bid Meeting for all interested Contractors at 2:00pm, Wednesday, January 24, 2024, at the Cumberland County Improvement Authority, 745 Lebanon Road, Millville, New Jersey 08332.

Bids must be submitted on the standard Bid Proposal form provided by the Authority in the manner designated and must be enclosed in a sealed envelope bearing the title of the bid, name and address of the Contractor on the outside; addressed to Cumberland County Improvement Authority, **NJ STATE POLICE BARRACKS BUILDING** and delivered to the above address at the date and time set at the place herein. The Cumberland County Improvement Authority is not responsible for any hand delivered or third party delivered bids that do not arrive at the proper time or location. Any such bid will be returned unopened to the vendor. All documents contained in this package must be returned to the Cumberland County Improvement Authority in their original form. No substitutions, alterations, or modifications of any of the bid documents are permitted.

The Cumberland County Improvement Authority requires that a Contractor submit with his/her bid, a bid guarantee in the form of a bid bond, certified check, or cashier's check in the amount of ten percent (10%) of the bid. In no case shall the bid guarantee exceed twenty thousand dollars (\$20,000). Bid bonds shall be from a surety company licensed to do business in the State of New Jersey. Bonds that are signed by an Attorney-in-Fact shall be accompanied by a certified Power-of-Attorney. - *Failure to include this item will mandate rejection of bid*.

Drawings and Specifications (electronic format only) can be obtained from http://www.theauthoritynj.com/bidportal, the website of the Cumberland County Improvement Authority upon a non-refundable payment as indicated on the site listed above. Select the "My Quest Account" menu to find the sign-in and registration page. The fee noted above is to be paid within the website portal. Documents will be available beginning Wednesday, January 10, 2024. Questions regarding the bid must be made via e-mail to Ryan Feaster at rfeaster@theauthoritynj.com Subject: NJ State Police Barracks Building. All questions must be received no later than 1:00 P.M. Wednesday, January 31, 2024.

The Contractor also will be required to submit performance security, in the form of a Performance Bond, in an amount equal to one hundred percent (100%) of the total value of the Contract. At the time of bid submission, all Contractors will be required to submit a Consent of Surety indicating that such surety will provide the Performance Bond if the Contractor is awarded a contract.

No bid may be withdrawn for a period of sixty (60) days after the date set for the opening thereof.

This bid is being solicited through fair and open process in accordance with the requirements of N.J.S.A. 19:44A-20.4, and shall be in conformance with the applicable requirements of the "Local Public Contracts Law," N.J.S.A. 40A:11-1 et seq.

The Contractor will be required to comply with requirements of N.J.S.A. 10:2-1 (Anti-Discrimination in Employment), N.J.S.A. 10:5-31 et seq. and N.J.A.C.17:27 et seq. (Equal Employment Opportunity), 42 U.S.C. §

12101 et seq. (Americans with Disabilities Act), N.J.S.A. 52:32-44 (New Jersey Business Registration), and N.J.S.A. 52:25-24.2 regarding the submission of a list of all Stockholders, Members or Partners owning more than ten percent (10%) stock or interest in their Corporation, Limited Liability Company or Partnership. All Contractors are placed on notice that they are required to comply with all requirements of P. L. 1975, Chapter 127 and N.J.A.C. 17:27.

All Contractors and subcontractors must provide a copy of their State of New Jersey Business Registration Certificate issued by the New Jersey Department of Treasury prior to the time a contract is awarded or authorized.

Contractors shall not submit bids with qualifying conditions or provisions.

The Authority reserves the right to consider the bids for sixty (60) days after receipt thereof, and further reserves the right to reject all bids, waive minor informalities, in accordance with applicable law.

Pursuant to P.L. 2021, c. 301, all Contractors are hereby notified that which this contract is for a public work subject to the provisions at N.J.S.A. 34:11-56.25 et seq., the New Jersey Prevailing Wage Act (PWA), and accordingly, the person or entity who makes the lowest bid for the contract by at least 10 percent under the amount of the next lowest bid shall, prior to award of the contract, be required to certify to the public body on a form prescribed by the Commissioner of the Department (Commissioner) that the prevailing wage rates required by the PWA shall be paid in performing the work under the contract. Further, if this bidder does not provide the certification on the form prescribed by the Commissioner prior to the award of the contract, the Authority shall award the contract to the next lowest responsible and responsive bidder.

In order to encourage full participation in this opportunity, submit any requests for accommodations of people with disabilities to the Cumberland County Improvement Authority (856) 825-3700. People who are deaf, hard of hearing and/or speech impaired should access this service by contacting the NJ Relay Service at 1-800-852-7899-(TTY).

BY ORDER OF THE CUMBERLAND COUNTY IMPROVEMENT AUTHORITY CUMBERLAND COUNTY, NEW JERSEY

Gerard Velazquez, III President/CEO

INSTRUCTIONS TO CONTRACTORS

1.1 THE BID

- A. The Cumberland County Improvement Authority is soliciting sealed bid proposals from companies interested in providing the services contained herein for the construction of NJ STATE POLICE BARRACKS BUILDING, in accordance with the terms of these bid specifications and N.J.S.A. 40A:11-1 et seq. and any amendments thereto. Bids will be received at the location and by the time and date indicated on the Notice to Contractors. Bids shall include (1) original and (1) copy with no staples. Original should be stamped: ORIGINAL.
- B. Before submitting a Proposal, the Contractor shall become familiar with the Drawings, Specifications and other documents that will from the Contract, shall investigate the site of the Project and make such examination thereof as may be necessary to determine the character and amount of work involved. It shall also determine that it can secure the necessary labor and equipment and that the materials it proposes to use will comply with the requirements specified therein and can be obtained by it in the quantities and at the time required.
- C. The Authority reserves the right to accept, reject and waive any minor informalities in the bid or reject all bids including Alternate Bids, if any, pursuant to N.J.S.A. 40A:11-13.2. Any bid received after the time and date specified will not be considered. No bidder shall withdraw a bid within sixty (60) days after actual date of the opening thereof.
- D. The Bid Documents include the Bidding Requirements and the proposed Contract Documents. The Bidding Requirements consist of the Notice to Contractors, the Instructions to Contractors, any Supplementary Instructions to Contractors, the Proposal Forms and any other sample bidding and contract forms included or referenced in the Specifications. The Contract Documents consist of the form of Agreement between the Authority and Contractor, Conditions of the Contract (General, Supplementary and any other Conditions), the Drawings, Specifications and all Addenda issued during the bidding period. A copy of all documents indicated as mandatory on the Bid Document Checklist, attached hereto as Exhibit A1, are required to be included in the Bid Proposal.
- E. Bid Documents, Drawings and Specifications can be obtained electronically under the Public Information tab on the website of the Cumberland County Improvement Authority, http://www.theauthoritynj.com/bidportal upon a non-refundable payment as indicated on the website. Bidders shall access the website, select the 'My Quest Account' menu to find the sign-in and registration page. The fee noted above is to be paid within the website portal.
- F. At the time of the opening of bids each Contractor will be presumed to have inspected the site and to have read and to be thoroughly familiar with the Bid Documents and Drawings and other Contract Documents, including all Addenda and Bulletins. The failure or omission of any Contractor to receive or examine any form, instrument or document or to visit the site and acquaint itself with conditions there existing, shall not relieve any Contractor from any obligation with respect to its bid.

1.1 CHANGES TO THE BID SPECIFICATIONS

- A. Notice of revisions or addenda to the advertisements or bid documents relating to bids will be advertised, no later than seven (7) days, Saturdays, Sundays and Holidays excepted, prior to the date for acceptance of bids, and will be published on the website of the Cumberland County Improvement Authority.
- B. During the bidding period, the Authority may furnish Addenda for additions to or alterations of the drawings and specifications, which shall be included in the work covered by the Proposals. Addenda will be published on the website of the Cumberland County Improvement Authority, not later than seven (7) days (Saturday, Sundays and holidays excepted) before Bid opening, however, the CCIA shall not be responsible for the failure of delivery to any one Contractor. It shall be the responsibility of the Contractor to ascertain that it has received all Addenda issued prior to submitting its bid.
- C. All Addenda issued, whether or not received or examined by the Contractor, are part of the Bid Documents, and will be binding on the Contractor as though originally incorporated in the Bid Documents. Failure of the Contractor to receive or examine any Addendum shall not relieve the Contractor from any of the requirements of the Documents.
- D. The Contractor shall carefully study the Bid Documents and compare them with each other, shall examine the Project site and local conditions and shall immediately report to the Authority in writing any errors, inconsistencies and ambiguities discovered.
- E. No oral interpretations will be made to any Contractor as to the meaning of the Bid Documents, drawings or specifications. Questions regarding the bid must be made via e-mail to the address and by the time and date indicated on the Notice to Contractors.
- F. The Authority shall respond to inquiries received by the question deadline date in writing. No inquiry received after the question deadline date will be given consideration. Interpretations made to a Contractor will be in the form of an Addendum which, when issued, will be sent promptly to all persons to whom the drawings and specifications have been issued. If no response is provided to a submitted question Contractors shall assume that no change to the Bid Documents is considered necessary or desirable in response to the question.
- G. Bids are requested on the items stated in the Bid Proposal Form for the project. The prices shall cover all cost of any nature incidental to and growing out of the work. In explanation, but not in limitation thereof, these costs shall include the cost of all work, labor, materials, equipment, transportation, and all else necessary to perform and complete the project in the manner and within the time required, all incidental expenses in connection therewith, all costs on account of loss by damage or destruction of the project, and any additional expenses for unforeseen difficulties encountered, for settlement of damages and for replacement of defective work and materials. Conditions, limitations or provisions attached to the proposal by the Contractor may cause its rejection. Any changes, whiteouts, strikeouts, etc. in the bid must be initialed in ink by the person signing the bid

2. BID SUBMISSION REQUIREMENTS

2.1 BID PROPOSAL

A. Each document in the Bid Proposal must be properly completed in accordance with these bid specifications. No Contractor shall submit the requested information on any form other than those provided in these specifications. Bid Proposal Form and all required forms (as noted on Bid Document Checklist) are supplied herewith. They shall be returned in sealed envelopes addressed to the location and by the time and date indicated on the Notice to Contractors.

- 1. The envelope shall bear on the outside the name of the Contractor, its address and their license number, if applicable. If forwarded by mail, the sealed envelope containing the bid must be enclosed in another envelope addressed to the Authority. Bid Document pages are not to be stapled or bound together.
- 2. The Authority accepts no liability for bids opened in error due to absence of such notation.
- B. One (1) original and one (1) copy with no staples of all Bid Proposals shall be hand delivered or mailed in a sealed envelope, and the name and address of the Contractor and the name of the Bid as set forth in the Public Advertisement for Bids must be written clearly on the outside of the sealed envelope. No Bid Proposal will be accepted past the date and time specified by the Cumberland County Improvement Authority in the Notice to Contractors.
- C. Each Contractor shall sign, where applicable, all bid submissions as follows:
 - 1. For a corporation, by a principal executive officer;
 - 2. For a partnership or sole proprietorship, by a general partner or the proprietor respectively;
 - 3. For a limited liability company by its Manager or authorized Members; or
 - 4. A duly authorized representative if:
 - i. The authorization is made in writing by a person described in paragraphs 1 and 2 above; and
 - ii. The authorization specifies either an individual or a position having responsibility for the overall operation of the business.
- D. Bid Proposals shall be submitted on the Bid Proposal Form furnished in the bid documents, properly filled out and duly executed. Bid Proposal forms shall not be altered or added to in any way. Lump Sum Bid or Base prices shall be filled in, in ink or typewritten in both words and figures. In case of discrepancy, the amount described in words shall govern. All blank spaces in the Bid Proposal Form must be filled out or completed by the Contractor. Incomplete spaces on the Bid Proposal Form may be reason for rejection of bid.
- E. Any Bid Proposal that does not materially comply with the requirements of the Bid Specifications shall be rejected as non-responsive.
- F. When the proposal is made by an individual, his post office address shall be stated, and he shall sign the proposal. When made by a firm or partnership or limited liability company, its name and post office address shall be stated and the proposal shall be signed by one or more of the partners or members, as appropriate. When made by a corporation, its name and principal post office address shall be stated, and the proposal shall be signed official of the bidder.
- G. Bids not based on the Bid Documents (including all Addenda issued), Bids containing a qualification or exception to the requirements of the Bid Documents, conditional or uninvited alternative Bids, Bids that are not complete or properly signed or submitted in accordance with the requirements of the Bid Documents and Bids containing an alteration of a form or irregularity of any kind shall be rejected.
- H. Bids may also be rejected for any of the following reasons:
 - 1. All bids pursuant to N.J.S.A. 40A:11-13.2.
 - 2. If more than one bid is received from an individual, firm or partnership, corporation or association under the same name.
 - 3. Multiple bids from an agent representing competitive bidders.
 - 4. The bid is inappropriately unbalanced.

- 5. The Authority determines the bidder is pursuant to N.J.S.A. 40A:11-4(b) Prior Negative Experience.
- 6. If the successful bidder fails to enter into a contract within 21 days after the Notice of Award or Notice to Proceed, Saturdays, Sundays and Holidays excepted, or as otherwise agreed upon by the parties to the contract. In this case, at its option, the Owner may accept the bid of the next lowest responsible bidder (N.J.S.A. 40A:11-24(b)).
- I. Each Bid shall include or be accompanied by:
 - Bid Security and Power of Attorney made payable to the Cumberland County Improvement Authority in the amount of ten percent (10%) of the Bid sum, but not to exceed \$20,000.00 Securities shall be either certified check, cashier's check, or Bid Bond by a surety licensed to conduct business in New Jersey.
 - i. A successful Contractor's bid security will be retained until the Contractor has signed the Contract and furnished the required Performance Bond(s) and Labor and Materials Payment Bond(s).
 - ii. The Authority reserves the right to retain the bid securities of the three (3) lowest responsible Contractors for up to three (3) days (Saturdays, Sundays, and holidays excepted) after the awarding and signing of the Contract with the successful Contractor and the approval of the Contractor's bonds or until sixty (60) days after Bid opening, whichever occurs first. All other bid securities will be returned within ten (10) days (Sundays and holidays excepted) after opening of Bids.
 - iii. If a Contractor fails to enter into a Contract and furnish the required bonds within (21) days after it has received notice of acceptance of its Bid, the Authority will retain that Contractor's bid security as liquidated damages, not as a penalty.
 - 2. Consent of Surety, in accordance with N.J.S.A. 40A:11-22, from a surety company licensed to conduct business in New Jersey, stating that it will provide the Contractor (or Subcontractor identified by the Contractor), if the Contractor is awarded the Contract, with the required Performance Bond and the required Labor and Material Payment Bond along with a surety disclosure statement and certification for each bond.
 - i. If the Contractor is awarded a Contract, performance and payment securities may be supplied by those individual Subcontractors on behalf of themselves and the Contractor, by the Contractor on behalf of itself and any or all of those Subcontractors, or by any combination thereof as long as the amount of the resulting Performance Bond(s) equals the total Contract Sum and the amount of the resulting Payment Bond(s) equals the total Contract Sum and all of these bonds name the Contractor as a principal. If the Contractor furnishes its Bonds covering itself and any subcontractor, only the Contractor need be named as a Principal.
 - ii. Any consent of Surety furnished by a proposed Subcontractor shall specify the dollar value of the Subcontractor's portion of the Work and shall name both the Contractor and the Subcontractor as the proposed principals.
 - iii. If the Contractor proposes to furnish bonds that cover both the Contractor and one or more of its Subcontractors, the Consent of Surety shall specify the dollar value of the Work covered and shall name the Contractor and cover the work of each Subcontractor included therein.
 - iv. The bonding company or companies shall be NJ Department of Insurance and Banking approved, shall have an A.M. Best Company rating of "A-" or better and meet all the requirements of N.J.S.A. 2A: 44-143.

- Subcontractor List Failure to identify on the Bid Proposal All subcontractors performing: (1) Steam and Hot Water Heating and Ventilating Apparatus, Steam Power Plants and all Kindred Work; (2) Electrical Work; (3) Plumbing and Gas Fitting and all Kindred Work; (4) Structural Steel and Ornamental Iron Work, shall be cause for the bid to be rejected. Failure to include this item will mandate rejection of bid
- 4. Non-Collusion Affidavit.
- 5. Disclosure Statement setting forth names and addresses of all stockholders, members or partners who hold ten percent (10%) or greater interest in any corporation or partnership or limited liability company bidding on the Project, in accordance with N.J.S.A. 52:25-24.2.
- 6. A letter from the Contractor's insurance company stating that if the Contractor is awarded the Contract the insurance company will, within ten (10) days of award, furnish the Contractor with a policy or policies of insurance of the types and in the amounts required by the Contract.
- 7. If applicable, Contractors acknowledgement of receipt of any notice(s) or revision(s) or addenda to an advertisement, specifications of bid document(s).
- 8. Such other items as set forth in the Bid Proposal Form or Contractors checklist.

2.2 BID GUARANTEES

- A. Bid Guarantee in the form of a Bid Bond, Cashier's Check or Certified Check, made payable to the Cumberland County Improvement Authority in the amount of ten percent (10%) of the bid, not to exceed twenty thousand dollars (\$20,000) must accompany each Bid Proposal. In the event that a Contractor to whom the Contract is awarded fails to enter into the Contract in the manner and within the time required, the award to the Contractor shall be rescinded and the bid guaranty shall become the property of the Cumberland County Improvement Authority. *Failure to submit a Bid Guarantee shall result in the rejection of the bid*.
- B. Pursuant to N.J.S.A. 40A:11-24, all Bid Guarantees, except those of the three apparent lowest responsible Contractors, will returned, unless otherwise requested by the bidder, within ten days after opening of bids, Saturdays, Sunday and holidays excepted. Within 3 days after the awarding of the contract and the approval of the Contractor's performance-payment bond, the bid security of the remaining unsuccessful Contractors will be returned, Saturdays, Sunday and holidays excepted.
- C. The Bid Guarantee shall be forfeited if Contractor fails to execute the Agreement and furnish the Payment and Performance Bond, as per N.J.S.A. 2A:44-147, along with a Surety Disclosure Statement and Certification for each bond and general Power of Attorney, with ten (10) days after notification of award of Contract. In the event of default and subsequent award to another Contractor, the Bid Guarantee will become liable up to its full amount for the difference between the amount of the bond in default, including Alternate Bids, which the Authority wished to accept and that amount for which the Authority is obligated on award to another Contractor, plus any additional expenses related thereto. To the extent that the Bid Guarantee does not satisfy the foregoing amount, Contractor shall be liable for the difference.

2.3 CONSENT OF SURETY

- A. Pursuant to N.J.S.A. 40A:11-22, Proposals shall be accompanied by a Consent of Surety in form as found in these documents, assuring that satisfactory arrangements have been made between the surety and the Contractor by which the surety agrees to furnish Contractor with a Payment and Performance Bond (Construction) as per N.J.S.A. 2A: 44-147, along with a Surety Disclosure Statement and Certification for each bond and General Power of Attorney, and Maintenance Bond. The Consent of Surety shall be executed by an approved surety company authorized to do business in the State of New Jersey or by the individual if an individual surety is being offered by the Contractor. The Surety Company must have a Best's rating of "A-" or better, and a Best's Financial Category of VII or larger, the minimum ratings and the financial size categories are those listed for the Surety Company in the most current issues of Best's Key Rating Guide, Property- Casualty, published by the A.M. Best Company, Oldwick, NJ.
- B. Pursuant to N.J.S.A. 40A:11-16(a)(3), Contractors submitting proposals for a Building Contract shall submit evidence of performance security simultaneously with the list of subcontractors. Evidence of performance security may be supplied by the Contractor on behalf of himself and any or all subcontractors, or by each respective subcontractor, or by any combination thereof which results in evidence of performance security equaling, but in no event, exceeding the total bid amount.

Failure to submit a Consent of Surety shall result in rejection of the bid.

2.4 CONTRACT BONDS

A. PAYMENT AND PERFORMANCE BOND: Contractor shall simultaneously with the delivery of the executed contract, submit an executed bond in the amount of one hundred (100%) percent of the acceptable bid as security for the faithful performance of this contract. The Payment and Performance Bond provided shall not be released until final acceptance of the whole work and then only if any liens or claims have been satisfied. The surety on such bond or bonds shall be a duly authorized surety company authorized to do business in the State of New Jersey pursuant to N.J.S.A. 17:31-5.

Failure to submit the Payment and Performance Bond with the executed contract shall be cause for declaring the contract null and void.

B. MAINTENANCE BOND: Upon acceptance of the work by the Authority, the contractor shall submit a Maintenance Bond (N.J.S.A. 40A:11-16.3) in an amount not to exceed one hundred (100%) percent of the project costs guaranteeing against defective quality of work or materials for the period of (2) Two years.

2.5 EXCEPTIONS TO THE BID SPECIFICATIONS

A. Any conditions, limitations, provisos, amendments, or other changes attached to or added by the Contractor to any of the provisions of these Bid Specifications or any changes made by the Contractor on the Proposal Forms shall result in the rejection of the Bid Proposal by the Cumberland County Improvement Authority.

2.6 SUBSTITUTIONS/MATERIALS

A. Whenever the Work Specifications identify a brand name, trade name or a manufacturer's name, this designation is used for classification or descriptive purposes only, and the Contractor may substitute an equal product, subject to the approval of the Cumberland County Improvement Authority.

- B. Variations between the goods and services described and the goods and services offered are to be fully identified and described by the bidder in accordance with the AIA[®] Document A201[™] 2017. Vendor literature WILL NOT suffice in explaining exceptions to these specifications. In the absence of any exceptions by the bidder, it will be presumed and required that the goods and services as described in the bid specification be provided or performed.
- C. It is the responsibility of the bidder to document and/or demonstrate the equivalency of the goods and services to be provided. The Authority reserves the right to evaluate the equivalency of the goods and services.
- D. In submitting its bid, the bidder certifies that the goods and services to be furnished will not infringe upon any valid patent or trademark and that the successful bidder shall, at its own expense, defend any and all actions or suits charging such infringement, and will hold the Authority harmless from any damages resulting from such infringement.
- E. Only manufactured products of the United States, wherever available, shall be used pursuant to N.J.S.A. 40A: 11 -18.
- F. The Contractor shall guarantee any or all goods and services supplied under these specifications. Defective or inferior goods shall be replaced at the expense of the Contractor. The Contractor will be responsible for return freight or restocking charges.
- G. Substitution Requests will not be reviewed during bidding. Bidders may include substitutions in their bid at their risk. The successful bidder shall submit substitution requests in accordance with the Contract Documents for approval of equivalency.

2.7 COMPLIANCE

A. The Contractor shall be familiar with and comply with all applicable local, state and federal laws and regulations in the submission of the Bid Proposal and, if the Contractor is awarded the Contract, in the performance of the Contract. These laws include, but are not limited to, N.J.S.A. 40A:11-1 et seq., and N.J.A.C. 5:34 and 7:26.

2.8 CONFLICT OF INTEREST AND NON-COLLUSION

A. The Contractor must execute and submit as part of the Bid Proposal a "Non-Collusion Affidavit."

Failure to submit a Non-Collusion Affidavit shall result in rejection of the bid.

2.9 NO ASSIGNMENT OF BID

A. The Contractor may not assign, sell, transfer or otherwise dispose of the Bid or any portion thereof or any right or interest therein. This Section is not intended to limit the ability of the successful Contractor to assign or otherwise dispose of its duties and obligations under the Contract provided that the Cumberland County Improvement Authority agrees to the assignment or disposition.

2.10 CONTRACT FORM

A. The form of agreement shall be the AIA^{\circ} Document A101TM – 2017 Form of Agreement, as amended.

2.11 PAY TO PLAY

A. All business entities are advised of their responsibility to file an annual disclosure statement of political contributions with the New Jersey Election Law Enforcement Commission (ELEC) pursuant to N.J.S.A. 19:44A-20.27 if they receive contracts in excess of \$50,000 from public entities in a calendar year. Business entities are responsible for determining if filing is necessary. Additional information on this requirement is available from ELEC at 888-313-3532 or at www.elec.state.nj.us.

2.11 PRIME CONTRACTS

- A. Pursuant to N.J.S.A. 40A:11-16, bidders must identify the subcontractors to whom it will subcontract the furnishing of:
 - 1. Steam and Hot Water Heating and Ventilating Apparatus, Steam Power Plants and all Kindred Work
 - 2. Electrical Work
 - 3. Plumbing and Gas Fitting and all Kindred Work
 - 4. Structural Steel and Ornamental Iron Work

Failure to include this item will mandate rejection of bid

3. AWARD OF CONTRACT

3.1 GENERALLY

- A. The Cumberland County Improvement Authority will award the Contract or reject all bids within the time specified in the Invitation to Bid, but in no case more than sixty (60) days after receiving the bids, except that the bids of any Contractors who consent thereto may, at the request of the Contracting Unit, be held for consideration for such longer period as may be agreed. All Contractors will be notified of the Authority's decision in writing.
- B. A written request for the withdrawal of a bid will be granted if received by the Authority before any bid has been opened. Upon proper request and identification, bids may be withdrawn as follows:
 - 1. At any time prior to the designated time for opening of bids.
 - 2. Provided the Proposal has not been accepted by the Authority, a bidder may request withdrawal of a bid, due to a mistake on the part of the bidder, within five business days after a bid opening.
- C. Unless a proposal is formally withdrawn, it shall be deemed open for acceptance until the Contract Agreement has been executed by both parties thereto or until the Authority manifests that he does not intend to accept the Proposal. Notice of acceptance of a Proposal shall not constitute rejection of any other Proposal.
 - 1. Award(s), if made, will be to the lowest responsive Contractor, including Alternate Bids, if any, which the Authority chooses to accept.
 - 2. Award made to a Contractor not a resident of the State is conditioned upon the Contractor designating a proper agent in the State on whom service can be made in the event of litigation.

- 3. If the successful Contractor is a corporation not organized under the laws of New Jersey, the award of Contract and payment of consideration thereunder shall be conditioned upon Corporation promptly filing a certificate of authorization to do business in the State of New Jersey pursuant to N.J.S.A. 14A:13-2 and complying with the provisions of N.J.S.A. 14A:13-4.
- 4. Whenever two or more bids of equal amounts are the lowest bids submitted by responsible Contractors, the Authority may award the Contract to any one of such Contractors in its discretion as it may determine is the most advantageous, price and other factors considered.
- 5. Any discrepancy between a numerical price and a price written in words shall be resolved in favor of the price as written in words. Any discrepancy between the unit price multiplied by the quantity and a corresponding total price figure set forth in the proposal form(s) shall be resolved in favor of a total price reached by multiplying the unit price by the quantity. The corrected total shall be used to determine the award of the Contract. After all Bid Proposals have been read, the bids will be tabulated and adjusted, if necessary, in accordance with this paragraph. If any mathematical corrections must be made on any Bid Proposal, then the Cumberland County Improvement Authority shall not award a contract until all tabulations are complete.
- 6. Note that no contract can be awarded to a Contractor appearing on the New Jersey Department of Labor and Workforce Development's list of contractors not paying prevailing wages until after the indicated date of expiration of the contractor's listing, in accordance with N.J.S.A. 34:11-56.37 and N.J.S.A. 34:11-56.38.
- 7. Contractor shall keep an accurate record showing the name, craft or trade and actual hourly rate paid to each worker employed by him in connection with the project. The record shall be preserved for a period of three years from the date of payment. Contractor shall further post the prevailing wage rates for each craft and classification involved in the project in prominent and easily accessible places at the site of work and at such other places as are used by employer to pay workers.
- 8. Before the Authority will make final payment, Contractor shall provide to the Authority a Payroll Verification Affidavit for each payroll period stating the wages then due to any and all workers for wages on account of the project. The affidavit shall certify that Contractor has paid wages in accordance with the Prevailing Wage Act.
- 9. The Contractor and its subcontractors awarded the Contract for the Project will be required to comply with:
 - i. New Jersey "Law Against Discrimination", N.J.S.A. 10:5-1 et seq. Contractors are required to comply with the requirements of N.J. P.L. 1975, c. 127.
 - ii. New Jersey Prevailing Wage Act, N.J.S.A. 34:11-56.27 et seq.
 - iii. Certification and submission of payroll records for each pay period, N.J.A.C. 12:60-5.1.
 - iv. Foreign product limitations, in accordance with N.J.S.A. 40A:11-18.
 - v. Public Works Contractor Registration Act, N.J.S.A. 34:11-56.48.
 - vi. N.J.S.A. 2C:21-34, et seq. governs false, fictitious, and fraudulent claims and misrepresentations fraudulent practices by Contractors. It is a serious crime for the

Contractors to knowingly submit a false claim and/or knowingly make a material misrepresentation.

- vii. N.J.S.A. 2C:27-10(a)-(b) provide a public servant commits a crime if, under color of office and in connection with any official act performed or to be performed by the public servant, the public servant directly or indirectly, knowingly solicits, accepts or agrees to accept any benefit, whether the benefit insures to the public servant or another person, to influence the performance of an official duty or to commit a violation of an official duty. A public servant commits a crime if, under color of office and in connection with any official act performed or to be performed by the public servant, the public servant directly or indirectly, knowingly receives any benefit, whether the benefit insures to the public servant or another person, to influence the performance of an official duty or to commit a violation of an official duty.
- viii. N.J.S.A. 2C:27-11, et seq. provides that a person (i.e. a Contractor) commits a crime if the person offers, confers or agrees to confer any benefit, whether the benefit insures to the public servant or another person, to influence a public servant in the performance of an official duty or to commit a violation of an official duty. A person commits a crime if the person, directly or indirectly, confers or agrees to confer any benefit not allowed by law to a public servant.
- D. Contractors should consult the statutes and regulations or legal counsel for further information.

3.2 NOTICE OF AWARD AND EXECUTION OF CONTRACT

- A. Award, if made, will be to the lowest responsible, responsive bidder. In such case where alternate bids will be considered, the low bidder will be determined based on the combined amount of the base bid plus the alternate bid, or bids, which will be included in the contract awarded.
- B. The Contractor to whom the contract is awarded shall be required to execute said Contract and obtain the Payment and Performance Bond and within ten (10) days from the date when the Notice of Award of Contract is delivered to the Contractor.
- C. The Authority, within seven (7) days of receipt of the Agreement signed by the party to whom the Agreement was awarded, shall sign the Agreement and return to such party an executed duplicate of the Agreement.
- D. The Notice to Proceed shall be issued within seven (7) days of the execution of the Performance Bond, Payment Bond and Agreement by the Authority. Should there be reasons why the Notice to Proceed cannot be issued within such period, the time may be extended by mutual agreement between the Authority and Contractor.
- E. Failure to deliver the documents as specified in the notice of award shall be cause for the Authority to declare the Contractor non-responsive and to award the Contract to the next lowest responsible Contractor.

3.3 RESPONSIBLE CONTRACTORS

A. The Cumberland County Improvement Authority shall determine whether a Contractor is "responsible" as defined in N.J.S.A. 40A:11-2(32). The Bid Proposal of any Contractor that is deemed not to be "responsible" shall be rejected.

3.4 PERFORMANCE BOND

- A. For the duration of the contract award, the successful Contractor shall provide a Performance Bond issued by a Surety in an amount equal to no more than one hundred percent (100%) of the total value of the Contract. The successful Contractor shall provide said Performance Bond concurrent with the delivery of the executed Contract to the Purchasing Agent at the address indicated in the advertisement. The Performance Bond for each succeeding year shall be delivered to the Cumberland County Improvement Authority with proof of full payment of the premium one hundred twenty (120) days prior to the expiration of the current bond.
- B. Failure to deliver a Performance Bond for any year of a multiyear contract one hundred twenty (120) days prior to the termination of the current bond will constitute a breach of contract and will entitle the Cumberland County Improvement Authority to terminate the Contract upon the expiration of the current bond. Notwithstanding termination pursuant to this Section, the Contractor is obligated to fully perform through the date of termination of the Contract and damages shall be assessed in an amount equal to the costs incurred by the Authority in rebidding or securing a contract including any increase in the contract amount.
- C. Failure to deliver the Performance Bonds at the time and place specified by the Cumberland County Improvement Authority shall be cause for the assessment of damages in an amount equal to the amount of the bid guarantee. In addition, the Authority may award the Contract to the next lowest responsible Contractor or terminate the bid process and rebid the project.

3.5 AFFIRMATIVE ACTION REQUIREMENTS

- A. If awarded a contract; the successful Contractor will be required to comply with the requirements of N.J.S.A. 10:5-31 et seq. and N.J.A.C. 17:27.
- B. For Maintenance/Construction Contracts, after notification of award, but prior to signing the contract, the Contractor shall submit to the public agency compliance officer and the Department of Labor and Workforce Development, Construction EEO Compliance Monitoring Program an Initial Project Workforce Report (Form AA-201) in accordance with N.J.A.C. 17:27-7. The Contractor shall also submit a copy of the Monthly Project Workforce Report (Form AA-202) once a month thereafter for the duration of the contract to the Department of Labor & Workforce Development, Construction EEO Compliance Monitoring Program, to the public agency compliance officer, and to the Owner. The Contractor shall also cooperate with the public agency in the payment of budgeted funds, as is necessary, for on-the-job programs for outreach and training of minorities and women.

4. GENERAL REQUIREMENTS

4.1 FEDERAL OCCUPATIONAL SAFETY AND HEALTH ACT OF 1970

A. The vendor or contractor guarantees that all materials, supplies and equipment as listed on any bid, request for proposal, quotation, contract or purchase order, furnished or delivered to the Authority meet the

requirements, specifications and standards as provided for under the Federal Occupational Safety and Health Act of 1970, as amended from time to time and enforced as of the date hereof.

4.2 SAFETY STANDARDS

- A. The bidder should be aware, if awarded the contract that they will be responsible for any and all subcontractors, as well as themselves, that they are required to comply with all applicable local, state and federal safety, health and environmental regulations, including provisions for protecting the Authority's employees and the public from construction hazards. Provide a copy of the Site-Specific Safety plan to the Owner.
- B. The Authority retains the right to have owner's safety representatives inspect any construction project taking place on the owner's property or through the owner's auspices. The Authority reserves the right to stop work if an imminent hazard exists. The costs, if any, created by a work stoppage due to unsafe conditions, will be borne by the contractor responsible for the unsafe condition.

4.3 AMERICANS WITH DISABILITIES ACT OF 1990

A. Discrimination on the basis of disability in contracting for the purchase of goods and services is prohibited. Contractors are required to read Americans With Disabilities language that is included as Form C7 of this specification and agree that the provisions of Title II of the Act are made a part of the contract. The Contractor is obligated to comply with the Act and to hold the owner harmless.

4.4 OWNERSHIP DISCLOSURE

A. N.J.S.A. 52:25-24.2 provided that no corporation, partnership or limited liability company shall be awarded any contract for the performance of any work or the furnishing of any goods and services, unless, prior to the receipt of the bid or accompanying the bid of said corporation or partnership Contractors shall submit a statement setting froth the names and addresses of all stockholders in the corporation, partnership or limited liability company who own ten percent or more of its stock of any class, or of all individual partners or Members in the partnership or limited liability company who own a ten percent or greater interest therein. The included Statement of Authority shall be completed and attached to the bid proposal. This requirement applies to all forms of corporations, partnerships and limited liability companies, including, but not limited to, limited partnerships, limited liability corporations limited liability partnerships and Subchapter S corporations. To comply with this section, a bidder with any direct or indirect parent entity which is publicly traded may submit the name and address of each publicly traded entity and the name and address of each person that holds a 10 percent or greater beneficial interest in the publicly traded entity as of the last annual filing with the federal Securities and Exchange Commission or the foreign equivalent, and, if there is any person that holds a 10 percent or greater beneficial interest, also shall submit links to the websites containing the last annual filings with the federal Securities and Exchange Commission or the foreign equivalent and the relevant page numbers of the filings that contain the information on each person that holds a 10 percent or greater beneficial interest.

Failure to submit a stockholder disclosure document shall result in rejection of the bid.

4.5 PROOF OF BUSINESS REGISTRATION

A. N.J.S.A 52:32-44 requires that each bidder (contractor) submit proof of business registration prior to the time a contract is awarded or authorized. Proof of registration shall be a copy of the bidder's Business Registration Certificate (BRC). A BRC is obtained from the NJ Division of Revenue. Information on obtaining

a BRC is available on the internet at <u>www.nj.gov/njbgs</u> or by phone at (609) 292-1730. N.J.S.A. 52:32-44 imposes requirements on contractors and all subcontractors that knowingly provide goods or perform services for a contractor fulfilling this contract.

- B. Prior to receipt of final payment from a contracting agency, a contractor must submit to the contracting agency an accurate list of all subcontractors or attest that none was used.
- C. In accordance with N.J.S.A. 54:49-4.1, any contractor, subcontractor or supplier that fails to provide proof of business registration information or that provides false information of business registration shall be liable to a penalty of \$25 for each day of violation, not to exceed \$50,000 for each business registration not properly provided or maintained under a contract with a contracting agency. Information on the law and its requirements is available by calling (609) 292-9292.

4.6 NEW JERSEY WORKER AND COMMUNITY RIGHT TO KNOW ACT

A. The manufacturer or supplier of chemical substances or mixtures shall label them in accordance with the NJ Worker and Community Right to Know Act and its regulations (N.J.S.A. 34:5A-1 et seq., and N.J.A.C. 8:59). Containers that the law and rules require to be labeled shall show the Chemical Abstracts Service number of all the components and the chemical name. Further, all applicable Material Safety Data Sheets (MSDS) - hazardous substance fact sheet - must be furnished.

4.7 PREVAILING WAGE ACT

A. Pursuant to N.J.S.A 34:11-56.25 et seq., contractors on projects for public work shall adhere to all requirements of the New Jersey Prevailing Wage Act. Workers shall be paid not less than such prevailing wage rate and in the event it is found that any worker, employed by the contractor or any subcontractor covered by said contract, has been paid a rate of wages less than the prevailing wage required to be paid by such contract, the public body, the lessee to whom the public body is leasing a property, or premises or the lessor from whom the public body is leasing or will be leasing a property, or premises may terminate the contractor's or subcontractor's right to proceed with the work, or such part of the work as to which there has been a failure to pay required wages and to prosecute the work to completion or otherwise. The contractor shall be required to submit a certified payroll record to the owner within ten (10) days of the payment of wages. The Contractor is also responsible for obtaining and submitting all subcontractors' certified payroll records within the aforementioned time period. The contractor shall submit said certified payrolls in the form set forth in N.J.A.C. 12:60-5.I(C). It is the contractor's responsibility to obtain any additional copies of the certified payroll form to be submitted by contacting the New Jersey Department of Labor and Workforce Development, Division of Workplace Standards.

4.8 PUBLIC WORKS CONTRACTOR REGISTRATION ACT

- A. N.J.S.A. 34:1 1-56.48 et seq. requires that a general or prime contractor and any listed subcontractors named in the contractor's bid proposal shall possess a certificate at the time the bid proposal is submitted. After bid proposals are received and prior to award of contract, the successful contractor shall submit a copy of the contractor's certification along with those of all listed subcontractors. All non-listed subcontractors and lower tier sub-contractors shall be registered prior to starting work on the project. It is the general contractor's responsibility that all non-listed sub-contractors at any tier have their certificate prior to starting work on the job.
- B. Under the law a "contractor" is "a person, partnership, association, joint stock company, trust, corporation or other legal business entity or successor thereof who enters into a contract" which is subject to the

provisions of the New Jersey Prevailing Wage Act (N.J.S.A. 34:11-56.25, et seq.). It applies to contractors based in New Jersey or in another state and to subcontractors or lower tier subcontractors of a contractor.

- C. The law defines "public works" as: "Construction, reconstruction, demolition, alteration, or repair work, or maintenance work, including painting and decorating, done under contract and paid for in whole or in part out of the funds of a public body, except work performed under a rehabilitation program." "Public Work" shall also mean construction, reconstruction, demolition, alteration, or repair work, done on any property or premises, whether or not the work is paid for from public funds, if, at the time of the entering into of the contract the property or premises is owned by the public body or:
 - 1. Not less than 55% of the property or premises is leased by a public body, or is subject to an agreement to be subsequently leased by the public body; and
 - 2. The portion of the property or premises that is leased or subject to an agreement to be subsequently leased by the public body measures more than 20,000 square feet.
- D. "Maintenance Work" means the repair of existing facilities when the size, type or extent of such facilities is not thereby changed or increased. "Maintenance Work" also means any work on a maintenance-related project that exceeds the scope of work and capabilities of in-house maintenance personnel, requires the solicitation of bids, and has an aggregate value exceeding \$50,000. Maintenance work, including painting and decorating, on such leased property is not covered by the provisions of the Act (see committee statement).
- E. To register, a contractor must provide the State Department of Labor and Workforce Development with a full and accurately completed application form.
- F. N.J.S.A.34:11-56.55 specifically prohibits accepting applications for registration as a substitute for a certificate of registration.

4.9 PRICING INFORMATION FOR PREPARATION OF BIDS

- A. The Authority is exempt from any local, state, or federal sales, use or excise tax. Authority will provide Form ST-4 upon request.
- B. Contractor shall be responsible for obtaining any applicable permits or licenses from any government entity that has jurisdiction to require the same. The cost of all permits will be paid for by the Authority.
- C. Bidders shall insert prices for furnishing goods and services required by these specifications. Prices shall be net, including any charges for packing, crating, containers, etc. All transportation charges shall be fully prepaid by the contractor, F.O.B. destination and placement at locations specified by the Owner. As specified, placement may require inside deliveries. No additional charges will be allowed for any transportation costs resulting from partial shipments made for the contractor's convenience.

4.10 CERTIFICATES

A. Upon notification by the Cumberland County Improvement Authority, the lowest responsible Contractor shall supply to the Contract Administrator, within five days of notification, a certificate of insurance as proof that the insurance policies required by these specifications are in full force and effect.

4.11 INDEMNIFICATION

A. The Contractor agrees to indemnify, hold harmless and defend the Cumberland County Improvement Authority and its consultants, elected and appointed officials, representatives, employees and agents (Authority Indemnified Parties) from and against any and all liabilities, claims, penalties, forfeitures, suits and the costs and expenses incidental thereto (including costs of defense, settlement and reasonable attorney's fees), which the Authority Indemnified Parties may hereafter incur, become responsible for, or pay out as a result of death or bodily injuries to any person, destruction or damage to any property, contamination of or adverse effects on the environment, or any violation of governmental laws, regulations or orders caused, in whole or in part, by the Contractor's performance or failure to perform its obligations under the provisions of this Bid Specification or by any negligent or willful act or omission of the Contractor, its employees or subcontractor(s) in the performance of this Contract.

4.12 VIOLATIONS OF CONTRACT SPECIFICATIONS

A. Notwithstanding any specifically enumerated remedy or right the Authority may have for any violation of the terms of the Contract or these Specifications, the Authority reserves the right to pursue any remedies available to it in law or equity for any breach of the terms and conditions contained herein. Any failure of the Authority to enforce the terms and conditions contained herein shall not be deemed a waiver by the Authority of a full enforcement thereof.

4.13 SEVERABILITY

A. The Contract between the Contractor and the Cumberland County Improvement Authority shall provide that the laws of the State of New Jersey shall govern the agreement. Should a court of competent jurisdiction find that a provision of the agreement is in whole or in part invalid or unenforceable, such finding shall not void or render unenforceable the remainder of the agreement or the provision. This applies but is not limited to the agreed upon costs and liquidated damages provisions. In the event that a specified liquidated damage amount is found to be inapplicable, damages may still be calculated as allowed by law.

4.14 TERMINATION OF CONTRACT

- A. If, through any cause, the Contractor shall fail to fulfill in a timely and proper manner obligations under the Contract or if the Contractor shall violate any of the requirements of the Contract, the Owner shall there upon have the right to terminate the Contract by giving written notice to the Contractor of such termination and specifying the effective date of termination. Such termination shall relieve the Owner of any obligation for balances to the contractor of any sum or sums set forth in the Contract. Owner will pay only for goods and services accepted prior to termination.
- B. Notwithstanding the above, the Contractor shall not be relieved of liability to the Owner for damages sustained by the Owner by virtue of any breach of the Contract by the Contractor and the Owner may withhold any payments to the Contractor for the purpose of compensation until such time as the exact amount of the damage due the Owner from the Contractor is determined.
- C. The Contractor agrees to indemnify and hold the Owner harmless from any liability to subcontractors and/or suppliers concerning payment for work performed or goods supplied arising out of the lawful termination of the Contract by the Owner under this provision.
- D. In case of default by the Contractor, the Owner may procure the goods or services from other sources and hold the Contractor responsible for any excess cost.

4.15 PAYMENT

- A. No payment will be made unless duly authorized by the Owner's authorized representative and accompanied by proper documentation.
- B. Contract shall be paid in accordance with the Contract upon receipt of an invoice and properly executed voucher. After approval by the Authority, the payment voucher shall be placed in line for prompt payment. Each invoice shall contain an itemized, detailed description of all work performed during the billing period per AIA[®] Document A101[™] 2017 Article 9.2 and Specification Section 01 29 00. *Failure to provide sufficient specificity shall be cause for rejection of the invoice until the necessary details are provided*. It is also agreed and understood that the acceptance of the final payment by the Contractor shall be considered a release in full of all claims against the Authority arising out of, or by reason of, the work done and materials furnished under the contract.
- C. Bonds, insurance and items similar in nature shall be listed separately and billed at the actual cost. Backup such as invoices, or other verification, may be requested by the Owner from time to time, for these and other items. Such backup shall not be unreasonably withheld.
- D. The payment cycle (as per N.J.S.A. 2A:30A-2a) shall be:
 - 1. If the contractor has performed in accordance with the contract; and
 - 2. The work has been approved and certified by the owner or the owner's authorized agent;
 - 3. The owner shall pay the bill not more than 30 calendar days after the billing date.
 - 4. Provided that the billing shall be deemed "approved" and "certified" 20 calendar days after the Owner receives it, unless the Owner provides, before the end of the 20-day period, a written statement of the amount withheld and reason for withholding payment.
 - 5. The 20th calendar day deadline of the decision to withhold full or partial payment shall be deferred until the next scheduled public meeting (any public meeting open to the public) following 20 calendar days of the billing date, at which time the bill must be approved for payment or notice provided as to why the bill or any portion thereof will not be approved.
 - 6. If the billing is approved, the bill is required to be paid in the payment cycle following the meeting.
- E. The billing date for the final and retainage payments shall be the date the bill is received by the Cumberland County Improvement Authority.
- F. Requests for payment that have been approved and certified are approved monthly at the meetings of the CCIA Board. Payment requests to be considered for the previous month's bill must be received, by the first business day of the following month. Meeting Dates can be viewed on the CCIA webpage: <u>https://www.theauthoritynj.com/public-information/meetings-resolutions.</u>

4.16 MANDATORY CONTRACT DISPUTE PROCEDURES

A. The bidder agrees to Mandatory Dispute Procedures required by N.J.S.A. 2A:30A-2(f) and N.J.S.A. 40A:11-50, as described below:

- B. In an effort to resolve any disputes that arise during the construction of the project or following the completion of the project, the Bidder and Owner agree that all disputes between them arising out of or relating to the performance of the work described in the contract documents shall be submitted to nonbinding mediation with the Construction Industry Mediation Rules of the American Arbitration Association currently in effect. Request for mediation shall be filed in writing with the other party to the party to the Contract and with the American Arbitration Association.
- C. The parties shall share the mediator's fee and any filing fees equally. The mediation shall be held in the place where the Project is located, unless another location is mutually agreed upon. Agreements reached in mediation shall be enforceable as settlement agreements in court having jurisdiction thereof. The Bidder further agrees to include a similar mediation provision in all agreements with independent contractors and consultants retained for the project and to require all independent contractors, sub-consultants also to include a similar mediation provision in all agreements with subcontractors, sub-consultants, suppliers or fabricators so retained, thereby providing for mediation as the primary method for dispute resolutions between the parties to those agreements.
- D. Nothing in this section shall prevent the Owner from seeking injunctive or declaratory relief in court or at any time. The alternative dispute resolution practices required by this section shall not apply to disputes concerning the bid solicitation or award process, or the formation of contracts or subcontracts to be entered into pursuant to P.L. 1971, c.198 (C:40A:11-1, et seq.).

4.17 ACCESS TO RELEVANT DOCUMENTS AND INFORMATION-N.J.S.A. 52:15C-14 (d)

A. Relevant records of private Contractors or other persons entering into contracts with covered entities are subject to audit or review by OSC pursuant to N.J.S.A. 52:15C-14(d). The contractor/vendor to whom a contract has been awarded, shall maintain all documentation related to products, transactions or services under this contract for a period of five years from the date of final payment. Such records shall be made available to the New Jersey Office of the State Comptroller upon request.

BID FORMS BID DOCUMENT CHECKLIST

Documents with an * are mandatory items to be submitted at the time of the receipt of bids. Failure to provide such items shall be a fatal defect and shall render the bid unresponsive.

Initial	tial Bid Documents		
	Bid Forms		
	Bid Document Checklist*	A1	
	Bid Proposal Form*	A2	
	List of Subcontractors*	A3	
	Construction Bids Subcontractors List Instructions*	A4	
	Acknowledgment of Receipt of Addenda*	A5	
	Consent of Surety Form*	A6	
	Qualifications		
	Certification of NJ Public Works Contractor Registration for Bidder and All Listed Contractors*	B1	
	Debarred, Suspended and Disqualified Bidder Statement for Bidder and All Listed Contractors*	B2	
	Certification of NJ Business Registration for Bidder and All Listed Contractors*	В3	
	Certification of Non-Debarment for Federal Government Contracts	B4	
	Additional Requirements		
	Certification of Non-segregated Facilities	C1	
	Disclosure of Contributions to NJ Election Law Affidavit	C2	
	Disclosure of Investment Activity in Iran*	C3	
	Non-Collusion Affidavit*	C4	
	Equipment Certification	C5	
	Stockholder Disclosure Certification*	C6	
	Americans With Disabilities Act of 1990	C7	
	Mandatory Equal Employment Opportunity Language	C8	
	Acknowledgement of Apprenticeship Requirements	С9	
	Section 40A:11-16.7CHANGED CONDITIONS CLAUSES FOR CERTAIN LOCAL PUBLIC CONTRACTS	C10	
	Section 40A:11-16.6DEFINITIONS RELATIVE TO VALUE ENGINEERING CHANGE ORDERS; REQUIREMENT FOR CERTAIN CONTRACTS.	C11	
	Bid Guarantee*	No form	

BID PROPOSAL FORM

NJ STATE POLICE BARRACKS BUILDING COMMERCIAL TOWNSHIP, NJ

General and Complete Construction Services, material, equipment, labor, oversight, and administration for complete and operable **NJ STATE POLICE BARRACKS, BUILDING COMMERCIAL TOWNSHIP, NJ** at Block 183, Lot 14, also known as 2007 Highland St, Port Norris, NJ 08349.

The undersigned proposes to furnish and deliver the above goods/services in accordance with the Contract Documents including the following:

- 1. Cumberland County Improvement Authority Bidding Requirements, Contract Forms and Conditions of the Contract.
- 2. Technical specifications and drawings prepared by Manders Merighi Portadin Farrell Architects.
- 3. Technical specifications and drawings prepared by Consulting Engineer Services.
- 4. Reports of Geotechnical Engineering Assessment prepared by Digneo Engineering
- 5. All associated project exhibits and addenda.

Company Name

Federal I.D. # or Social Security #

Address

Telephone Number

Date

E-mail Address

TOTAL LUMP SUM BID AMOUNT:

Base Bid:

The TOTAL LUMP SUM BID AMOUNT for General and Complete Construction Services, material, equipment, labor, oversight, and administration for complete and operable facility as per all project documents, is submitted as follows:

	\$
	\$125,000
wance):	<u>\$</u>
Words)	
	NAME OF BIDDER
SIGNAT	URE OF AUTHORIZED REPRESENTATIVE
PRI	NT NAME AND TITLE OF SIGNATORY
	DATE
	wance): Words) SIGNAT

LIST OF SUBCONTRACTORS

Pursuant to N.J.S.A.40A:11-16, the Bidder probe awarded subcontracts for the portions of Contract. The Bidder further certifies that subcontracts if no subcontractors are listed Structural Steel and Ornamental Iron Work	roposes that the following subcontracting firms and/or businesses will of the work listed below, in the event that the Bidder is awarded the t except as otherwise provided herein, it does not intend to use below: a Subcontractor:
Subcontractor Name:	
Subcontractor Address:	
Plumbing and Gas Fitting and all Kindred W	/ork Subcontractor:
Subcontractor Name:	License #:
Subcontractor Address:	
Note: To comply with N.J.S.A.45:14C-2(h), a subcontractor. Identify below the licensed r	master plumber must own at least 10% of the named plumbing naster plumber:
Name of Master Plumber:	License #:
Steam and Hot Water Heating and Ventilat	ing Apparatus Subcontractor:
Subcontractor Name:	License #:
Subcontractor Address:	
Electrical Work Subcontractor:	
Subcontractor Name:	License #:
Subcontractor Address:	
	NAME OF BIDDER
	SIGNATURE OF AUTHORIZED REPRESENTATIVE
	PRINT NAME AND TITLE OF SIGNATORY
	DATE

CONSTRUCTION BIDS SUBCONTRACTORS LIST INSTRUCTIONS

Failure to complete any certification and include it with your bid package shall result in your bid being deemed incomplete pursuant to N.J.S. A. 40A: 11-16.

If you plan to use in-house employees for any trade then you must include, with your bid, the name of the license holder for this trade and a copy of his/her license.

PROCEDURE FOR CHANGE IN SUBCONTRACTORS AFTER AN AWARD IS MADE

Construction contracts using subcontractors may only use those they listed in the bid package. Should the need arise to change subcontractors, the following rules must be adhered to prior to making any changes.

1. The request for a change of subcontractors must be in writing arid submitted to the contact person, along with copies of agreements between the general contractor and his existing subcontractor and the proposed agreement with the replacement contractor.

2. The reason for the change in subcontractors must be presented in the request to change subcontractors. The request must also note any potential savings or additional costs that may be derived as a result of the change.

3. This request will be reviewed by the CCIA Construction Manager, President/CEO, and CCIA Counsel.

4. The general contractor will be notified in writing with the result of the findings of the request.

NAME OF BIDDER

SIGNATURE OF AUTHORIZED REPRESENTATIVE

PRINT NAME AND TITLE OF SIGNATORY

ACKNOWLEDGMENT OF RECEIPT OF ADDENDA

The undersigned Contractor hereby acknowledges receipt of the following Addenda:

Addendum Number	Dated	<u>Acknowledge Receipt</u> (initial)
No Addenda were receiv	ed 🗌	

NAME OF BIDDER

SIGNATURE OF AUTHORIZED REPRESENTATIVE

PRINT NAME AND TITLE OF SIGNATORY

CONSENT OF SURETY

A performance bond will be required from the successful contractor on this project, and consequently, all Contractors shall submit, with their bid, a consent of surety in substantially the following form:

o:(Authority)
(Contractor)
(Project Description)
his is to certify that the
(Surety Company)
vill provide to
(Authority)
performance bond in the full amount of awarded contract in the event that said contractor is awarded contract for the above project.
Authorized Agent of Surety Company
DATE
CONSENT OF SURETY MUST BE SIGNED BY AN AUTHORIZED AGENT OR REPRESENTATIVE OF A SURETY COMPANY AND NOT BY THE INDIVIDUAL OR COMPANY REPRESENTATIVE SUBMITTING THE BID

CERTIFICATION OF NEW JERSEY PUBLIC WORKS CONTRACTOR REGISTRATION FOR PRIME CONTRACTOR AND ALL LISTED SUBCONTRACTORS

Pursuant to the requirements of New Jersey Business Statute P.L. 1999, c.238. (N.J.S.A. 34:11-56 48 et. seq.), I hereby certify that the below named Contractor <u>and all named subcontractors</u> in the bid proposal hold a valid New Jersey Public Works Contractor Registration Certificate at the time the bid proposal is submitted. As stated in N.J.S.A. 34:1 1-56.48 et seq., <u>a copy of the Public Works Contractor Registration Certificate for</u> <u>the Bidder and all named subcontractors IS NOT</u> required to be submitted at the time of the bid but must be provided prior to award of the contract.

(N.J.S.A. 34:1 1-56.48 et seq. requires that a general or prime contractor and any listed subcontractors named in the contractor's bid proposal shall possess a certificate at the time the bid proposal is submitted. After bid proposals are received and prior to award of contract, the successful contractor shall submit a copy of the contractor's certification along with those of all listed subcontractors. All non-listed subcontractors and lower tier sub-contractors shall be registered prior to starting work on the project. It is the general contractor's responsibility to certify that all non-listed sub-contractors at any tier have their certificate prior to starting work on the job.)

<u>This form is required</u> to be signed by the Bidder and shall be included with the bid submission. Failure to include a signed copy of this form by the bidder shall render the bid unresponsive.

NAME OF BIDDER

SIGNATURE OF AUTHORIZED REPRESENTATIVE

PRINT NAME AND TITLE OF SIGNATORY

DEBARRED, SUSPENDED AND DISQUALIFIED BIDDER STATEMENT FOR PRIME CONTRACTOR AND ALL LISTED SUBCONTRACTORS

I, the undersigned, solemnly swear that_

(Name of Contractor)

at the time of the Bid, is not included on the New Jersey State Treasurer's List of Debarred, Suspended, or Disqualified Bidders. Furthermore, I agree to immediately notify the Cumberland County Improvement Authority wherever it appears that aforementioned contractor is on the aforementioned New Jersey State Treasurer List. By the bidder signing this form they are also certifying that all listed subcontractors are also not included on the New Jersey State Treasurer's List of Debarred, Suspended or Disqualified Bidders.

NAME OF BIDDER

SIGNATURE OF AUTHORIZED REPRESENTATIVE

PRINT NAME AND TITLE OF SIGNATORY

<u>CERTIFICATION OF NEW JERSEY BUSINESS REGISTRATION FOR PRIME</u> <u>CONTRACTOR AND ALL LISTED SUBCONTRACTORS</u>

Pursuant to the requirements of New Jersey Business Registration Statute (N.J.S.A. 52:32-44), I hereby certify that the below named Contractor <u>and all named subcontractors</u> in the bid proposal hold a valid Business Registration Certificate, and, as proof thereof, a copy of each Business Registration Certificate shall be provided prior to award. <u>A copy of the Registration IS NOT</u> required to be submitted at the time of the bid but must be provided prior to award of the contract.

<u>This form is required</u> to be signed by the Bidder and shall be included with the bid submission. Failure to include a signed copy of this form by the bidder shall render the bid unresponsive

NAME OF BIDDER

SIGNATURE OF AUTHORIZED REPRESENTATIVE

PRINT NAME AND TITLE OF SIGNATORY

STANDARD BID DOCUMENT REFERENCE		
Name of Form:	FEDERAL NON-DEBARMENT CERTIFICATION	
Statutory Reference:	N.J.S.A. 52:32-44.1 (P.L. 2019, c.406)	
Description:	Meets statutory criteria for certification of non-debarment by a federal government agency.	

Summary of the Certification Requirements under N.J.S.A. 52:32-44.1

Pursuant to state law any natural person, company, firm, association, corporation, or other entity prohibited, or "debarred," from contracting with the federal government agencies, shall also be prohibited from contracting for public work in the state of New Jersey. This prohibition also extends to any affiliate organization(s) held by or subject to the control of an entity of that prohibited person or entity.

Prior to awarding a contract for public work a local unit must obtain written certification from the contracting person or entity through the form below, attesting to their non-debarment from contracting with federal government agencies. Contracting units are reminded that they must fill-in the boilerplate information in the certification sections of Parts II through IV regarding their name and type of contracting unit before using the form.

CERTIFICATION OF NON-DEBARMENT

FOR FEDERAL GOVERNMENT CONTRACTS

<u>N.J.S.A</u>. 52:32-44.1 (P.L. 2019, c.406)

This certification shall be completed, certified to, and submitted to the contracting unit prior to contract award, except for emergency contracts where submission is required prior to payment.

PART I: VENDOR INFORMATION		
Individual or		
Organization Name		
Address of Individual		
or Organization		
DUNS Code		
(if applicable)		
CAGE Code		
(if applicable)		
Check the box that represents the type of husipess organization:		

Check the box that represents the type of business organization:

□ Sole Proprietorship (skip Parts III and IV) □ Non-Profit Corporation (skip Parts III and IV)

□ For-Profit Corporation (any type) □ Limited Liability Company (LLC) □ Partnership

□ Limited Partnership □ Limited Liability Partnership (LLP)

□ Other (be specific): _

PART II – CERTIFICATION OF NON-DEBARMENT: Individual or Organization

I hereby certify that the **individual or organization listed above in Part I** is not debarred by the federal government from contracting with a federal agency. I further acknowledge: that I am authorized to execute this certification on behalf of the above-named organization; that the County of Cumberland is relying on the information contained herein and that I am under a continuing obligation from the date of this certification through the date of contract award by the County of Cumberland to notify the County of Cumberland in writing of any changes to the information contained herein; that I am aware that it is a criminal offense to make a false statement or misrepresentation in this certification, and if I do so, I am subject to criminal prosecution under the law and that it will constitute a material breach of my

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agreement(s) with the County of Cumberland, permitting the County of Cumberland to declare any			
contract(s) resulting from this certification void and unenforceable.			
Signature:		Date:	

PART III – CERTIFICATION OF NON-DEBARMENT: Individual or Entity Owning Greater than 50 Percent of					
	Organization				
Section A (Check the Box that a	nnlies)				
	Below is the name and address of the stockholder in the corporation who owns more than 50 percent of its voting stock, or of the partner in the partnership who owns more than 50 percent interest therein, or of the member of the limited liability company owning more than 50 percent interest therein, as the case may be.				
Name of Individual or					
Organization					
Home Address (for Individual)					
or Business Address					
	OR				
	No one stockholder in the corporation owns more than 50 percent of its voting stock, or no partner in the partnership owns more than 50 percent interest therein, or no member in the limited liability company owns more than 50 percent interest therein, as the case may be.				
Section B (Skip if no Business entity is listed in Section A above)				
	Below is the name and address of the stockholder in the corporation who owns more than 50 percent of the voting stock of the organization's parent entity, or of the partner in the partnership who owns more than 50 percent interest in the organization's parent entity, or of the member of the limited liability company owning more than 50 percent interest in organization's parent entity, as the case may be.				
Stockholder/Partner/Member Owning Greater Than 50 Percent of Parent Entity					
Home Address (for Individual)					
or Business Address					
ORImage: Description of the percent interest therein, or no member in the percent interest therein, or no member in the entity limited liability company owns more than 50 percent interest therein, as the case may be.					
Section C Dart III Contification					
I hereby certify that no individua contracting with a federal agence if applicable, owns greater than s organization>. I further acknow	I or organization that is debarred by the federal government from y owns greater than 50 percent of the Organization listed above in Part I or, 50 percent of a parent entity of <name of<br="">ledge: that I am authorized to execute this certification on behalf of the</name>				

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above-named organization; that the County of Cumberland is relying on the information contained herein
and that I am under a continuing obligation from the date of this certification through the date of contract
award County of Cumberland to notify the County of Cumberland in writing of any changes to the
information contained herein; that I am aware that it is a criminal offense to make a false statement or
misrepresentation in this certification, and if I do so, I am subject to criminal prosecution under the law and
that it will constitute a material breach of my agreement(s) with the County of Cumberland, permitting the
County of Cumberland to declare any contract(s) resulting from this certification void and unenforceable.Full Name (Print):Title:Signature:Date:

Part IV – CERTIFICATION OF NON-DEBARMENT: Contractor – Controlled Entities					
		Section A			
	Section A Below is the name and address of the corporation(s) in which the Organization listed in Part I owns more than 50 percent of voting stock, or of the partnership(s) in which the Organization listed in Part I owns more than 50 percent interest therein, or of the limited liability company or companies in which the Organization listed above in Part I owns more than 50 percent interest therein, as the case may be				
Name of Business Entity		Business Address			
	, ,				
Add additional she	eets if necessary				
		OR			
	The Organization listed above in Part I does not own greater than 50 percent of the voting stock in any corporation and does not own greater than 50 percent interest in any partnership or any limited liability company.				
Sec	ction B (skip if no business e	ntities are listed in Section A of Part IV)			
	Below are the names and addresses of any entities in which an entity listed in Part III A owns greater than 50 percent of the voting stock (corporation) or owns greater than 50 percent interest (partnership or limited liability company).				
Name of Business Entity Controlled by Entity Listed in Section A of Part IV		Business Address			
Add additional Sho	eets if necessary				
ÓR					
	No entity listed in Part III A owns greater than 50 percent of the voting stock in any corporation or owns greater than 50 percent interest in any partnership or limited liability company.				
Section C – Part IV Certification					
I hereby certify that the Organization listed above in Part I does not own greater than 50 percent of any entity that that is debarred by the federal government from contracting with a federal agency and, if applicable, does not own greater than 50 percent of any entity that in turns owns greater than 50 percent of any entity debarred by the federal government from contracting with a federal agency. I further acknowledge: that I					
am authorized to exe Cumberland is relying	ecute this certification on be g on the information containe	half of the above-named organization; that the County of ed herein and that I am under a continuing obligation from			

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the date of this certification through the date of contract award by County of Cumberland to notify the County of Cumberland in writing of any changes to the information contained herein; that I am aware that it is a criminal offense to make a false statement or misrepresentation in this certification, and if I do so, I am subject to criminal prosecution under the law and that it will constitute a material breach of my agreement(s) with the County of Cumberland, permitting the County of Cumberland to declare any contract(s) resulting from this certification void and unenforceable.

Full Name (Print):	Title:	
Signature:	Date:	

CERTIFICATION OF NONSEGREGATED FACILITIES

THE UNDERSIGNED CERTIFIES that he/she does not maintain or provide for his/her employees any segregated facilities at any of his/her establishments, and that he/she does not permit his/her employees to perform their services at any location under his/her control where segregated facilities are maintained. He/she certifies further that he/she will not maintain or provide for his/her employees any segregated facilities at any of his/her establishments, and that he/she will not permit his/her employees to perform their services at any location, under his/her control, where segregated facilities are maintained. The bidder agrees that a breach of this certification is a violation of the Equal Opportunity clause in this Contract. As used in this certification, the term "segregated facilities" means any waiting rooms, work areas, rest rooms and other storage or dressing areas, transportation, and housing facilities, recreation or entertaining areas, parking lots, drinking fountains provided for employees which are segregated by explicit directive or are in fact segregated on the basis of race, color, religion, or national origin, because of habit, local custom, or otherwise.

THE UNDERSIGNED FURTHER AGREES that except where he has obtained identical certifications from proposed subcontractors for specific time periods he/she will obtain identical certifications from proposed subcontractors prior to the award of subcontracts exceeding \$10,000.00 which are not exempt from the provisions of the Equal Opportunity clause; that he/she will retain such certifications in his/her files; and that he/she will forward a notice to his/her proposed subcontractors as provided in the Instructions to Bidders.

Signature Of Bidder	
	, 20
Date	
Title	
Subscribed and sworn to I	pefore me
This day of	, 20
Signature	
My commission expires	
	, 20
Date (Seal)	
DISCLOSURE OF CONTRIBUTIONS TO NEW JERSEY ELECTION LAW ENFORCEMENT COMMISSION AFFIDAVIT IN ACCORDANCE WITH N.J.S.A. 19:44A-20.27

STATE OF)		
COUNTY OF)	ss:	
	,		
,(Nan	ne)		, of full age, being duly sworn according to
law, on my oath depose a	and say tha	t I am	
			(Title, Position, etc.)
of the firm of			
the Bidder, making the B	id for the fo	ollowing pr	oject:
that I executed the said I file an annual disclosure Commission (ELEC) pursu entities in a calendar yea filing is necessary and tha made with full knowled statements contained in for said project.	Proposal wi e statemen lant to <i>N.J.S</i> ar. I further at all staten ge that the said Propos	th full auth t of politic S.A. 19:44A acknowled nents conta c Cumberla sal and in t	nority to do so; that said Bidder acknowledges our responsibility to al contributions with the New Jersey Election Law Enforcement -20.27 if in receipt of contracts in excess of \$50,000.00 from public dge that business entities are solely responsible for determining if ained in said Proposal and in this Affidavit are true and correct, and and County Improvement Authority relies upon the truth of the he statements contained in this Affidavit in awarding the Contract
(Signature)			
(Type of print name of af	fiant)		

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

[SEAL]

Notary Public, State of ______

My commission expires _____

DISCLOSURE OF INVESTMENT ACTIVITY IN IRAN

Proposer:

Pursuant to Public Law 2012, c. 25, any person or entity that submits a bid or proposal or otherwise proposes to enter into or renew a contract must complete the certification below to attest, under penalty of perjury, that the person or entity, or one of the person or entity's parents, subsidiaries, or affiliates, is not identified on a list created and maintained by the New Jersey Department of the Treasury ("Treasury") as a person or entity engaging in investment activities in Iran. If the Director finds a person or entity to be in violation of the Act or of the principles which are the subject of this law, s/he shall take action as may be appropriate and provided by law, rule or contract, including but not limited to, imposing sanctions, seeking compliance, recovering damages, declaring the party in default and seeking debarment or suspension of the person or entity.

I certify, pursuant to Public Law 2012, c.25, that the person or entity listed above for which I am authorized to submit a proposal: Is not providing goods or services of \$20,000.00 or more in the energy sector of Iran, including a person or entity that provides oil or liquified natural gas tankers, or products used to construct or maintain pipelines used to transport oil or liquified natural gas, for the energy sector of Iran; and is not a financial institution that extends \$20,000.00 or more in credit to another person or entity, for 45 days or more, if that person or entity will use the credit to provide goods or services in the energy sector of Iran.

In the event that a person or entity is unable to make the above certification because it or one of its parents, subsidiaries, or affiliates has engaged in the above-referenced activities, a detailed, accurate and precise description of the activities must be provided in Part 2 below to Cumberland County Improvement Authority under penalty of perjury. *Failure to provide such will result in the proposal being rendered as non-responsive and appropriate penalties, fines and/or sanctions will be assessed as provided by law.*

Please provide further information related to investment activities in Iran

You must provide a detailed, accurate and precise description of the activities of the proposer, or one of its parents, subsidiaries or affiliates, engaging in the investment activities in Iran outlined above by completing the information below.

Name:	_ Relationship to Proposer:
Description of Activities:	
Duration of Engagement:	Anticipated Cessation Date:
Proposer Contact Name:	Contact Phone Number:

Certification: I, being duly sworn upon my oath, hereby represent and state that the foregoing information and any attachments thereto to the best of my knowledge are true and complete. I attest that I am authorized to execute this certification on behalf of the above-referenced person or entity. I acknowledge that the State of New Jersey is relying on the information contained herein and thereby acknowledge that I am under a continuing obligation from the date of this certification through the completion of any contracts with the State to notify the State in writing of any changes to the answers of information contained herein. I acknowledge that I am aware that it is a criminal offense to make a false statement or misrepresentation in this certification, and if I do so, I recognize that I am subject to criminal prosecution under the law and that it will also constitute a material breach of my agreement(s) with the State of New Jersey and that the State at it option may declare any contract(s) resulting from this certification void and unenforceable.

Full Name (Print):	_Signature:
Title	Data
	Date:

NON-COLLUSION AFFIDAVIT

State of New Jersey			
County of	ss:		
l.	residing	in	
(name of affiant)			(name of municipality)
in the County of	and	State of	of full age, being
duly sworn according to law on my oath depose	and say that	:	
lam	of the firm	of	
(title or position)			(name of firm)
the Contractor making this Proposal for the bid e	entitled		,
			(title of bid proposal)
and that I executed the said proposal with full au	thority to do	o so that	said Contractor has not, directly or
indirectly entered into any agreement, participat	ted in any co	llusion, o	or otherwise taken any action in restraint of
free, competitive bidding in connection with the	above name	d project	t; and that all statements contained in said
proposal and in this amdavit are true and correc	t, and made	with full	Knowledge that the
(name of contracting unit)	apon in		the statements contained in salu roposal
and in the statements contained in this affidavit	in awarding	the contr	ract for the said project.
I further warrant that no person or selling agence contract upon an agreement or understanding fo except bona fide employees or bona fide establis	y has been e or a commiss shed comme 	mployed ion, perc rcial or se	or retained to solicit or secure such entage, brokerage, or contingent fee, elling agencies maintained by
Subscribed and sworn to before me			
This day of, 20			
Signature			
My commission expires			
20			
, 20, Date			
(Seal)			

EQUIPMENT CERTIFICATION

The undersigned Contractor hereby certifies as follows:

The Contractor owns or controls all the necessary equipment required to accomplish the work described in the specifications.

NAME OF BIDDER

SIGNATURE OF AUTHORIZED REPRESENTATIVE

PRINT NAME AND TITLE OF SIGNATORY

DATE

OWNERSHIP DISCLOSURE CERTIFICATION

This Statement Shall Be Included with Bid Submission

Name of Business

No corporation, partnership, or limited liability company shall be awarded any contract nor shall any agreement be entered into for the performance of any work or the furnishing of any materials or supplies, the cost of which is to be paid with or out of any public funds, by the State, or any county, municipality or school district, or any subsidiary or agency of the State, or of any county, municipality or school district, or by any authority, board, or commission which exercises governmental functions, unless prior to the receipt of the bid or accompanying the bid, of said corporation, said partnership, or said limited liability company there is submitted a statement setting forth the names and addresses of all stockholders in the corporation who own 10 percent or more of its stock, of any class, or of all individual partners in the partnership who own a 10 percent or greater interest therein, or of all members in the limited liability company who own a 10 percent or greater interest therein, as the case may be. If one or more such stockholder or partner or member is itself a corporation or partnership or limited liability company, the stockholders holding 10 percent or more of that corporation's stock, or the individual partners owning 10 percent or greater interest in that partnership, or the members owning 10 percent or greater interest in that limited liability company, as the case may be, shall also be listed. The disclosure shall be continued until names and addresses of every noncorporate stockholder, and individual partner, and member, exceeding the 10 percent ownership criteria established in this act, has been listed.

A bidder with any direct or indirect parent entity which is publicly traded may submit the name and address of each publicly traded entity and the name and address of each person that holds a 10 percent or greater beneficial interest in the publicly traded entity as of the last annual filing with the federal Securities and Exchange Commission or the foreign equivalent, and, if there is any person that holds a 10 percent or greater beneficial interest, also shall submit links to the websites containing the last annual filings with the federal Securities and Exchange Commission or the foreign equivalent and the relevant page numbers of the filings that contain the information on each person that holds a 10 percent or greater beneficial interest.

□ I certify that the list below contains the names and addresses of all stockholders holding 10% or more of the issued and outstanding stock of the undersigned.

OR

□ I certify that no one stockholder owns 10% or more of the issued and outstanding stock of the undersigned.

Check the box that represents the type of business organization:

- PartnershipCorporation
- Sole Proprietorship
- Limited Partnership
- Limited Liability Corporation
- □ Limited Liability Partnership

□ Subchapter S Corporation

Sign and notarize the form below, and, if necessary, complete the stockholder list below.

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Stockholders:

Name:		Name:
Home Address:		Home Address:
Name:		Name:
Home Address:		Home Address:
Name:		Name:
Home Address:		Home Address:
		(Affiant)
		(Print name & title of affiant) (Corporate Seal)
Subscribed and sworn to before me		
This day of	, 20	
Signature		
My commission expires		
	_, 20	
Date (Seal)		

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AMERICANS WITH DISABILITIES ACT OF 1990 EQUAL OPPORTUNITY FOR INDIVIDUALS WITH DISABILITY

The contractor and the Cumberland County Improvement Authority, (hereafter "owner") do hereby agree that the provisions of Title II of the Americans With Disabilities Act of 1990 (the "Act") (42 U.S.C. 121 01 et seq.), which prohibits discrimination on the basis of disability by public entities in all services, programs, and activities provided or made available by public entities, and the rules and regulations promulgated pursuant there unto, are made a part of this contract. In providing any aid, benefit, or service on behalf of the owner pursuant to this contract, the contractor agrees that the performance shall be in strict compliance with the Act. In the event that the contractor, its agents, servants, employees, or subcontractors violate or are alleged to have violated the Act during the performance of this contract, the contractor shall defend the owner in any action or administrative proceeding commenced pursuant to this Act. The contractor shall indemnify, protect, and save harmless the owner, its agents, servants, and employees from and against any and all suits, claims, losses, demands, or damages, of whatever kind or nature arising out of or claimed to arise out of the alleged violation. The contractor shall, at its own expense, appear, defend, and pay any and all charges for legal services and any and all costs and other expenses arising from such action or administrative proceeding or incurred in connection therewith. In any and all complaints brought pursuant to the owner's grievance procedure, the contractor agrees to abide by any decision of the owner which is rendered pursuant to said grievance procedure. If any action or administrative proceeding results in an award of damages against the owner, or if the owner incurs any expense to cure a violation of the ADA which has been brought pursuant to its grievance procedure, the contractor shall satisfy and discharge the same at its own expense.

The owner shall, as soon as practicable after a claim has been made against it, give written notice thereof to the contractor along with full and complete particulars of the claim, If any action or administrative proceeding is brought against the owner or any of its agents, servants, and employees, the owner shall expeditiously forward or have forwarded to the contractor every demand, complaint, notice, summons, pleading, or other process received by the owner or its representatives.

It is expressly agreed and understood that any approval by the owner of the services provided by the contractor pursuant to this contract will not relieve the contractor of the obligation to comply with the Act and to defend, indemnify, protect, and save harmless the owner pursuant to this paragraph.

It is further agreed and understood that the owner assumes no obligation to indemnify or save harmless the contractor, its agents, servants, employees and subcontractors for any claim which may arise out of their performance of this Agreement. Furthermore, the contractor expressly understands and agrees that the provisions of this indemnification clause shall in no way limit the contractor's obligations assumed in this Agreement, nor shall they be construed to relieve the contractor from any liability, nor preclude the owner from taking any other actions available to it under any other provisions of the Agreement or otherwise at law.

MANDATORY EQUAL EMPLOYMENT OPPORTUNITY LANGUAGE <u>N.J.S.A. 10:5-31 ET SEQ. (P.L. 1975, C. 127)</u> <u>N.J.A.C. 17:27</u> <u>CONSTRUCTION CONTRACTS</u>

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

The contractor or subcontractor, where applicable, will not discriminate against any employee or applicant for employment because of age, race, creed, color, national origin, ancestry, marital status, affectional or sexual orientation, gender identity or expression, disability, nationality or sex. Except with respect to affectional or sexual orientation and gender identity or expression, the contractor will ensure that equal employment opportunity is afforded to such applicants in recruitment and employment, and that employees are treated during employment, without regard to their age, race, creed, color, national origin, ancestry, marital status, affectional or sexual orientation, gender identity or expression, disability, nationality or sex. Such equal employment opportunity shall include, but not be limited to the following: employment, upgrading, demotion, or transfer; recruitment or recruitment advertising; layoff or termination; rates of pay or other forms of compensation; and selection for training, including apprenticeship. The contractor agrees to post in conspicuous places, available to employees and applicants for employment, notices to be provided by the Public Agency Compliance Officer setting forth provisions of this nondiscrimination clause.

The contractor or subcontractor, where applicable will, in all solicitations or advertisements for employees placed by or on behalf of the contractor, state that all qualified applicants will receive consideration for employment without regard to age, race, creed, color, national origin, ancestry, marital status, affectional or sexual orientation, gender identity or expression, disability, nationality or sex.

The contractor or subcontractor will send to each labor union, with which it has a collective bar-gaining agreement, a notice, to be provided by the agency contracting officer, advising the labor union or workers' representative of the contractor's commitments under this act and shall post copies of the notice in conspicuous places available to employees and applicants for employment.

The contractor or subcontractor, where applicable, agrees to comply with any regulations promulgated by the Treasurer, pursuant to N.J.S.A. 10:5-31 et seq., as amended and supplemented from time to time and the Americans with Disabilities Act.

When hiring or scheduling workers in each construction trade, the contractor or subcontractor agrees to make good faith efforts to employ minority and women workers in each construction trade consistent with the targeted employment goal prescribed by N.J.A.C. 17:27-7.2; provided, however, that the Dept. of LWD, Construction EEO Monitoring Program, may, in its discretion, exempt a contractor or subcontractor from compliance with the good faith procedures pre-scribed by the following provisions, A, B, and C, as long as the Dept. of LWD, Construction EEO Monitoring Program is satisfied that the contractor or subcontractor is employing workers provided by a union which provides evidence, in accordance with standards prescribed by the Dept. of LWD, Construction EEO Monitoring Program, that its percentage of active "card carrying" members who are minority and women workers is equal to or greater than the targeted employment goal established in accordance with N.J.A.C. 17:27-7.2. The contractor or subcontractor agrees that a good faith effort shall include compliance with the following procedures:

- A. If the contractor or subcontractor has a referral agreement or arrangement with a union for a construction trade, the contractor or subcontractor shall, within three business days of the contract award, seek assurances from the union that it will cooperate with the contractor or sub-contractor as it fulfills its affirmative action obligations under this contract and in accordance with the rules promulgated by the Treasurer pursuant to N.J.S.A. 10:5-31 et. seq., as supplemented and amended from time to time and the Americans with Disabilities Act. If the contractor or subcontractor is unable to obtain said assurances from the construction trade union at least five business days prior to the commencement of construction work, the contractor or sub-contractor agrees to afford equal employment opportunities minority and women workers directly, consistent with this chapter. If the contractor's or subcontractor's prior experience with a construction trade union, regardless of whether the union has provided said assurances, indicates a significant possibility that the trade union will not refer sufficient minority and women workers consistent with affording equal employment opportunities as specified in this chapter, the contractor or subcontractor agrees to be prepared to provide such opportunities to minority and women workers directly, consistent with this chapter, by complying with the hiring or scheduling procedures prescribed under (B) below; and the contractor or subcontractor further agrees to take said action immediately if it determines that the union is not referring minority and women workers consistent with the equal employment opportunity goals set forth in this chapter.
- B. If good faith efforts to meet targeted employment goals have not or cannot be met for each construction trade by adhering to the procedures of (A) above, or if the contractor does not have a referral agreement or arrangement with a union for a construction trade, the contractor or subcontractor agrees to take the following actions:
 - 1. To notify the public agency compliance officer, the Dept. of LWD, Construction EEO Monitoring Program, and minority and women referral organizations listed by the Division pursuant to N.J.A.C. 17:27-5.3, of its workforce needs, and request referral of minority and women workers;
 - 2. To notify any minority and women workers who have been listed with it as awaiting available vacancies;
 - 3. Prior to commencement of work, to request that the local construction trade union refer minority and women workers to fill job openings, provided the contractor or subcontractor has a referral agreement or arrangement with a union for the construction trade;
 - 4. To leave standing requests for additional referral to minority and women workers with the local construction trade union, provided the contractor or subcontractor has a referral agreement or arrangement with a union for the construction trade, the State Training and Employment Service and other approved referral sources in the area;
 - 5. If it is necessary to lay off some of the workers in a given trade on the construction site, layoffs shall be conducted in compliance with the equal employment opportunity and non-discrimination standards set forth in this regulation, as well as with applicable Federal and State court decisions;
 - 6. To adhere to the following procedure when minority and women workers apply or are referred to the contractor or subcontractor:
 - i. The contactor or subcontractor shall interview the referred minority or women worker.

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- ii. If said individuals have never previously received any document or certification signifying a level of qualification lower than that required in order to perform the work of the construction trade, the contractor or subcontractor shall in good faith determine the qualifications of such individuals. The contractor or subcontractor shall hire or schedule those individuals who satisfy appropriate qualification standards in conformity with the equal employment opportunity and non-discrimination principles set forth in this chapter. However, a contractor or subcontractor shall determine that the individual at least possesses the requisite skills, and experience recognized by a union, apprentice program or a referral agency, provided the referral agency is acceptable to the Dept. of LWD, Construction EEO Monitoring Program. If necessary, the contractor or subcontractor shall hire or schedule minority and women workers who qualify as trainees pursuant to these rules. All of the requirements, however, are limited by the provisions of (C) below.
- iii. The name of any interested women or minority individual shall be maintained on a waiting list, and shall be considered for employment as described in (i) above, whenever vacancies occur. At the request of the Dept. of LWD, Construction EEO Monitoring Program, the contractor or subcontractor shall provide evidence of its good faith efforts to employ women and minorities from the list to fill vacancies.
- iv. If, for any reason, said contractor or subcontractor determines that a minority individual or a woman is not qualified or if the individual qualifies as an advanced trainee or apprentice, the contractor or subcontractor shall inform the individual in writing of the reasons for the determination, maintain a copy of the determination in its files, and send a copy to the public agency compliance officer and to the Dept. of LWD, Construction EEO Monitoring Program.
- v. To keep a complete and accurate record of all requests made for the referral of workers in any trade covered by the contract, on forms made available by the Dept. of LWD, Construction EEO Monitoring Program and submitted promptly to the Dept. of LWD, Construction EEO Monitoring Program upon request.
- C. The contractor or subcontractor agrees that nothing contained in (B) above shall preclude the contractor or subcontractor from complying with the union hiring hall or apprentice-ship policies in any applicable collective bargaining agreement or union hiring hall arrangement, and, where required by custom or agreement, it shall send journeymen and trainees to the union for referral, or to the apprenticeship program for admission, pursuant to such agreement or arrangement. However, where the practices of a union or apprenticeship program will result in the exclusion of minorities and women or the failure to refer minorities and women consistent with the targeted county employment goal, the contractor or subcontractor shall consider for employment persons referred pursuant to (B) above without regard to such agreement or arrangement; provided further, however, that the contractor or subcontractor shall not be required to employ women and minority advanced trainees and trainees in numbers which result in the employment of advanced trainees and trainees as a percentage of the total workforce for the construction trade, which percentage significantly exceeds the apprentice to journey worker ratio specified in the applicable collective bargaining agreement, or in the absence of a collective bargaining agreement, exceeds the ratio established by practice in the area for said construction trade. Also, the contractor or subcontractor agrees that, in implementing the procedures of (B) above, it shall, where applicable, employ minority and women workers residing within the geographical jurisdiction of the union.

After notification of award, but prior to signing a construction contract, the contractor shall submit to the public agency compliance officer and the Dept. of LWD, Construction EEO Monitoring Program an initial project workforce report (Form AA-201) electronically provided to the public agency by the Dept.

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of LWD, Construction EEO Monitoring Program, through its web-site, for distribution to and completion by the contractor, in accordance with N.J.A.C. 17:27-7. The contractor also agrees to submit a copy of the Monthly Project Workforce Report once a month thereafter for the duration of this contract to the Dept. of LWD, Construction EEO Monitoring Program, and to the public agency compliance officer.

The contractor agrees to cooperate with the public agency in the payment of budgeted funds, as is necessary, for on-the-job and/or off-the job programs for outreach and training of minorities and women.

D. The contractor and its subcontractors shall furnish such reports or other documents to the Dept. of LWD, Construction EEO Monitoring Program as may be requested by the Dept. of LWD, Construction EEO Monitoring Program from time to time in order to carry out the purposes of these regulations, and public agencies shall furnish such information as may be re-quested by the Dept. of LWD, Construction EEO Monitoring Program for conducting a compliance investigation pursuant to N.J.A.C. 17:27-1.1 et seq.

CUMBERLAND COUNTY IMPROVEMENT AUTHORITY

The Cumberland County Improvement Authority believes it is a function of government to train people for careers, and for their future, as well as to ensure that there will be a skilled trained workforce in the future, and that an appropriate apprenticeship program would provide that workforce of skilled labor. Therefore, the Authority requires the following:

- A. That with respect to award of construction contracts which meet or exceed the bid threshold as established by the State of New Jersey, the bidder shall have an approved apprenticeship program pursuant to standards established under N.J.S.A. 34:1A-36 et seq.
- B. All sub-contractors used by said bidders shall also have an approved apprenticeship program; and
- C. If a bidder or sub-contractor does not have its own approved apprenticeship program as set forth above, the requirement may be met by submitting a statement of agreement not to employ any worker of less than journeyman status on the project ("Statement of Agreement").

Public policy in the State of New Jersey as reflected by statutes (N.J.S.A. 34:15E -1 et seq. and N.J.S.A. 34:1A-36 et seq.) recognizes the benefits of highly skilled workforces through the implementation of apprenticeship programs. Apprenticeship is training in occupations that require a wide and diverse range of skills and knowledge, as well as maturity and independence of judgment. It involves planned, day-by-day training on the job and experience under proper supervision, combined with related technical instruction.

As practiced by modern industry, apprenticeship is a business-like system designed to provide workers entering industry with comprehensive training by exposing then to the practical and theoretical aspects of the work required in a highly skilled occupation. This is accomplished through structured training on the job and related theoretical instruction.

TITLE 29, FEDERAL REGULATIONS, PART 29.4

An apprentice-able occupation is one that:

- A. Is customarily learned in a practical way through a structured, systematic program of supervised on-the-job training.
- B. Is clearly identified and commonly recognized throughout an industry.
- C. Involves manual, mechanical, or technical skills and knowledge that require a minimum of 2,000 hours of onthe-job training.
- D. Requires related instruction to supplement the on-the-job training. Such instruction may be given in a classroom, through correspondence courses, self-study, or other means of approved instruction.

Under the National Apprenticeship Act, the Bureau of Apprenticeship and Training (BAT) is responsible for providing service to existing apprenticeship programs and technical assistance to organizations who would like to establish an apprenticeship program. The Bureau works very closely with State

Apprenticeship Councils (SAC) and the educational system to deliver support services at the national, state, and local levels.

Approved apprenticeship programs are usually available through local county vocational schools, through various union locals and/or through the U.S. Department of Labor. The U.S. Department of Labor of New Jersey is located at:

U.S. Department of Labor Bureau of Apprenticeship and Training 485 Route 1 South Building "E", Room 300 Iselin, New Jersey 08830 Phone: 732-750-9191 / Fax: 732-750-0788

The Cumberland County Improvement Authority's specifications for all construction require proof of an approved apprenticeship program or a Statement of Agreement.

Acceptable forms of verification may include a United States Department of Labor Office of Apprenticeship Training Employer and Labor Registration, or a signed agreement with a contractor or other apprenticeship program, or any other form of verification acceptable to the County. Application forms for U.S. Department of Labor Apprenticeship Agreement, which are administered by the Office of NJ Department of Education, Office of School-to-Career and College Initiatives, and a sample copy of the U.S. Department of Labor Agreement are contained in this specification. These Apprenticeship program requirements are considered a material requirement. Failure to comply with these requirements will be cause for rejection of your bid. Proof of an apprenticeship program for all trades shall be presented with your bid at the time scheduled, or the Statement of Agreement.

Following is a form upon which you will identify all various trades called for on this project. The bidder shall provide proof of participation in an approved apprenticeship program for each trade listed (and any other the vendor proposes to use).

Vendor must also supply proof of participation in appropriate apprenticeship program for subcontractors or provide the requested Statement of Agreement as well.

NOTE TO ALL BIDDERS:

A <u>sample</u> of an application for an apprenticeship program, and a copy of the certificate of an apprenticeship program are included in these specifications. A completed copy of either of these two forms submitted to the county or a Statement of Agreement will suffice as proof of an apprenticeship program.

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THE APPRENTICE AND APPRENTICESHIP AGREEMENT

An "apprentice" shall mean an employee of legal working age who meets the qualifications established by the sponsor (age, education, physical, residency requirements, etc., shall be attached if applicable), and who is employed under a written agreement which provides that training and experience received be in accordance with these standards of Apprenticeship. The apprentice shall be registered with the Bureau of Apprenticeship and Training, U.S. Department of Lator and approved by the Office of School-To-Career and College Initiatives. New Jersey Department of Education, referred to hereafter as the Joint Agencies, as an apprentice and using the approved apprenticeship agreement form for these registrations. The apprentice agreement shall be signed by the sponsor, the apprentice and, if the apprentice is a minor, by his/her parent of guardian.

EQUAL OPPORTUNITY PLEDGE

The recruitment, selection, employment and training of apprentices during their apprenticeship, shall be without discommation because of race, color, religion, national origin, or sex. The sponsor will take affirmative action to provide equal opportunity in apprenticeship and will operate the apprenticeship program as required under Title 29 CFR, Part 30, as amended. Selection Procedures and Affirmative Action Plan attached, if applicable,

Apprentices will be accorded equal opportunity in all phases of apprenticeship as stated above.

TERM OF APPRENTICESHIP, PROBATION PERIOD, CANCELLATION, WORK EXPERIENCE, WAGE SCHEDULE; LAYOFF: RATIO: ETC.

The term of apprenticeship shall be as stated on the attached trade schedule(s). Either party or agency may cancel the apprenticeship agreement by notifying the others. During the probationary period the apprenticeship agreement may be cancelled by either party without stated cause. After the probationary period, the agreement may be suspended or cancelled by sponsor for cause, or at the request of the apprentice. The registration and approval agencies and apprentices that be notified in writing of all suspended or cancellations, termination, and completions of apprentices to skilled workers (journeyworker) in the caff. Any apprentice laid off under this section shall be given the opportunity to be re-employed before any new apprentices to skilled workers (journeyworker) in the caff. Any apprentice laid off under this section shall be agreement the transfer of the employer's training obligation should be made to another employer under the same program with the consent of the apprentices and apprentices has been program sponsor. The ratio of apprentices to built employeer under the same program with the Bureau of Apprentices and Training consistent with the proper supervision, training and continuation of employment. The entry wages of the progressively increasing schedule of wages shall not be lass that the Federat or State infinitum wage unless a higher wage is required by a collective bargaining agreement.

SUPERVISION OF APPRENTICES

The sponsor shall designate a qualified person who will be responsible for the supervision and training of apprentices in accordance with the attached work process. Adequate records shall be kept by the sponsor indicating the apprentice's progress as well as current status in the training program by conducting periodic reviews and evaluations in both on-the-job and related instruction.

DUTIES OF THE JOINT AGENCIES

The sponsor and apprentice may consult with the representatives of the Bureau of Apprenticeship and Training or the Office of School-To-Career and College Initiatives concerning interpretations of the provisions of these standards.

WORKING CONDITIONS

The sponsor agrees to become familiar with Federal, State and local laws or regulations which may affect the employment of apprentices under this agreement. Except for related instruction, the workday and workweek should be the same as that of the journeyworkers in the trade.

RELATED INSTRUCTION

Supplemental related instruction is recognized as necessary to the development of competent journeyworkers. The New Jersey State Department of Education, Office of School-To-Career and College Initiatives and the county apprenticeship boordinator have the primary responsibility for providing and approving related instruction. This instruction constitutes a minimum of 144 hours for each year of apprenticeship. Exceptions must be approved by the Joint Agencies. Related instruction curriculums are on file.

CREDIT FOR PREVIOUS EXPERIENCE

The sponsor may give credit for previous trade experience. Commensurate wage rates shaft reflect any advancement of work credit. Related instruction credit will be evaluated and approved by the New Jersey Department of Education, Office of School-To-Career and College Initiatives together with county apprenticeship coordinators.

SAFETY PROVISIONS

Adequate and safe equipment and facilities for training and supervision, and safety training for apprentices on the job and in related instruction shall be turnished.

CERTIFICATE OF COMPLETION OF APPRENTICESHIP

Upon completion of apprenticeship, the sponsor will recommend that a Certificate of Completion of Apprenticeship be awarded to the apprentice. The Joint Agencies must verify completion of both parts of training prior to issuance of a Certificate of Completion, by the U.S. Department of Labor, Bureau of Apprenticeship and Training, and the New Jersey Department of Education, Office of School-To-Career and College Initiatives.

MODIFICATION OF STANDARDS

Any modification or changes in these standards will be submitted for approval promptly to the Bureau of Apprenticeship and Training. The Joint Agencies must verify completion of both parts of training prior to issuance of a Certificate of Completion by the U.S. Department of Labor, Bureau of Apprenticeship and Training, and the New Jersey Department of Education, Office of School-To-Career and College Initiatives.

ADJUSTMENT OF DIFFERENCES

In the event that differences arise as to the interpretation of the standards of the apprenticeship agreement which cannot be satisfactorily sattled by the apprentice and the program sponsor, either party may request the advice and assistance of the Bureau of Apprenticeship and Training, the county apprenticeship coordinator, and/or the Office of School-To-Career and College Initiatives.

MAINTENANCE OF RECORDS

It is maintained as required by the Bureau of Apprenticeship and Training and the Office of School-Yo-Career and College Initiatives



<u>SAMPLE</u> Begintinana Xa Authority Survey States

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Section 40A:11-16.7

CHANGED CONDITIONS CLAUSES FOR CERTAIN LOCAL PUBLIC CONTRACTS

All construction contracts issued by a contracting unit for bids which were advertised on or after the effective date [Jan. 16, 2018] of <u>P.L.2017, c.317 (C.40A:11-16.7</u> et seq.) shall include the changed conditions contract provisions set forth in this section, which provisions shall be deemed to be a part of any such contract even if not expressly incorporated therein, and which provisions may not be modified in any manner by the contracting unit.

- A. A contract subject to this section shall include the following differing site conditions provisions:
 - 1. If the contractor encounters differing site conditions during the progress of the work of the contract, the contractor shall promptly notify the contracting unit in writing of the specific differing site conditions encountered before the site is further disturbed and before any additional work is performed in the impacted area.
 - 2. Upon receipt of a differing site conditions notice in accordance with paragraph (1) of this subsection, or upon the contracting unit otherwise learning of differing site conditions, the contracting unit shall promptly undertake an investigation to determine whether differing site conditions are present.
 - 3. If the contracting unit determines different site conditions that may result in additional costs or delays exist, the contracting unit shall provide prompt written notice to the contractor containing directions on how to proceed.
 - 4.
- i. The contracting unit shall make a fair and equitable adjustment to the contract price and contract completion date for increased costs and delays resulting from the agreed upon differing site conditions encountered by the contractor.
- ii. If both parties agree that the contracting unit's investigation and directions decrease the contractor's costs or time of performance, the contracting unit shall be entitled to a fair and equitable downward adjustment of the contract price or time of performance.
- iii. If the contracting unit determines that there are no differing site conditions present that would result in additional costs or delays, the contracting unit shall so advise the contractor, in writing, and the contractor shall resume performance of the contract, and shall be entitled to pursue a differing site conditions claim against the contracting unit for additional compensation or time attributable to the alleged differing site conditions.
- 5. Execution of the contract by the contractor shall constitute a representation that the contractor has visited the site and has become generally familiar with the local conditions under which the work is to be performed.
- 6. As used in this subsection, "differing site conditions" mean physical conditions at the contract work site that are subsurface or otherwise concealed and which differ materially from those indicated in the contract documents or are of such an unusual nature that the conditions differ materially from those ordinarily encountered and generally recognized as inherent in the work of the character provided for in the contract.
- B. A contract subject to this section shall include the following suspension of work provisions:

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- 1. The contracting unit shall provide written notice to the contractor in advance of any suspension of work lasting more than 10 calendar days of the performance of all or any portion of the work of the contract.
- 2. If the performance of all or any portion of the work of the contract is suspended by the contracting unit for more than 10 calendar days due to no fault of the contractor or as a consequence of an occurrence beyond the contracting unit's control, the contractor shall be entitled to compensation for any resultant delay to the project completion or additional contractor expenses, and to an extension of time, provided that, to the extent feasible, the contractor, within 10 calendar days following the conclusion of the suspension, notifies the contracting unit, in writing, of the nature and extent of the suspension of work. The notice shall include available supporting information, which information may thereafter be supplemented by the contractor as needed and as may be reasonably requested by the contracting unit. Whenever a work suspension exceeds 60 days, upon seven days' written notice, either party shall have the option to terminate the contract for cause and to be fairly and equitably compensated therefor.
- 3. Upon receipt of the contractor's suspension of work notice in accordance with paragraph (2) of this subsection, the contracting unit shall promptly evaluate the contractor's notice and promptly advise the contractor of its determination on how to proceed in writing.

4.

- i. If the contracting unit determines that the contractor is entitled to additional compensation or time, the contracting unit shall make a fair and equitable upward adjustment to the contract price and contract completion date.
- ii. If the contracting unit determines that the contractor is not entitled to additional compensation or time, the contractor shall proceed with the performance of the contract work, and shall be entitled to pursue a suspension of work claim against the contracting unit for additional compensation or time attributable to the suspension.
- 5. Failure of the contractor to provide timely notice of a suspension of work shall result in a waiver of a claim if the contracting unit can prove by clear and convincing evidence that the lack of notice or delayed notice by the contractor actually prejudiced the contracting unit's ability to adequately investigate and defend against the claim.
- C. A contract subject to this section shall include the following change in character of work provisions:
 - 1. If the contractor believes that a change directive by the contracting unit results in a material change to the contract work, the contractor shall so notify the contracting unit in writing. The contractor shall continue to perform all work on the project that is not the subject of the notice.
 - 2. Upon receipt of the contractor's change in character notice in accordance with paragraph (1) of this subsection, the contracting unit shall promptly evaluate the contractor's notice and promptly advise the contractor of its determination on how to proceed in writing.
 - 3.
- i. If the contracting unit determines that a change to the contractor's work caused or directed by the contracting unit materially changes the character of any aspect of the contract work, the contracting unit shall make a fair and equitable upward adjustment to the contract price and contract completion date. The basis for any such price adjustment shall be the difference between the cost of performance of the work as planned at the time of contracting and the actual cost of such work as a result of its

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change in character, or as otherwise mutually agreed upon by the contractor and the contracting unit prior to the contractor performing the subject work.

- ii. If the contracting unit determines that the contractor is not entitled to additional compensation or time, the contractor shall continue the performance of all contract work and shall be entitled to pursue a claim against the contracting unit for additional compensation or time attributable to the alleged material change.
- 4. As used in this subsection, "material change" means a character change which increases or decreases the contractor's cost of performing the work, increases or decreases the amount of time by which the contractor completes the work in relation to the contractually required completion date, or both.
- D. A contract subject to this section shall include the following change in quantity provisions:
 - 1. The contracting unit may increase or decrease the quantity of work to be performed by the contractor.
 - 2.
 - i. If the quantity of a pay item is cumulatively increased or decreased by 20 percent or less from the bid proposal quantity, the quantity change shall be considered a minor change in quantity.
 - ii. If the quantity of a pay item is increased or decreased by more than 20 percent from the bid proposal quantity, the quantity change shall be considered a major change in quantity.
 - 3. For any minor change in quantity, the contracting unit shall make payment for the quantity of the pay item performed at the bid price for the pay item.
 - 4.
- i. For a major increase in quantity, the contracting unit or contractor may request to renegotiate the price for the quantity in excess of 120 percent of the bid proposal quantity. If a mutual agreement cannot be reached on a negotiated price for a major quantity increase, the contracting unit shall pay the actual costs plus an additional 10 percent for overhead and an additional 10 percent for profit, unless otherwise specified in the original bid.
- ii. For a major decrease in quantity, the contracting unit or contractor may request to renegotiate the price for the quantity of work performed. If a mutual agreement cannot be reached on a negotiated price for a major quantity decrease, the contracting unit shall pay the actual costs plus an additional 10 percent for overhead and an additional 10 percent for profit, unless otherwise specified in the original bid; provided, however, that the contracting unit shall not make a payment in an amount that exceeds 80 percent of the value of the bid price multiplied by the bid proposal quantity.
- 5. As used in this subsection, the term "bid proposal quantity" means the quantity indicated in the bid proposal less the quantities designated in the project plans as "if and where directed."

Section 40A:11-16.6

DEFINITIONS RELATIVE TO VALUE ENGINEERING CHANGE ORDERS; REQUIREMENT FOR CERTAIN CONTRACTS

A. For the purpose of this act:

"Construction" means the construction, reconstruction, demolition, erection, alteration, or repair of a structure or other improvement to real property, other than the construction, reconstruction, demolition, or renovation of a public building.

"Value engineering construction change order" means a change order that results in cost reductions to a project or any portion of the work from the original bid specifications after a construction contract is awarded.

"Value engineering construction proposal" means a cost reduction proposal based on analysis by a contractor of the functions, systems, equipment, facilities, services, supplies, means and methods of construction, and any other item needed for the completion of the contract consistent with the required performance, quality, reliability, and safety.

- B. All construction contracts issued by a contracting unit when the total price of the originally awarded contract equals or exceeds \$5,000,000, shall allow for value engineering construction change orders to be approved after the award of the contract.
- C. Value engineering construction change orders shall be subject to the following provisions:
 - 1. Value engineering construction change orders shall not be used to impair any of the essential functions, or characteristics of the project, or any portion of the work involved.
 - 2. The contractor shall submit a value engineering construction proposal that completely describes the changes to the original specifications or proposal, impact on other project components, advantages and disadvantages of the proposed change, cost estimates and calculations on which they are based, any impact on the contract time schedule, and any other relevant information that the contracting unit may require in order to review the value engineering construction proposal. The contractor's cost for developing the value engineering construction proposal shall not be eligible for reimbursement by the contracting unit.
 - 3. The contractor shall be liable for all reasonable costs incurred by the contracting unit for the technical evaluation and engineering review of a value engineering construction proposal presented by the contractor.
 - 4. The contracting unit's engineer shall prepare a written report for the governing body that shall evaluate the value engineering construction proposal, make a recommendation on whether or not it should be accepted, rejected, or modified, and state to the contracting unit and contractor the amount of any projected cost savings.
 - 5. The proposal shall not be approved unless the engineer reports to the governing body that the proposal appears consistent with the required performance, quality, reliability, and safety of the project and does not impair any of the essential functions, or characteristics of the project, or any portion of the work involved.
 - 6. The contracting unit shall have the sole discretion to approve or disapprove a value engineering construction proposal.

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- 7. The contractor and the contracting unit shall equally share in the cost savings generated on the contract as a result of an approved value engineering construction change order. Once the project is completed, the contracting unit's engineer shall verify the cost savings to reflect the actual cost of the work, and such verified cost saving shall be the basis for the savings shared equally with the contractor.
- 8. The contractor shall have no claim against the contracting unit as a result of the contracting unit's disapproval of a value engineering construction proposal.
- 9. A contracting unit shall include in its bid specifications and contract documents procedures to regulate the value engineering construction change order process. Such procedures shall be based on procedures established by the New Jersey Department of Transportation, or any other appropriate State agency, or rules adopted by the director of the Division of Local Government Services.
- D. This section shall not invalidate or impair rules regarding change orders adopted by the director of the Division of Local Government Services prior to the effective date of this act. Notwithstanding any provision of P.L.1968, c.410 (C.52:14B-1 et seq.) to the contrary, the director may adopt, immediately upon filing with the Office of Administrative Law, such rules and regulations as the director deems necessary to implement the provisions of P.L.2005, c.67 (C.40A:11-16.6) which shall be effective for a period not to exceed 12 months. The regulations shall thereafter be amended, adopted or readopted in accordance with the provisions of P.L.1968, c.410 (C.52:14B-1 et seq.).

DRAFT AIA Document A101[™] - 2017

Standard Form of Agreement Between Owner and Contractor

where the basis of payment is a Stipulated Sum

AGREEMENT made as of the « » day of « » in the year **2024** (*In words, indicate day, month and year.*)

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

Cumberland County Improvement Authority 745 Lebanon Road Millville, New Jersey 08332

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

LEAVE THIS BLANK FOR BID

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

NJ State Police Barracks Building Block 183 Lot 14 aka 2007 Highland St, Port Norris, NJ 08349

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

Design Professional: Manders Merighi Portadin Farrell 1138 E Chestnut Ave, Building 4 Vineland, NJ 08360

With supporting documents from

Consulting Engineer Services 645 Berlin-Cross Keys Road, Suite 1 Sicklerville, NJ 08081

The Owner and Contractor agree as follows.

ADDITIONS AND DELETIONS:

The author of this document has added information needed for its completion. The author may also have revised the text of the original AIA standard form. An Additions and Deletions Report that notes added information as well as revisions to the standard form text is available from the author and should be reviewed.

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

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





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- 6 DISPUTE RESOLUTION
- 7 TERMINATION OR SUSPENSION
- 8 MISCELLANEOUS PROVISIONS
- 9 ENUMERATION OF CONTRACT DOCUMENTS
- 10 MISCELLANEOUS



2

ARTICLE 0 BACKGROUND AND INTENT

§ 0.1 Contractor hereby represents and warrants to Owner that:

§ 0.1.1 Contractor is financially solvent, able to pay its debts as they mature and possessed of sufficient working capital to complete the services required and perform its obligations hereunder;

§ 0.1.2 Contractor is able to furnish the services required hereunder and perform all of its obligations hereunder;

§ 0.1.3 Contractor is qualified to do business in the State of New Jersey;

§ 0.1.4 Contractor's execution of this Agreement and its performance is within its duly authorized powers; and

§ 0.1.5 Contractor's duly authorized representative has visited the Project and familiarized himself generally with the local conditions under which the services required hereunder are to be performed.

ARTICLE 1 THE CONTRACT DOCUMENTS

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

ARTICLE 2 THE WORK OF THIS CONTRACT

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

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DATE OF COMMENCEMENT AND SUBSTANTIAL COMPLETION ARTICLE 3

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

[« »] The date of this Agreement. [« X »] A date set forth in a notice to proceed issued by the Owner. [« »] Established as follows: (Insert a date or a means to determine the date of commencement of the Work.) The date of commencement will be fixed in a notice to proceed. If a date of commencement of the Work is not selected, then the date of commencement shall be the date of this

§ 3.2 The Contract Time shall be Three Hundred Sixty Five (365) calendar days measured from the date of commencement of the Work.

See 3.3.1, Below.

Agreement.

§ 3.3 Substantial Completion

§ 3.3.1 Subject to adjustments of the Contract Time as provided in the Contract Documents, the Contractor shall achieve Substantial Completion of the entire Work:

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

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

[« X »] By the following date: «May 1, 2025»

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

Portion of Work Substantial Completion Date

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

ARTICLE 4 CONTRACT SUM

§ 4.1 The Owner shall pay the Contractor the Contract Sum in current funds for the Contractor's performance of the Contract. The Contract Sum shall be « and 00/100 Dollars » (\$NUMERICAL VALUE), subject to additions and deductions as provided in the Contract Documents.

§ 4.2 Alternates

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

Item

Price

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

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Item	Price	Conditions for Acceptance
N/A		
Allowances, if any, included in the Contract Sum:		
ify each allowance.)		

Item	Price	
General Allowance	\$125,000.00	

§ 4.4 Unit prices, if any:

§ 4.3 (Iden

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

Item	Units and Limitations	Price per Unit (\$0.00)
N/A		

§ 4.5 Liquidated damages, if any:

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

1. Liquidated Damages Apply. The Liquidated Damages for failure to achieve Substantial Completion of the Work by the date identified in Section 3.3 are \$500.00 per calendar day for each day, weekends and holidays included, that the Contractor fails to achieve Substantial Completion within the timeframe enumerated in item 3.3.1 above.

§ 4.6 Other:

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

None

ARTICLE 5 PAYMENTS

§ 5.1 Progress Payments

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

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

§ 5.1.3 Provided that an Application for Payment is received by the Architect not later than the $\ll 30^{th}$ day of a month, the Owner shall make payment of the certified amount to the Contractor not later than the $\ll 30^{th}$ day of the $\ll next$ month, subject to Section 5.1.10. If an Application for Payment is received by the Architect after the application date fixed above, payment shall be made by the Owner not later than $\ll thirty$ ($\ll 30^{s}$) days after the Architect receives the Application for Payment, subject to Section 5.1.10

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

§ 5.1.3.1 The parties agree that the invoice date shall be that date that the Owner receives the Contractor's Invoice and all additional items required to be submitted with the invoice under the Agreement.

§ 5.1.4 Each Application for Payment shall be based on the most recent schedule of values submitted by the Contractor in accordance with the Contract Documents. The schedule of values shall allocate the entire Contract Sum among the various portions of the Work. The schedule of values shall be prepared in such form, and supported by such data to substantiate its accuracy, as the Architect may require. This schedule of values shall be used as a basis for reviewing the Contractor's Applications for Payment. The Contractor shall use the AIA Payment Application Form 702 and the Cost Breakdown/Schedule of Values attached hereto as Exhibit "1" or such other form approved by Owner. The Contractor shall be required to obtain the signature of the Architect on the Certification section of Form 702 each month prior to submitting the payment application to the Owner.

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

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

§ 5.1.6.1 The amount of each progress payment shall first include:

- .1 That portion of the Contract Sum properly allocable to completed Work;
- .2 That portion of the Contract Sum properly allocable to materials and equipment delivered and suitably stored at the site for subsequent incorporation in the completed construction, or, if approved in advance by the Owner, suitably stored off the site at a location agreed upon in writing, less retainage of two percent (2%); and
- .3 That portion of Construction Change Directives that the Architect determines, in the Architect's professional judgment, to be reasonably justified.

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

- .1 The aggregate of any amounts previously paid by the Owner;
- .2 The amount, if any, for Work that remains uncorrected and for which the Architect has previously withheld a Certificate for Payment as provided in Article 9 of AIA Document A201–2017;
- .3 Any amount for which the Contractor does not intend to pay a Subcontractor or material supplier, unless the Work has been performed by others the Contractor intends to pay;
- .4 For Work performed or defects discovered since the last payment application, any amount for which the Architect may withhold payment, or nullify a Certificate of Payment in whole or in part, as provided in Article 9 of AIA Document A201–2017; and
- .5 Retainage withheld pursuant to Section 5.1.7.

§ 5.1.7 Retainage

§ 5.1.7.1 For each progress payment made prior to Substantial Completion of the Work, the Owner may withhold the following amount, as retainage, from the payment otherwise due:

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

« See Article 9 of the AIA Document -A201-2017 »

§ 5.1.7.1.1 The following items are not subject to retainage: (Insert any items not subject to the withholding of retainage, such as general conditions, insurance, etc.)

«N/A»

§ 5.1.7.2 Reduction or limitation of retainage, if any, shall be as follows:

(If the retainage established in Section 5.1.7.1 is to be modified prior to Substantial Completion of the entire Work, including modifications for Substantial Completion of portions of the Work as provided in Section 3.3.2, insert provisions for such modifications.)

«N/A»

§ 5.1.7.3 Except as set forth in this Section 5.1.7.3, upon Substantial Completion of the Work, the Contractor may submit an Application for Payment that includes the retainage withheld from prior Applications for Payment pursuant to this Section 5.1.7. The Application for Payment submitted at Substantial Completion shall not include retainage as follows:

(Insert any other conditions for release of retainage upon Substantial Completion.)

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

§ 5.1.9 Except with the Owner's prior approval, the Contractor shall not make advance payments to suppliers for materials or equipment which have not been delivered and stored at the site. The Owner shall only consider payment for off-site storage in the event that the material is stored at a bonded and licensed facility acceptable to Owner and where the Owner can reasonably visually verify or receive other acceptable verification of the storage of materials. If verification is necessary or required by Owner and/or Architect by a site visit outside of a local site visit for materials and equipment suitably stored off the site in a licensed and bonded facility and to consider payment for these items, Contractor shall pay all costs associated with site visits/review outside of local site visits by Owner and/or Architect.

§ 5.1.10 Payments to the Contractor shall be subject to New Jersey's Prompt Payment Act, NJ.S.A. 2A:30A-1, et seq. (the "Act"). For purposes of the Agreement, the "billing date", as provided for in the Act shall be the date that the Application for Payment is received by the Owner. Any dispute regarding whether a party to this Contract has failed to make payments as required by the Act (and no other matters) may be submitted to mediation.

§ 5.1.10.1 Owner is a public entity that requires a vote in authorization for each periodic payment, final payment and retainage monies. The amount due may be approved and certified at the next scheduled public meeting of the Owner's governing body and paid during the Owner's subsequent payment cycle.

§ 5.1.10.2 The Contractor shall submit such additional paperwork as Owner may reasonably require for Owner's internal billing process.

§ 5.2 Final Payment

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

- the Contractor has fully performed the Contract except for the Contractor's responsibility to correct .1 Work as provided in Article 12 of AIA Document A201–2017, and to satisfy other requirements, if any, which extend beyond final payment; and
- .2 a final Certificate for Payment has been issued by the Architect, and all of the requirements of Section 9.10 of the A201 for the Project have been met; and
- .3 all government approvals, unconditional certificates of occupancy, inspections and permits have been issued by local, state and federal authorities.

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

§ 5.3 Interest

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

«Prime Rate as set forth in the Wall Street Journal Money Section.

ARTICLE 6 DISPUTE RESOLUTION

§ 6.1 Initial Decision Maker

The Architect will serve as the Initial Decision Maker pursuant to Article 15 of AIA Document A201-2017, unless the parties appoint below another individual, not a party to this Agreement, to serve as the Initial Decision Maker. (If the parties mutually agree, insert the name, address and other contact information of the Initial Decision Maker, *if other than the Architect.*)

1. Throughout this Agreement and the AIA A201-2017 General Conditions, the Owner shall have the right to substitute itself in place of the Architect, wherever the term "Architect" is set forth in the Agreement.

§ 6.2 Binding Dispute Resolution

For any Claim subject to, but not resolved by, mediation pursuant to Article 15 of AIA Document A201–2017, the method of binding dispute resolution shall be as follows: (Check the appropriate box.)

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[**« X »**] Arbitration pursuant to Section 15.4 of AIA Document A201–2017

- [« »] Litigation in a court of competent jurisdiction
- [« »] Other (Specify)

« »

If the Owner and Contractor do not select a method of binding dispute resolution, or do not subsequently agree in writing to a binding dispute resolution method other than litigation, Claims will be resolved by litigation in a court of competent jurisdiction.

TERMINATION OR SUSPENSION ARTICLE 7

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

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

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

ARTICLE 8 MISCELLANEOUS PROVISIONS

§ 8.1 Where reference is made in this Agreement to a provision of AIA Document A201–2017 or another Contract Document, the reference refers to that provision as amended or supplemented by other provisions of the Contract Documents.

§ 8.2 The Owner's representative: (Name, address, email address, and other information)

Cumberland County Improvement Authority Attn: Ryan Feaster 745 Lebanon Rd Millville, NJ 08332 rfeaster@theauthoritynj.com 856-825-3700 x1406

§ 8.3 The Contractor's representative: (Name, address, email address, and other information)

LEAVE THIS BLANK FOR BID

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

§ 8.5 Insurance and Bonds

§ 8.5.1 The Owner and the Contractor shall purchase and maintain insurance as set forth in AIA Document A101TM 2017, Standard Form of Agreement Between Owner and Contractor where the basis of payment is a Stipulated Sum, Exhibit A, Insurance and Bonds, and elsewhere in the Contract Documents.

§ 8.5.2 The Contractor shall provide bonds as set forth in AIA Document A101TM-2017 Exhibit A, and elsewhere in the Contract Documents.

§ 8.6 Notice in electronic format, pursuant to Article 1 of AIA Document A201–2017, may be given in accordance with AIA Document E203TM–2013, Building Information Modeling and Digital Data Exhibit, if completed, or as otherwise set forth below:

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

§ 8.7 Other provisions:

.1 Throughout this Agreement and the AIA A201 General Conditions, the Owner shall have the right to substitute itself in place of the Architect, wherever the term "Architect" is set forth in the Agreement.

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ARTICLE 9 ENUMERATION OF CONTRACT DOCUMENTS

§ 9.1 This Agreement is comprised of the following documents:

- .1 AIA Document A101TM_2017, Standard Form of Agreement Between Owner and Contractor
- .2 AIA Document A201TM–2017, General Conditions of the Contract for Construction
- .4 The Supplementary and other Conditions of the Contract:

	Document	Title	Date	Pages
.5	Drawings (Drawing List Table of Conte	ents Attached)		
	Number	Title		Date
.6	Specifications (Specification Table of C	Contents Attached)		
	Section	Title	Date	Pages
.7	Addenda, if any:			J
	Number	Date	Pages	
.8	Portions of Addenda relating to bidding Documents unless the bidding or propo Other Exhibits: (Check all boxes that apply and include required.)	g or proposal requirement sal requirements are also e appropriate information	ts are not part of the enumerated in this in identifying the ext	e Contract Article 9. hibit where
	[« »] AIA Document E204 TM –2017 (Insert the date of the E204-20	, Sustainable Projects Ex 017 incorporated into this	hibit, dated as indic s Agreement.)	cated below:
	[« »] The Sustainability Plan:	Data	Paul	\int
	N/A	Date	Pages	
	[« »] Supplementary and other Con-	ditions of the Contract:		
	Document	Title	Date	Pages
	N/A			

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.9 Other documents, if any, listed below:

(List here any additional documents that are intended to form part of the Contract Documents. AIA Document $A201^{\text{TM}}-2017$ provides that the advertisement or invitation to bid, Instructions to Bidders, sample forms, the Contractor's bid or proposal, portions of Addenda relating to bidding or proposal requirements, and other information furnished by the Owner in anticipation of receiving bids or proposals, are not part of the Contract Documents unless enumerated in this Agreement. Any such documents should be listed here only if intended to be part of the Contract Documents.)

«Contractor's bid or proposal, Addenda relating to bidding or proposal requirements, and other information furnished by the Owner in anticipation of receiving bids or proposals are expressly part of the Contract Documents»

ARTICLE 10 MISCELLANEOUS

§ 10.1 Any notice provided or required to be given under this Agreement must be in writing and shall be served (and shall be deemed to have been served): (1) by hand delivering a copy thereof to the party being served in person or by commercial courier; (2) by postage prepaid certified mail, return receipt requested; (3) by nationally recognized guaranteed overnight delivery service; (4) by facsimile, evidenced by confirmed receipt, to the person or persons set forth below for each party to this Agreement; or by (5) email, evidenced by confirmed receipt, to the person or persons set forth below for each party to this Agreement:

As to the Owner: Gerard Velazquez, III President/CEO Cumberland County Improvement Authority 745 Lebanon Road Millville, NJ 08332

As to the Architect: Building: Manders Merighi Portadin Farrell Attn: Ron Portadin 1138 E Chestnut Ave, Building 4 Vineland, NJ 08360 856-696-9155

Site Work: Consulting Engineer Services Attn: O. Andrew Simkins 645 Berlin-Cross Keys Road, Suite 1 Sicklerville, NJ 08081 856-228-2200

As to the Contractor: **LEAVE THIS BLANK FOR BID**

§ 10.2 If any term, covenant or condition of this Agreement shall, to any extent, be held invalid or unenforceable, the remainder of this Agreement shall not be affected thereby and each term, covenant and condition of this Agreement shall be separately valid and enforceable to the fullest extent permitted by law.

§ 10.3 All rights, privileges and remedies afforded to the parties by this Agreement shall be cumulative and not exclusive, and the exercise of any one of such remedies shall not be deemed to be a waiver of any other rights, remedies or privileges provided for herein or available at law or in equity.

§ 10.4 The failure of either party to seek redress for violation, or to insist upon the strict performance, of any covenant, agreement, provision or condition of this Agreement shall not constitute a waiver thereof and such party shall have all remedies provided for herein or by applicable law with respect to the same or any subsequent act or omission which constitutes such violation or nonperformance.

§ 10.5 The captions appearing in this Agreement are inserted only as a matter of convenience and for reference and in no way define, limit or describe the scope and intent of this Agreement or any of the provisions hereof.

§ 10.6 Services provided by the Contractor hereunder shall be performed in a reasonably prompt manner and shall be in accordance with the professional standards applicable to such services on the type of Project contemplated by this Agreement and Contractor shall be responsible for services provided hereunder whether such services are provided

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directly by Contractor or by any subcontractors or consultants hired by Contractor. The Contractor will perform duties and services and make decisions called for hereunder promptly and without unreasonable delay and will give this Project such priority in its offices as is reasonably necessary to cause the Contractor services hereunder to be timely and properly performed consistent with sound professional practices.

As to	
This Agreement entered into as of the day and year fir	st written above.
OWNER (Signature)	CONTRACTOR (Signature)
«Gerard Velazquez, III, President/CEO»	«Contractor Name, Title »
(Printea name and title)	
218236684v1	

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DRAWING LIST

Sheet # Sheet Name

GENERAL

EG1.0 Building Data & Egress Plans

<u>CIVIL</u>

1 of 11	Site Plan
2 of 11	Existing Conditions
3 of 11	Site Plan
4 of 11	Grading Plan
5 of 11	Utility Plan
6 of 11	Landscaping Plan
7 of 11	Lighting Plan
8 of 11	Construction Details
9 of 11	Storm Sewer Details
10 of 11	Soil Erosion & Sediment Control Plan
11 of 11	Soil Erosion & Sediment Control Plan – Notes & Details

SEPTIC

STRUCTURAL

- S1.0 Foundation Plan
- S1.1 Roof Truss Framing Plan
- S1.2 Roof Structural Plan
- S1.3 Bearing and Shear Walls
- S1.4 Structural Details
- S1.5 Structural Details
- S1.6 Structural Details

ARCHITECTURAL

- A1.0 Floor Plan
- A1.1 Door/Frame/Window & Partition Types & Schedules
- A1.2 Door & Window Details
- A1.3 Plan Details
- A1.4 Roof Plan
- A1.5 Roof Details
- A2.0 Building Elevations
- A2.1 Building Sections
- A3.1 Wall Sections 1
- A3.2 Wall Sections 2
- A3.3 Wall Sections 3
- A3.4 Wall Sections 4
- A3.5 Wall Sections 5
- A3.6 Wall Sections 6

- A3.7 Wall Sections 7
- A3.8 Wall Sections8
- A4.0 Typ. Toilet Room Plans & Elevations Details
- A4.1 Enlarged Toilet Room Plans & Elevations Toilet Accessories Schedule
- A4.2 Interior Elevations & Details
- A5.0 Reflected Ceiling Plan

MECHANICAL

- M0.1 HVAC Legend
- M1.0 HVAC Zoning Plan
- M1.1 First Floor HVAC Plan
- M1.2 Roof HVAC Plan
- M3.0 HVAC Sections
- M4.0 HVAC Details
- M5.0 HVAC Schedules

ELECTRICAL

- E0.1 Electrical Legend, General Notes & Details
- E0.2 Site Electrical Plan
- E0.3 Site Details
- E2.0 First Floor Lighting Plan
- E3.0 First Floor Data Plan
- E3.1 Roof Electrical Plan
- E4.0 First Floor Systems Plan
- E6.0 Lighting Schedule and Details
- E6.1 One-Line Diagram, Motor Schedule, and Details
- E6.2 Electrical Details
- E7.0 Panel Schedules

PLUMBING

- P0.1 Plumbing Legend and Schedules
- P0.2 Plumbing Details
- P1.0 Below First Floor Plumbing Plan
- P2.0 First Floor Plumbing Plan
- P3.0 Plumbing Roof Plan
- P4.0 Waste and Vent Riser Diagram
- P5.0 Domestic Water Riser Diagram

SECTION 01010 - SUMMARY OF WORK

1.1 GENERAL

- A. The Project consists of one (1) new one-story freestanding Building. The building is a New Jersey State Police Barracks, Commercial Township located at 2007 Highland St, Port Norris, NJ 08349.
 - 1. Owner: The Authority: Cumberland County Improvement Authority, 745 Lebanon Road, Millville, New Jersey 08332.
- B. Contract Documents were prepared for the Project by Manders Merighi Portadin Farrell, 1138 E Chestnut Ave, Vineland, NJ 08360 with supporting documents from Consulting Engineer Services, 645 Berlin-Cross Keys Road, Sicklerville, NJ 08081, and Ewing Associates Land Surveyors, 900 N Delsea Dr, Clayton, NJ 08312.
- C. The Work consists of one (1) Lump Sum Contract for all work in the construction documents for the one (1) new freestanding one-story Building. Please note that the Site Work is being bid as a separate prime contract.
 - The Contractors are strongly encouraged to visit the site and verify all existing 1. condition, dimensions and areas prior to submitting a responsive / responsible bid. Such site visit shall be for familiarizing the Contractor with the conditions as they exist and the character of the operations to be carried on under the Contract Documents, including all existing site conditions, access to the site, physical characteristics of the site and surrounding areas. Site visits can be Feaster arranged through Ryan of The Authority, email rfeaster@thauthoritynj.com.
 - 2. The Building is an approximately 13,307 SF one-story wood-framed building and includes, but is not limited to the following (see drawings for more information):
 - a. Arrest processing area includes rooms for holding cells, general office space, public lobby, sally port garage, conference and break rooms, gym, and locker room areas.
 - b. Toilet Rooms, Custodial, IT Office, MDF, Mechanical, Storage, and Electrical Areas.
 - c. All structural and steel work
 - d. All plumbing work
 - e. All HVAC work and Controls.
 - f. Conduits, wiring and outlet boxes for Security/access/intrusion/CCTV system equipment (Security System Devices are by the Owner)
 - g. Outdoor natural gas generator
 - h. Conduits, wiring, outlet boxes, jacks and testing for IT Systems
 - i. Electrical Work and Fire Alarm System: All equipment, devices, wiring and other work shown on electrical drawings is by this contractor, except as follows (or as specifically indicated otherwise on the drawings).
 - Conduits and outlet boxes for telephone and data systems shall be by this Contractor. Telephone and data system shall be furnished and installed by the Contractor including wiring, jacks, cover plates, patch panels, punch-down blocks, and final connections. Actual purchase of telephones shall be by owner.
 - Audio/visual systems and wiring shall be furnished and installed by

SECTION 01010 - SUMMARY OF WORK

the Contractor's audio/visual vendor. Pathways to facilitate audio/visual work is by this contractor as shown on the drawings.

- Security/door access controls equipment, devices, and final connections shall be furnished and installed by the Contractor. Wiring for door releases, card readers, and cameras is by the Contractor. Pathways to facilitate security work is by this contractor as shown on the drawings.
- CCTV system equipment, devices, and final connections shall be furnished and installed by the owner's systems vendor (under a separate contract direct with the owner). Pathways, conduit, wiring and jacks to facilitate CCTV work is by this contractor as shown on the drawings.
- Fire alarm system equipment, devices, wiring, and final connections shall be furnished and installed by this Contractor.
- j. The building pad will be brought to finished sub grade elevation by the site contractor (eight (8) inches below finished floor). Compaction reports and a signed surveyor as-built documents will be provided to the general contractor. Any excess soil generated by the general contractor shall be disposed of at the Cumberland County Landfill with no tipping fees. The Contractor is responsible for loading and hauling. Landfill Address: 169 Jesse Bridge Rd., Millville, NJ.
- k. All site utilities (gas, potable water by domestic well, electric, on-site sewage disposal system (septic) and storm water) will be terminated 5 feet from the building by others (site contractor). This contractor shall make all connections from the 5-foot point into the building.
- D. Schedule of work sequence:
 - 1. No work can be started until all permits are received. See Exhibit "F" for the Milestone Contract Dates. The project must be Substantially complete on or before May 1, 2025.
- E. The Work of this Contract will be constructed under one lump sum prime contract.
- F. Separate Contract: The Owner will award separate contracts for construction operations that may be conducted simultaneously with work under this Contract. Those Contracts may include the following:
 - 1. All Site work and utilities, parking lot paving and sidewalks.
 - 2. Potable Well
 - 3. Security, door access controls, television, and computer data systems. The separate contract work only includes connections and equipment. The conduits and wall boxes to the control panels shall be included in the contractor's work.
- G. Cooperate with separate contractors so that work under those contracts may be carried out smoothly, without interfering with or delaying work under this Contract.
- H. Future Contracts: The Owner may award separate contracts for work to be performed following Substantial Completion. Completion of that work depends on completion of work under this Contract. The schedule of this work will be coordinated with the contractor to ensure the smooth, successful completion of the project.

SECTION 01010 - SUMMARY OF WORK

- I. Contractor Use of Premises: During construction the Contractor shall have full use of the premises and use of the site inside the construction limit fence. The Contractor's use of premises is limited only by the Owner's right to perform work or employ other contractors on portions of the Project.
- J. Use of the Site: Limit use of premises to areas indicated inside of the construction limit fence. Do not disturb portions of the site beyond the areas indicated. Areas which will be disturbed shall also be fenced in during construction.
 - 1. Keep driveways and entrances clear. Do not use these areas for parking or material storage. Schedule deliveries to minimize on-site storage of materials and equipment. The existing NJ State Police Barracks is adjacent to this site and in operation; access to and from the existing buildings shall not be impeded.
 - 2. All construction vehicles should park inside the construction fence and not in public parking areas.
 - 3. Contractor's personnel are not permitted to wear on-site any clothing with wording or graphics that may be construed as offensive, profane or obscene. The Owner and Construction Manager will be the sole judge of what is appropriate or inappropriate.
 - 4. The use of drugs (including cannabis), tobacco or alcohol anywhere on the grounds or in the building will not be permitted and will be cause for removal from the site.
- K. Partial Owner Occupancy: The Owner reserves the right to occupy and to place and install equipment in completed areas of the building prior to Substantial Completion. Placing equipment and partial occupancy do not constitute acceptance of the Work.
 - 1. The Architect will prepare a Certificate of Substantial Completion after the Contractor obtains a Certificate of Occupancy from Building Officials for each portion of Work occupied prior to Owner occupancy.
 - 2. Mechanical and electrical systems shall be operational and required inspections and tests completed prior to partial Owner occupancy. Upon occupancy, the Owner will operate and maintain systems serving occupied portions of the building.
 - 3. The Owner will be responsible for maintenance and custodial service for occupied portions of the building.
- L. Owner-Furnished Products: The Owner may furnish some security, telephone, television, and computer data systems. The Work includes providing support systems to receive Owner's equipment, and mechanical and electrical connections.
 - 1. The Owner will arrange for and deliver shop drawings, product data, and samples to the Contractor.
 - 2. The Owner will arrange and pay for delivery according to the Contractor's Construction Schedule.
 - 3. The Owner will inspect items delivered for damage.
 - 4. If items are damaged, defective, or missing, the Owner will arrange for replacement.
 - 5. The Owner will arrange for field services and for the delivery of warranties to the Contractor.
SECTION 01010 - SUMMARY OF WORK

- 6. The Contractor shall designate delivery dates in the Contractor's Construction Schedule.
- 7. The Contractor shall review shop drawings, product data, and samples and return them noting discrepancies or problems anticipated in using the product.
- 8. The Contractor is responsible for protecting items from damage, including exposure to the elements. The Contractor shall repair or replace items damaged as a result of his operations.
- M. Fees, Permits and Taxes: The Contractor is advised that a Building Permit is required for this project. Upon contract award, it shall be the responsibility of the **Contractor** to secure all required permits. It shall be the **Owner's** responsibility to pay for the permit review fee. It shall be the **Contractor's** responsibility to pay for all fees and permit costs for the jobsite trailer if required.
- N. **SAFETY**: The Contractor is responsible for providing and enforcing all safety onsite and conform with all OSHA regulations, codes and standards. The Owner, Construction Manager, Clerk of the Works and Architect have no responsibility to provide for the safety or protection of the trades. The Contractor shall submit a site-specific Emergency Action Safety Plan and review this with all onsite personnel. The Contractor shall conduct periodic (as needed at least one a month) site safety inspections and issue a report on the conditions. The Contractor shall maintain a first aid kit onsite. For further contractor responsibilities with respect to safety, refer to Article 10 of the General Conditions of the Contract for Construction.
- O. The Contractor shall not use any product containing asbestos and all plumbing is lead free. The Contractor shall provide a notarized Letter stating: "No Asbestos containing materials were provided on the project and the plumbing is "lead free"".
- P. The Contractor is required to have all long lead items in fabrication and provide proof from the manufacturer within (45) days of the award of the contract. The Owner will pay for stored material in accordance with the General Conditions. Delays caused by the failure of the Contractor to adhere to this requirement will not be cause for a time extension. NO TIME EXTENSIONS WILL BE GRANTED!
- Q. Contractor shall furnish a letter agreeing to provide complete parts and labor service and maintenance of all HVAC systems, equipment, devices, controls, etc., for 2 years from date of substantial completion as determined by architect. The letter shall also affirm that the Contractor will provide scheduled maintenance service quarterly (3-month interval) as the maximum time period between scheduled service.

SECTION 01 11 00 - SUMMARY OF WORK

PART 1 GENERAL

1.1 PROJECT DESCRIPTION

- A. The Project consists of Building Construction of a New Jersey State Police Barracks on Block 183 Lot 14, commonly known as 2007 Highland Street in Port Norris, New Jersey as required by the Contract Documents for the Cumberland County Improvement Authority (Owner).
- B. The extent of the contract work is indicated in the Contract Documents.1. Local custom and trade union jurisdictional settlement do not control the Scope of Work.
- C. Employ workers for overtime work if required to meet the completion dates, at no additional cost to the Owner.
- D. The scope of the work is not limited to what is specifically called out on the drawings or specifications but includes any and all selective demolition as well as any cutting and patching as may be required to accomplish the intended construction.

1.2 PERMITS, LICENSES, AND CERTIFICATIONS

A. Apply for and procure all applicable permits and licenses and give all notices necessary for the commencement of Work. If applicable, the Owner will reimburse the Contractor for a local "building" permit. Obtain and pay for all other permits and contractor registration fees and licenses. Contact the <u>Township of Commercial</u> to determine all permits, licenses, applications, etc. which are required as part of this project.

1.3 USE OF PREMISES

- A. Limit use of the premises to construction activities in areas indicated; allow for Owner access, and secure site to protect against ingress by the general public in the areas of work.
 - 1. Confine operations to areas within contract limits indicated. Portions of the site beyond areas in which construction operations are indicated are not to be disturbed.

1.4 SAFETY

A. Follow the standard requirements outlined in OSHA 1926, subpart R (current edition) as a minimum. Submit a jobsite specific Safety Plan to the Owner for record purposes prior to mobilizing at the project site. The Owner has the right to stop the work at any time if in the Owner's view people or property are in harm's way. This in no way shifts responsibility for Safety to the Owner, and the General Contractor remains fully responsible for Safety and is responsible to make any corrections in means or methods required to ensure the safety of the workers and protect the project and or property surrounding the project site.

1.5 KNOWLEDGE OF CONTRACT REQUIREMENTS

- A. Consult the General Conditions, Supplementary Conditions, all Divisions and Sections of the Specifications, all Drawings, and all Addenda in detail for instructions and requirements pertaining to the Work. Provide all labor, materials, equipment, and services necessary to furnish, install and complete the work in strict conformance with all provisions thereof.
- B. The Scope of Work for the Contract is not necessarily limited to the description of each Section of the Specifications and the illustrations shown on the Drawings. Include all minor items not expressly indicated in the Contract Documents, or as might be found necessary as a result of field conditions, in order to complete the work as it is intended, without any gaps between the various subdivisions of work of the Contractor and his Subcontractors.
- C. The Contractor will be held to be thoroughly familiar with all conditions affecting labor in the neighborhood of the project including, but not limited to, Unions, incentive pay, procurement, living and commuting conditions and to have informed his Subcontractors and Sub-Subcontractors thereof.

1.6 CONTRACT DOCUMENTS INFORMATION

- A. The Contract Documents are prepared in accordance with available information as to existing conditions and locations. If, during construction, conditions are revealed at variance with the Contract Documents, notify the Architect promptly so that supplementary instructions may be issued.
- B. The Specifications determine the kinds and methods of installation of the various materials, the Drawings establish the quantities, dimensions and details of materials, the schedules on the Drawings give the location, type, and extent of the materials.
- C. Should the Drawings, Specifications or schedules disagree in themselves or with either or both of the others, provide the better quality or greater quantity of work or materials unless otherwise directed in writing by the Architect.
- D. Dimensions given on the Drawings govern scale measurements and large-scale drawings govern small-scale drawings, except as to anything omitted unless such omission is expressly noted on the larger scale drawings.
- E. The techniques or methods of specifying to record requirements varies throughout text, and may include "prescriptive", "open generic/descriptive", "compliance with standards", "performance", "proprietary", or a combination of these. The method used for specifying one unit of work has no bearing on requirements for another unit of work.
- F. Whenever a material, article or piece of equipment is referred to in the singular number in the Contract Documents, it shall be the same as referring to it in the plural. As many such materials, articles or pieces of equipment shall be provided as are required to complete the work.
- G. With the approval of the Architect and without additional cost to the Owner, make all necessary changes or modifications to locations as may be necessary to suit requirements and conditions at

the building and for the proper and conveniently accessible location of all parts of systems within the project.

- H. Provide small details not usually shown or specified, but necessary for the proper installation and operation of the work.
- I. Cap all incomplete lines, ducts, conduits, openings, etc., until ready for final connection, after which they shall be thoroughly cleaned and left unobstructed.

PART 2 PRODUCTS (Not applicable).

PART 3 EXECUTION (Not applicable).

SECTION 01 21 00 - ALLOWANCES

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes administrative and procedural requirements governing allowances.
- B. Types of allowances include the following:1. General allowances.
- C. Related Sections:
 - a. Division 01 Section "Quality Requirements" for procedures governing the use of allowances for testing and inspecting.
 - b. Divisions 02 through 28 Sections for items of Work covered by allowances.

1.2 SUBMITTALS

- A. The General Allowance shall appear on the Schedule of Values as its own line item, and will be reduced only by items requested or specifically authorized by the Owner, the Architect or Construction Manager.
- B. Submit proposals for purchase of products or systems included in allowances, in the form specified for Change Order Requests.
- C. Submit invoices or delivery slips to show actual quantities of materials delivered to the site for use in fulfillment of each allowance.
- D. Submit time sheets and other documentation to show labor time and cost for installation of allowance items that include installation as part of the allowance.
- E. Coordinate and process submittals for allowance items in same manner as for other portions of the Work.

1.3 COORDINATION

A. Coordinate allowance items with other portions of the Work. Furnish templates as required to coordinate installation.

1.4 GENERAL ALLOWANCES

- A. Use the general allowance only as directed by Architect or Construction Manager for the Owner's purposes and only by written Change Request that indicate amounts to be charged to the allowance.
- B. Contractor's overhead, profit, and related costs for products and equipment ordered by Owner under the contingency allowance are included in the allowance and are not part of the Contract Sum. These costs include delivery, installation, insurance, equipment rental, and similar costs.

- C. Written direction for Change Requests authorizing use of funds from the general allowance will include Contractor's related costs and overhead and profit margins as follows:
 - 2. If work or purchase is performed by the General Contractor, no more than 10% may be added for overhead and profit.
 - 3. If work or purchase is performed by Subcontractor, the Subcontractor may add no more than 10% overhead and profit, and the General Contractor may add no more than 5% to the total Subcontractor cost.
 - 4. Total overhead and profit allowed for all tiers of subcontractors, combined, may not exceed 10%.
- D. At Project closeout, credit unused amounts remaining in the general allowance to Owner by Change Order.

1.5 ADJUSTMENT OF ALLOWANCES

- A. Allowance Adjustment: To adjust allowance amounts, prepare a Change Request proposal based on the difference between purchase amount and the allowance, multiplied by final measurement of work-in-place where applicable. If applicable, include reasonable allowances for cutting losses, tolerances, mixing wastes, normal product imperfections, and like margins.
 - 1. Include installation costs in purchase amount only where indicated as part of the allowance.
 - 2. If requested, prepare an explanation and documentation to substantiate distribution of overhead costs and other margins claimed.

PART 2 PRODUCTS (Not Used)

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine products covered by an allowance promptly on delivery for damage or defects. Return damaged or defective products to manufacturer for replacement.

3.2 PREPARATION

A. Coordinate materials and their installation for each allowance with related materials and installations to ensure that each allowance item is completely integrated and interfaced with related work.

3.3 SCHEDULE OF ALLOWANCES

A. General Allowance: Include an allowance of \$125,000.00 for use according to Owner's instructions.

SECTION 01 25 00 - PRODUCT SUBSTITUTIONS

PART 1 GENERAL

1.1 SUMMARY

- A. This Section specifies administrative and procedural requirements for handling requests for substitutions made after award of the Contract.
- B. Standards: Refer to Section "Reference Standards and Definitions" for applicability of industry standards to products specified.
- C. Procedural requirements governing the Contractor's selection of products and product options are included under Section "Materials and Equipment."

1.2 DEFINITIONS

- A. Definitions used in this Article are not intended to change or modify the meaning of other terms used in the Contract Documents.
- B. Substitutions: Requests for changes in products, materials, equipment, and methods of construction required by Contract Documents proposed by the Contractor <u>after award</u> of the Contract are considered requests for "substitutions." The following are not considered substitutions:
 - 1 Substitutions requested by Bidders during the bidding period will not be permitted.
 - 2 Revisions to Contract Documents requested by the Owner or Architect.
 - 3 Specified options of products and construction methods included in Contract Documents.
 - 4 The Contractor's determination of and compliance with governing regulations and orders issued by governing authorities.

1.3 SUBMITTALS

- A. Substitution Request Submittal: Requests for substitution will be considered if received within 20 working days after issuance of the Notice to Proceed. Requests received more than 20 working days after issuance of the Notice to Proceed may be considered or rejected at the discretion of the Architect.
 - 1. Submit each request for substitution electronically to the Architect for consideration. Submit requests in the form and in accordance with procedures required for Change Order proposals.
 - 2. Identify the product, or the fabrication or installation method to be replaced in each request. Include related Specification Section and Drawing numbers. Provide complete documentation showing compliance with the requirements for substitutions, and the following information, as appropriate. It is the intent to put the burden on the Contractor to prove the equivalence of the substitute with the originally specified item:
 - a. Product Data, including Drawings and descriptions of products, fabrication, and installation procedures.
 - b. Samples, where applicable or requested.

- c. A detailed comparison of significant qualities of the proposed substitution with those of the Work specified. Significant qualities may include elements such as size, weight, durability, performance, and visual effect.
- d. Coordination information, including a list of changes or modifications needed to other parts of the Work and to construction performed by the Owner and separate Contractors, that will become necessary to accommodate the proposed substitution.
- e. A statement indicating the substitution's effect on the Contractor's Construction Schedule compared to the schedule without approval of the substitution. Indicate the effect of the proposed substitution on overall Contract Time.
- f. Cost information, including a proposal of net change, if any, in the Contract Sum.
- g. Certification by the Contractor that the substitution proposed is equal-to or better in every significant respect to that required by the Contract Documents, and that it will perform adequately in the application indicated. Include the Contractor's waiver of rights to additional payment or time, that may subsequently become necessary because of the failure of the substitution to perform adequately.
- 3. Architect's Action: Within 5 working days of receipt of the request for substitution, the Architect will request additional information or documentation necessary for evaluation of the request. Within 10 working days of receipt of the request, or 5 working days of receipt of the additional information or documentation, whichever is later, the Architect will notify the Contractor of acceptance or rejection of the proposed substitution. If a decision on use of a proposed substitute cannot be made or obtained within the time allocated, use the product specified by name. Acceptance will be in the form of a Change Order.
 - a. The Architect and/or Engineer will review each request for substitution only once. The Contractor will be required to reimburse the Architect at his hourly rate, for any reviews which are required, or requested, beyond the initial review.

PART 2 PRODUCTS (Not Applicable)

PART 3 EXECUTION

3.1 SUBSTITUTIONS

- A. Substitutions may be permitted by the Architect, if, in his opinion, the requirements of the proposed substitution comply with the requirements specified for the material, article or piece of equipment; however, the Architect is not required to permit substitution pursuant to; "George R. Whitten, Jr., Inc. v. Paddock Pool Builders, Inc., 376 F. Supp. 125 (D. Mass. 1974)" United States District Court, Massachusetts, April 12, 1974, affirmed by the Federal First Circuit Court, December 14, 1974, and the United States Supreme Court, 1988.
- B. The Architect has no obligation, after award of contract, to consider any brand other than those named in the Contract Documents. However, the Contractor may submit substitutes to the Architect for review, fully documented and certified, and accompanied by his proposal for a deduction in the Contract Sum.
- C. Conditions: The Contractor's substitution request will be received and considered by the Architect when one or more of the following conditions are satisfied, as determined by the

Architect; otherwise, requests will be returned without action except to record noncompliance with these requirements.

- 1 Extensive revisions to Contract Documents are not required.
- 2 Proposed changes are in keeping with the general intent of Contract Documents.
- 3 The request is timely, fully documented and properly submitted.
- 4 The request is directly related to an "or equal" clause or similar language in the Contract Documents.
- 5 The specified product or method of construction cannot be provided within the Contract Time. The request will not be considered if the product or method cannot be provided as a result of failure to pursue the Work promptly or coordinate activities properly.
- 6 The specified product or method of construction cannot receive necessary approval by a governing authority, and the requested substitution can be approved.
- 7 A substantial advantage is offered the Owner, in terms of cost, time, energy conservation or other considerations of merit, after deducting offsetting responsibilities the Owner may be required to bear. Additional responsibilities for the Owner may include additional compensation to the Architect for redesign and evaluation services, increased cost of other construction by the Owner or separate Contractors, and similar considerations.
- 8 The specified product or method of construction cannot be provided in a manner that is compatible with other materials, and where the Contractor certifies that the substitution will overcome the incompatibility.
- 9 The specified product or method of construction cannot be coordinated with other materials, and where the Contractor certifies that the proposed substitution can be coordinated.
- 10 The specified product or method of construction cannot provide a warranty required by the Contract Documents and where the Contractor certifies that the proposed substitution provide the required warranty.
- 11 Where a proposed substitution involves more than one prime Contractor, each Contractor shall cooperate with the other Contractors involved to coordinate the Work, provide uniformity and consistency, and to assure compatibility of products.
- D. The Contractor's submittal and Architect's acceptance of Shop Drawings, Product Data or Samples that relate to construction activities not complying with the Contract Documents does not constitute an acceptable or valid request for substitution, nor does it constitute approval.
- E. Refer to SUBSTITUTION REQUEST FORMS ON THE FOLLOWING PAGES.

REQUEST FOR SUBSTITUTION

Submit this form for each requested substitution. Fill in all blanks, check all boxes that apply and attach all necessary supporting data.

SUBSTITUTION NO.:		
Specified Item:		
Specification Section(s)/Paragraph(s):		
Drawing Number(s):		
Proposed Substitute:		
Reason for Proposed Substitution:		
Change to Contract Time: Days; Days;		
The following required supporting documents are attached (Check all that apply):		
Complete Product Data		
□ Itemized comparison of properties of proposed product to specified product.		
□ List of other projects on which proposed has been used, with project name, design professional's name and owner contact.		
□ List of maintenance services and replacement materials available.		
□ Statement of effect of substitution on construction schedule.		
Description of change that will be required in other work or products if substitute product is approved.		
Additional Information:		

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REQUEST FOR SUBSTITUTION

The undersigned testifies that he/she:

- Is submitting this substitution request within the limits set forth in the Contract Documents.
- Has investigated the proposed product and determined that it is equal to or better than the specified product.
- Will provide the same warranty for the proposed product as for the specified product.
- Will coordinate installation and make other changes as required for the work to be complete in all respects, including: (a) redesign and (b) additional components and capacity required by other work affected by the change.
- Waives all claims for additional costs for evaluation of the substitution request, redesign if required, and reapproval by authorities having jurisdiction, if required.
- Waives reimburse the Owner for additional costs for evaluation of the substitution request, redesign if required, and reapproval by authorities having jurisdiction, if required.

Contractor's Signature:	
Typed or Printed Name:	
Title:	
Company:	
Address:	
Phone Number:	
Owner Approval:	Date:
Construction Manager Approval (If Applicable):	Date:
USA Architects, P.A. Approval:	Date:
Consulting Engineer Approval:	Date:

SECTION 01 26 00 - MODIFICATION PROCEDURES

PART 1 GENERAL

1.1 SUMMARY

- A. This section specifies administrative and procedural requirements for handling and processing Contract modifications.
- B. Related Sections: The following sections contain requirements that relate to this section:
 - 1. Division 01 Section "Submittals" for requirements for the Contractor's Construction Schedule.
 - 2. Division 01 Section "Application for Payment" for administrative procedures governing applications for payment.
 - 3. Division 01 Section "Product Substitutions" for administrative procedures for handling requests for substitutions made after award of the Contract.

1.2 CHANGE ORDER PROPOSAL REQUESTS

- A. Owner-Initiated Proposal Requests: Proposed changes in the Work that will require adjustment to the Contract Sum or Contract Time will be issued by the Architect, with a detailed description of the proposed change and supplemental or revised Drawings and Specifications, if necessary.
 - 1. Proposal requests issued by the Architect are for information only. Do not consider them an instruction either to stop work in progress, or to execute the proposed change.
 - 2. Unless otherwise indicated in the proposal request, within 10 working days of receipt of the proposal request, submit to the Architect for the Owner's review an estimate of cost necessary to execute the proposed change.
 - a. Include a list of quantities of products to be purchased and unit costs, along with the total amount of purchases to be made. Where requested, furnish survey data to substantiate quantities.
 - b. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
 - c. Include a statement indicating the effect the proposed change in the Work will have on the Contract Time.
- B. Contractor-Initiated Change Order Proposal Requests (COR): When latent or other unforeseen conditions require modifications to the Contract, the Contractor may propose changes by submitting a request for a change to the Architect.
 - 1. Prior to issuing a COR, the matter must be raised to the attention of the Architect or Construction Manager and discussed verbally. Only after it is agreed that a COR is indicated, then shall the Contractor provide a written COR.
 - 2. Proposal requests must be submitted on the Contractor's Company Letterhead. Standard software-generated Change Order Requests will not be accepted.

- 3. Include a statement outlining the reasons for the change and the effect of the change on the Work. Provide a complete description of the proposed change. Indicate the effect of the proposed change on the Contract Sum and Contract Time.
- 4. Include a list of quantities of products to be purchased and unit costs along with the total amount of purchases to be made. Where requested, furnish survey data to substantiate quantities.
- 5. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts, if allowed and or applicable.
- 6. Comply with requirements in Section "Product Substitutions" if the proposed change in the Work requires the substitution of one product or system for a product or system specified.
- C. Proposal Request Form: Use AIA Document G 709 for Change Order Proposal Requests, plus the backup information described in this Spec Section.

1.3 CHANGES IN THE WORK

- A. Tabulate cost breakdown into subcontracts and trades. Separately indicate quantity, labor, material, other costs, and resulting final cost per unit for each. Quantity, labor, material, other cost and cost per unit generally include but are not necessarily limited to the following:
 - 1. Quantity; total number of items for each portion or unit of work as determined from the change.
 - 2. Labor; on site labor for the handling and installation of material from point of delivery at site.
 - 3. Material; cost of material as delivered to the site for installation and erection.
 - 4. Other cost; rental equipment, depreciation, site office, administration, overhead and profit, testing survey and layout, samples and all other costs not included in labor and material.
- B. When a change in the Work includes a category or categories of Work both added to and deducted from the Contract, determine the total quantities of added Work and of deleted Work separately for each category, and apply the appropriate unit price or net cost of the Work to the difference between the two total quantities.
- C. Provide the following information as backup for all Change Order Requests. Failure to provide complete information as described below will be cause for rejection.
 - 1. A clear description of the Change and reason for the Change Order Request.
 - 2. A cost estimate spreadsheet broken down as follows to show:
 - a. Labor, separate from material, and from equipment costs for all Contractors and Subcontractors.
 - b. Labor rate sheets, showing actual rate paid including fringe benefit costs for the total Labor rate.
 - c. Material costs, including actual invoices or estimates to verify all material costs.
 - d. Equipment costs for hours worked including delivery, including actual rental receipts or Bluebook rates for Contractor owned equipment.
 - e. Bond and Insurance costs at actual cost or percentages used in the original bid.
 - f. Any other actual costs and explanation of costs.

- g. Total markup.
- h. Total requested amount to be added or Deleted from the Contract
- 3. Explanation and reasoning for anticipated schedule impact if any.

1.4 CONSTRUCTION CHANGE DIRECTIVE

- A. Construction Change Directive: When the Owner and Contractor are not in total agreement on the terms of a Change Order Proposal Request, the Architect may issue a Construction Change Directive on AIA Form G714, instructing the Contractor to proceed with a change in the Work, for subsequent inclusion in a Change Order.
 - 1. The Construction Change Directive will contain a complete description of the change in the Work and designate the method to be followed to determine change in the Contract Sum or Contract Time.
- B. Documentation: Maintain detailed records on a time and material basis of work required by the Construction Change Directive.
 - 1. After completion of the change, submit an itemized account and supporting data necessary to substantiate cost and time adjustments to the Contract.

1.5 CHANGE ORDER PROCEDURES

A. Upon the Owner's approval of a Change Order Proposal Request, the Architect will issue a Change Order for signatures of the Owner and Contractor on AIA Form G701 (or similar), as provided in the Conditions of the Contract.

PART 2 PRODUCTS (Not Applicable)

PART 3 EXECUTION (Not Applicable)

SECTION 01 29 00 - APPLICATIONS FOR PAYMENT

PART 1 GENERAL

1.1 SUMMARY

- A. This Section specifies administrative and procedural requirements governing the Contractor's Applications for Payment.
 - 1. Coordinate the Schedule of Values and Applications for Payment with the Contractor's Construction Schedule, List of Subcontracts, and Submittal Schedule.

1.2 SCHEDULE OF VALUES

- A. The Contractor shall coordinate preparation of the Schedule of Values with preparation of the Contractor's Construction Schedule.
 - 1. Correlate line items in the Schedule of Values with other required administrative schedules and forms, including:
 - a. Contractor's construction schedule.
 - b. Application for Payment form. (G702 and G703)
 - c. List of subcontractors.
 - d. Schedule of alternates.
 - e. List of products.
 - f. List of principal suppliers and fabricators.
 - 2. Submit the Schedule of Values to the Architect and Construction Manager for review and approval at the earliest feasible date, but in no case later than 10 working days before the date scheduled for submittal of the initial Application for Payment. Schedule of Values shall utilize the same format (AIA G702 and G703) as the Applications for Payment and shall appear as a zero billing.
 - a. Submit an electronic pencil copy to the Owner for initial review, comment, and approval.
 - b. Submit final, approved of Schedule of Values electronically to Architect and Construction Manager, to become a record document.
- A. Format and Content: Use the Project Manual Table of Contents as a guide to establish the format for the Schedule of Values.
 - 1. Identification: Include the following Project identification on the Schedule of Values:
 - a. Project name and location.
 - b. Name of the Architect.
 - c. Project number, and purchase order number.
 - d. Contractor's name and address.
 - e. Date of submittal.
 - 2. Provide a breakdown of the Contract Sum in sufficient detail to facilitate continued evaluation of Applications for Payment and progress reports. Break principal subcontract amounts down into several line items. Break down the Contract Sum into at least one line item for each Specification Section in the Project Manual table of contents.

- 3. Bonds, Insurance and like items shall be listed separately on the Schedule of Values and at the actual cost.
- 4. Breakdown shall show Labor and Material separately for each line item. Failure to provide said breakdown will necessitate all materials to be installed as part of the work prior to billing for this work.
- 5. Round amounts off to the nearest whole dollar; the total shall equal the Contract Sum.
- 6. For each part of the Work where an Application for Payment may include materials or equipment, purchased, or fabricated and stored, but not yet installed, provide separate line items on the Schedule of Values for initial cost of the materials, for each subsequent stage of completion, and for total installed value of that part of the Work.
- 7. Breakdowns shall be Labor and Material by floor and by area, by phase of the work, or other means, to allow for an expedient review of the work in place.
- 8. Provide line item for:
 - a. If 'mobilization' is provided for on the SOV, provide a like dollar value for 'demobilization'.
 - b. Provide separate line items each for 'punch list', for 'training', and for 'closeout materials' (O&M manuals and As-Built drawings).
- B. Billing Instructions
 - 1. Bonds, Insurance, and items similar in nature shall be listed separately and billed at the actual cost. Backup such as invoices, or other verification, may be requested by the Owner from time to time, for these and other items. Such backup shall not be unreasonably withheld. Schedule of Values must be submitted on AIA G702/G703.

1.3 STORED MATERIALS

- A. The Owner may, at their discretion, pay for materials suitably stored off-site. Required documentation shall include at a minimum the following:
 - 1. Bill of Sale totaling the amount of the stored material payment request. Invoice shall name the Owner and others to be determined throughout the course of the project.
 - 2. Pictures of Materials showing labels indicating the material is designated for the Project.
 - 3. Inventory list of the materials and value whenever possible.
 - 4. Materials stored off-site must be housed in a bonded warehouse or other similar facility. Submit verification showing the warehouse to be bonded, and Insurance Certificate for the stored materials, naming the Owner and others to be determined as additional insured.

1.4 APPLICATIONS FOR PAYMENT:

A. Payment Application Times: Each Payment Application shall be made at the end of each month and shall be based upon the entire month's completed work. A "pencil copy" shall be submitted electronically prior to the last Project Meeting of the month, showing the projected completion of work for the month, for review. After the project meeting, the Architect and/or Construction Manager will review the work on site.

- B. Application Preparation: Complete every entry on the Application for Payment Form (G702 and G703), including notarization and execution by person authorized to sign legal documents on behalf of the Contractor. Incomplete applications will be returned without action.
 - 1. Entries shall match data on the Schedule of Values and Contractor's Construction Schedule. Use updated schedules if revisions have been made.
 - 2. Include amounts of Change Orders, Construction Change Directives, and Allowance adjustments issued prior to the last day of the construction period covered by the application. Provide description of Change Order work by name and Change Order Number determined by the Owner. Do Not bill for Change Order work until the Change Order has been officially approved by a Formal Board Approval.
- C. Affirmative Action Requirements: Comply with the requirements of N.J.S.A. 10:5-31 et seq. and N.J.A.C. 17:27 as follows.
 - c. Submit a copy of the current Monthly Project Workforce Report (Form AA-202) submitted to the Department of Labor & Workforce Development, Construction EEO Compliance Monitoring Program, and to the public agency compliance officer. The Contractor shall also cooperate with the public agency in the payment of budgeted funds, as is necessary, for on-the-job programs for outreach and training of minorities and women.
- D. Local Participation Reporting: Report the number of Cumberland County residents that have been employed on the project during the preceding month.
- E. Certified Wage Statements: Retain and package all Certified Wage Statements for the pay period along with the Application for Payment materials. Do not send weekly Wage Statements to the Owner unless specifically requested.
- F. Transmittal: Submit 3 executed copies of each Application for Payment to the Owner by means ensuring receipt within 24 hours; each copy shall be complete, including waivers of lien and similar attachments, when required.
 - 1. Transmit each copy with a transmittal form listing attachments, and recording appropriate information related to the application in a manner acceptable to the Architect.

PART 2 PRODUCTS (Not Applicable)

PART 3 EXECUTION (Not Applicable)

SECTION 01 30 00 – ADMINISTRATIVE REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

- A. This project will utilize web-based construction project management collaboration software, Procore (www.procore.com), to submit, track, distribute and collaborate on project documentation and action items.
 - 1. The cost of Procore Technologies services has been paid in full by the Owner.
- 1.2 PROJECT MANAGEMENT AND COORDINATION
 - A. Subcontract List: Submit a written summary identifying individuals or firms proposed for each portion of the Work.
 - 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. List e-mail addresses and telephone numbers.
 - C. Coordinate construction operations to ensure efficient and orderly execution of each part of the Work.
 - D. Requests for Information (RFI): On discovery of the need for additional information or interpretation of the Contract Documents, Contractor shall prepare and submit an RFI.
 - E. Schedule and conduct progress meetings at the Project site every two weeks. Notify the Owner and Engineer of meeting dates and times. Require attendance of each subcontractor or other entity concerned with current progress or involved in planning, coordination, or performance of future activities.
 - 1. Contractor will record minutes and distribute to everyone concerned, including Owner and Engineer.
 - F. Suggested agenda for progress meetings:
 - 1. Review of Work Progress.
 - 2. Status of progress schedule and adjustments thereto.
 - 3. Delivery schedules.
 - 4. Submittals.
 - 5. Maintenance of quality standards.
 - 6. Pending changes and substitutions.
 - 7. Other items affecting progress of Work.

1.3 SUBMITTAL ADMINISTRATIVE REQUIREMENTS

A. Engineer's Digital Data Files: Electronic digital data files of the Contract Drawings will not be provided by Engineer for Contractor's use in preparing submittals.

ADMINISTRATIVE REQUIREMENTS

- B. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.
 - 1. 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.
 - 2. Submit each action submittal which the contractor requires.
 - 3. Submit each informational submittal.
 - 4. Engineer will not accept submittals received from sources other than Contractor.
- C. Paper Submittals: Place a permanent label or title block on each submittal for identification. Provide a space approximately 6 by 8 inches on label or beside title block to record Contractor's review and approval markings and action taken by Engineer. Include the following information on the label:
 - 1. Project name.
 - 2. Date.
 - 3. Name and address of Contractor.
 - 4. Name and address of subcontractor or supplier.
 - 5. Number and title of appropriate Specification Section.
 - 6. Contractor's certification that materials comply with specified requirements
- D. Identify options requiring selection by Architect.
- E. Identify deviations from the Contract Documents on submittals

PART 2 - PRODUCTS

2.1 SUBMITTAL PROCEDURES

A. General Submittal Procedure Requirements: Prepare and submit submittals required by individual Specification Sections.

2.2 ACTION SUBMITTALS

- A. Submit each action submittal which the contractor requires.
- B. Product Data: Mark submittals to show applicable products and options. Include the following
 - 1. Manufacturer's written recommendations, product specifications,
 - 2. instructions.
 - 3. Wiring diagrams showing factory-installed wiring.
 - 4. Printed performance curves and operational range diagrams.
 - 5. Testing by recognized testing agency.
 - 6. For equipment data, include rated capacities, dimensions, weights, required clearances, and furnished specialties and accessories.
 - 7. Notation of coordination requirements.
 - 8. Compliance with specified standards and requirements.

- C. Shop Drawings: Prepare Project-specific information, drawn accurately to scale. Do not base Shop Drawings on reproductions of the Contract Documents or standard printed data. Submit on sheets at least 8-1/2 by 11 inches but no larger than 30 by 42 inches. Include the following:
 - 1. Identification of products.
 - 2. Dimensions, profiles, methods of attachment, coordination with adjoining work, large scale details, and other information, as appropriate for the Work.
 - 3. Fabrication and installation drawings and roughing-in and setting diagrams.
 - 4. Wiring diagrams showing field-installed wiring.
 - 5. Notation of coordination requirements.
 - 6. Notation of dimensions established by field measurement.
- D. Samples: Submit Samples for review of kind, color, pattern, and texture and for a comparison of these characteristics between submittal and actual component as delivered and installed. Include the name of manufacturer and product name on label.
 - 1. If variation is inherent in material or product, submit at least three sets of paired units that show variations.

2.3 INFORMATIONAL SUBMITTALS

- A. Submit each informational submittal.
- B. Qualification Data: Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.
- C. Product Certificates: Prepare written statements on manufacturer's letterhead certifying that product complies with requirements in the Contract Documents.
- D. Manufacturer's Instructions: When required in individual specification sections, submit manufacturer's printed instructions for delivery, storage, assembly, installation, start-up, adjusting and finishing.

2.4 CONTRACTOR'S CONSTRUCTION SCHEDULE

- A. Prepare a horizontal bar-chart-type, construction schedule. Provide a separate time bar for each activity and a vertical line to identify the first workday of each week. Use same breakdown of Work indicated in the Schedule of Values. As Work progresses, mark each bar to indicate actual completion.
 - 1. Submit within 15 days of the date established for Commencement of the Work.
 - 2. Prepare the schedule on reproducible media, of width sufficient to show data for the entire construction period.
 - 3. Coordinate each element with other activities. Show each activity in proper sequence. Indicate sequences necessary for completion of related Work.
 - 4. Indicate Substantial Completion and allow time for Architect's procedures necessary for certifying Substantial Completion.
 - 5. Schedule Distribution: Distribute copies to Owner, Architect, subcontractors, and parties required to comply with dates.

- 6. Revise the schedule after each meeting or activity where revisions have been made.
- B. Preparation: Indicate each significant construction activity separately. Identify the first workday of each week with a continuous vertical line.
- C. 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.
- D. Cost Correlation: Prepare a separate cost correlation timeline, indicating planned and actual costs. On the timeline, show planned and actual dollar volume of the Work performed as of planned and actual dates used for preparation of payment requests.
- E. 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, and equipment required to achieve compliance, and indicate date by which recovery will be accomplished.

PART 3 - EXECUTION

3.1 SUBMITTAL REVIEW

- A. Review each submittal and check for coordination with other Work of the Contract and for compliance with the Contract Documents. Note corrections and field dimensions. Mark with approval stamp before submitting to Engineer.
- B. Engineer will review each action submittal, make marks to indicate corrections or modifications required, will stamp each submittal with an action stamp, and will mark stamp appropriately to indicate action. Compliance with specified requirements remains Contractor's responsibility.
- C. Informational Submittals: Engineer will review each submittal and will not return it or will return it if it does not comply with requirements. Engineer will forward each submittal to appropriate party.
- D. Submittals not required by the Contract Documents may not be reviewed and may be discarded.

3.2 CONTRACTOR'S CONSTRUCTION SCHEDULE

A. Updating: At monthly intervals, update schedule to reflect actual construction progress and activities. Issue schedule one week before each regularly scheduled progress meeting. As the Work progresses, indicate Actual Completion percentage for each activity.

B. Distribute copies of approved schedule to Owner, Engineer, subcontractors, testing and inspecting agencies, and parties identified by Contractor with a need-to-know schedule responsibility. When revisions are made, distribute updated schedules to the same parties.

END OF SECTION 01 30 00

SECTION 01 31 13 - PROJECT COORDINATION

PART 1 GENERAL

1.1 SUMMARY

- A. This Section specifies administrative and supervisory requirements necessary for Project coordination including, but not necessarily limited to:
 - 1. Coordination as a responsibility of each contractor.
 - 2. Special responsibility of the General Contractor for coordination.
 - 3. Administrative and supervisory personnel.
 - 4. General installation provisions.
 - 5. Cleaning and protection.
- B. Field engineering is included in Section "Field Engineering".
- C. Progress meetings, coordination meetings and pre-installation conferences are included in Section "Project Meetings".
- D. Requirements for the Contractor's Construction Schedule are included in Section "Submittals".

1.2 COORDINATION

- A. Coordination: Coordinate construction activities included under various Sections of these Specifications to assure efficient and orderly installation of each part of the Work. Coordinate construction operations included under different Sections of the Specifications that are dependent upon each other for proper installation, connection, and operation.
 - 1. Where installation of one part of the Work is dependent on installation of other components, either before or after its own installation, schedule construction activities in the sequence required to obtain the best results.
 - 2. Where availability of space is limited, coordinate installation of different components to assure maximum accessibility for required maintenance, service, and repair.
 - 3. Make adequate provisions to accommodate items scheduled for later installation.
- B. Where necessary, prepare memoranda for distribution to each party involved outlining special procedures required for coordination. Include such items as required notices, reports, and attendance at meetings.
 - 1. Prepare similar memoranda for the Owner and separate Contractors where coordination of their Work is required.
- C. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities to avoid conflicts and ensure orderly progress of the Work. Such administrative activities include, but are not limited to, the following:
 - 1. Preparation of schedules.
 - 2. Installation and removal of temporary facilities.
 - 3. Delivery and processing of submittals.

- 4. Progress meetings.
- 5. Project Close-out activities.
- D. Conservation: Coordinate construction activities to ensure that operations are carried out with consideration given to conservation of energy, water, and materials.
 - 1. Salvage materials and equipment involved in the performance of, but not actually incorporated in, the Work. Refer to other sections for disposition of salvaged materials that are designated as Owner's property.

1.3 EMERGENCY CONTACT INFORMATION

A. Provide a list of phone numbers where the job superintendent and two responsible members of the organization can be reached in an emergency by the Owner or the Architect. Include 24 hour, 7 days per week contacts for use in an emergency. If Contractor does not respond to an emergency, the Owner reserves the right to respond and charge the Contractor for any costs incurred to resolve emergency issue in the absence of the Contractor's response. Provide keys for all Contractor gate locks to Owner.

1.4 SUBMITTALS

- A. Logistics Plans: Provide the Owner for Owner's information prior to start of any work on site.
- B. Coordination Drawings: Prepare and submit coordination Drawings based on appropriate information from each primary subcontractor, where close and careful coordination is required for installation of products and materials fabricated off-site by separate entities, and where limited space availability necessitates maximum utilization of space for efficient installation of different components.
 - 1. Show the interrelationship of components shown on separate Shop Drawings.
 - 2. Indicate required installation sequences.
 - 3. Comply with requirements contained in Section "Submittals."
 - 4. Refer to Division 22 Section "Common Work Results for Plumbing", Division 23 Section "Common Work Results for HVAC", and Division 26 Section "Common Work Results for Electrical" for specific coordination Drawing requirements for plumbing, mechanical and electrical installations, for the work.
- C. Staff Names: Within 10 days of Notice to Proceed, submit a list of the Contractor's principal staff assignments, including the Superintendent and other personnel in attendance at the site; identify individuals, their duties and responsibilities; list their addresses and telephone numbers.
 - 1. Provide resumes of proposed Project Manager and Project Superintendent, for review and approval by the Architect and Owner.
 - 2. The Project Manager and Project Superintendent shall remain with this project from the beginning until final closeout and final payment.
 - 3. Post copies of the list in the Project meeting room, and the temporary field office.

PART 2 PRODUCTS (Not Applicable)

PART 3 EXECUTION

3.1 GENERAL INSTALLATION PROVISIONS

- A. Inspection of Conditions: Require the Installer of each major component to inspect both the substrate and conditions under which Work is to be performed. Do not proceed until unsatisfactory conditions have been corrected in an acceptable manner.
- B. Manufacturer's Instructions: Comply with manufacturer's installation instructions and recommendations, to the extent that those instructions and recommendations are more explicit or stringent than requirements contained in Contract Documents.
- C. Inspect materials or equipment immediately upon delivery and again prior to installation. Reject damaged and defective items.
- D. Provide attachment and connection devices and methods necessary for securing Work. Secure Work true to line and level. Allow for expansion and building movement.
- E. Visual Effects: Provide uniform joint widths in exposed Work. Arrange joints in exposed Work to obtain the best visual effect. Refer questionable choices to the Architect for final decision.
- F. Recheck measurements and dimensions before starting each installation.
- G. Install each component during weather conditions and Project status that will ensure the best possible results. Isolate each part of the completed construction from incompatible material as necessary to prevent deterioration.
- H. Coordinate temporary enclosures with required inspections and tests, to minimize the necessity of uncovering completed construction for that purpose.
- I. Mounting Heights: Where mounting heights are not indicated, install individual components at standard mounting heights recognized within the industry for the particular application indicated. Refer questionable mounting height decisions to the Architect for final decision.

3.2 CLEANING AND PROTECTION

- A. During handling and installation, clean and protect construction in progress and adjoining materials in place. Apply protective covering where required to ensure protection from damage or deterioration at Substantial Completion.
- B. Clean and maintain completed construction as frequently as necessary through the remainder of the construction period. Adjust and lubricate operable components to ensure operability without damaging effects.
- C. Limiting Exposures: Supervise construction activities 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. Where applicable, such exposures include, but are not limited to, the following:

- 1. Excessive static or dynamic loading.
- 2. Excessive internal or external pressures.
- 3. Excessively high or low temperatures.
- 4. Thermal shock.
- 5. Excessively high or low humidity.
- 6. Air contamination or pollution.
- 7. Water or ice.
- 8. Solvents.
- 9. Chemicals.
- 10. Light.
- 11. Radiation.
- 12. Puncture.
- 13. Abrasion.
- 14. Heavy traffic.
- 15. Soiling, staining and corrosion.
- 16. Bacteria.
- 17. Rodent and insect infestation.
- 18. Combustion.
- 19. Electrical current.
- 20. High speed operation,
- 21. Improper lubrication,
- 22. Unusual wear or other misuse.
- 23. Contact between incompatible materials.
- 24. Destructive testing.
- 25. Misalignment.
- 26. Excessive weathering.
- 27. Unprotected storage.
- 28. Improper shipping or handling.
- 29. Theft.
- 30. Vandalism.

SECTION 01 31 19 - PROJECT MEETINGS (SINGLE PRIME CONTRACT)

PART 1 GENERAL

1.1 SUMMARY

- A. This Section specifies administrative and procedural requirements for project meetings including but not limited to:
 - 1. Pre-Construction Conference.
 - 2. Pre-Installation Conferences.
 - 3. Coordination Meetings.
 - 4. Progress Meetings.

1.2 PRE-CONSTRUCTION CONFERENCE

- A. The Owner may schedule a preconstruction conference and organizational meetings at the Project Site or other convenient location no later than 10 days after execution of the Agreement and prior to commencement of construction activities, or as agreed upon by both parties. The purpose is to conduct the meeting to review responsibilities and personnel assignments.
- B. Attendees: The Owner, Architect and their consultants, the Contractor and its superintendent, major subcontractors, manufacturers, suppliers and other concerned parties shall each be represented at the conference by persons familiar with and authorized to conclude matters relating to the Work.
- C. Agenda: Attendees shall discuss items of significance that could affect progress including such topics as:
 - 1. Tentative construction schedule and Critical Work sequencing.
 - 2. Designation of responsible personnel.
 - 3. Procedures for processing field decisions and Change Orders.
 - 4. Procedures for processing Applications for Payment.
 - 5. Distribution of Contract Documents.
 - 6. Submittal of Shop Drawings, Product Data and Samples.
 - 7. Preparation of record documents.
 - 8. Use of the premises. See also "Summary of the Work", item 1.3.A.2.a.
 - 9. Office, Work, and storage areas.
 - 10. Equipment deliveries and priorities.
 - 11. Safety procedures, First Aid, Security, Housekeeping, Working hours.

1.3 PRE-INSTALLATION CONFERENCES

A. The Contractor shall conduct a pre-installation conference at the site before each construction activity that requires coordination with other construction, and/or Owner input. The Installer and representatives of manufacturers and fabricators involved in or affected by the installation, and its coordination or integration with other materials and installations that have preceded or will follow, shall attend the meeting.

- B. Advise the Architect of scheduled meeting dates.
 - 1. Review the progress of other construction activities and preparations for the particular activity under consideration at each pre-installation conference, including requirements for:
 - a. Contract Documents.
 - b. Possible conflicts, Compatibility problems, Options and or, Related Change Orders.
 - c. Purchases and Deliveries.
 - d. Shop Drawings, Product Data, and quality control Samples.
 - e. Time schedules and Weather limitations.
 - f. Manufacturer's recommendations.
 - g. Compatibility of materials.
 - h. Acceptability of substrates.
 - i. Temporary facilities.
 - j. Space and access limitations.
 - k. Governing regulations.
 - 1. Safety.
 - m. Inspection and testing requirements.
 - n. Required performance results.
 - o. Recording requirements.
 - p. Protection.
 - 2. The Contractor shall record significant discussions and agreements and disagreements of each conference, along with the approved schedule. Distribute the record of the meeting to everyone concerned, promptly, including the Owner and Architect.
 - 3. Do not proceed if the conference cannot be successfully concluded. Initiate whatever actions are necessary to resolve impediments to performance of Work and reconvene the conference at the earliest feasible date.

1.4 COORDINATION MEETINGS

- A. The Contractor shall conduct Project coordination meetings at regularly scheduled times convenient for all parties involved. Project coordination meetings are in addition to specific meetings held for other purposes, such as regular progress meetings and special pre-installation meetings.
 - 1. For Coordination Meetings where the Owner, Architect and/or Construction Manager will be present, schedule Coordination Meeting for directly before or directly after regular Progress Meeting.
- B. Request representation at each meeting by every party currently involved in coordination or planning for the construction activities involved.
- C. Record meeting results and distribute copies to everyone in attendance and to others affected by decisions or actions resulting from each meeting.

1.5 PROGRESS JOB MEETINGS

- A. Progress meetings will occur at the Project site or at another agreed-upon location and shall usually be conducted every other week. When work progress indicates the need for meetings more frequently, the Contractor shall make his regular staff available. A schedule of regular Progress Meeting dates will be worked out at the Pre-Construction Meeting. It is desired to coordinate Job Meetings with payment requests, as practical.
 - 1. The Contractor shall preside at each meeting, shall compile meeting notes, and distribute copies to everyone in attendance and to others as required. Items not resolved at a progress meeting shall be carried in the notes to the following meeting, or until resolved.
- B. Attendees: In addition to representatives of the Owner and Architect, each subcontractor, supplier, or other entity concerned with current progress or involved in planning, coordination or performance of future activities shall be represented at these meetings by persons familiar with the Project and authorized to make commitments for this company as regards matters relating to progress.
- C. Agenda: Review and correct or approve minutes of the previous progress meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to the current status of the Project.
 - 1. Contractor's Construction Schedule/Progress Report: Contractor to provide and distribute a list of activities completed in the prior two weeks and proposed for the subsequent two weeks. Determine where each activity is in relation to the Contractor's Construction Schedule, whether on time or ahead or behind 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 activities will be completed within the Contract Time.
 - 2. Review the present and future needs of each entity present, including such items as:
 - a. Time, Hours of Work.
 - b. Quality and Work standards.
 - c. Sequences, Site Utilization, Temporary facilities and services, Deliveries, Access.
 - d. Off-site fabrication problems.
 - e. Hazards and risks.
 - f. Housekeeping.
 - g. Change Orders and Documentation of information for payment requests.
- D. Reporting: No later than 3 working days after each progress meeting date, the Architect will distribute copies of the minutes of the meeting electronically to each party present and to other parties who should have been present. Include a brief summary, in narrative form, of progress since the previous meeting and report.
 - 1. Schedule Updating: The Contractor shall revise the construction schedule after each progress meeting where revisions to the schedule have been made or recognized. Issue the revised schedule electronically to all affected parties no later than 3 working days of the prior meeting date, for inclusion with the Architects meeting minutes.

PART 2 PRODUCTS (Not Applicable)

PART 3 EXECUTION (Not Applicable)

SECTION 01 33 00 - SUBMITTALS

PART 1 GENERAL

1.1 SUMMARY

- A. This Section specifies administrative and procedural requirements for submittals required for performance of the Work, including;
 - 1. Contractor's construction schedule.
 - 2. The Overall Project Schedule.
 - 3. Submittal schedule.
 - 4. Daily construction reports.
 - 5. Shop Drawings.
 - 6. Product Data and Samples.
- B. Administrative Submittals: Refer to other Division-01 Sections and other Contract Documents for requirements for administrative submittals. Such submittals include, but are not limited to:
 - 1. Permits.
 - 2. Applications for payment.
 - 3. Performance and payment bonds.
 - 4. Insurance certificates.
 - 5. List of Subcontractors.
- C. The Schedule of Values submittal is included in Section "Applications for Payment."
- D. Inspection and test reports are included in Section "Quality Control Services" and in Division 02 -28 specifications.

1.2 SUBMITTAL PROCEDURES

- A. Shop drawings, product data and samples will not be processed by Architect until list of subcontractors, material suppliers and fabricators are submitted as required by the General Conditions, the Instructions to Bidders, and this Section.
- B. Coordination: Coordinate preparation and processing of submittals with performance of construction activities. Transmit each submittal sufficiently in advance of performance of related construction activities to avoid delay.
 - 1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals and related activities that require sequential activity.
 - 2. Coordinate transmittal of different types of submittals for related elements of the Work so processing will not be delayed by the need to review submittals concurrently for coordination.
 - a. The Architect reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.
- 3. Processing: Allow sufficient review time so that installation will not be delayed as a result of the time required to process submittals, including time for re-submittals.
 - Allow 10 working days for initial Architect/Engineer review. Allow additional time a. if processing must be delayed to permit coordination with subsequent submittals. The Architect will promptly advise the Contractor when a submittal is being processed must be delayed for coordination.
 - If an intermediate submittal is necessary, process the same as the initial submittal. b.
 - Allow 10 working days for re-processing each submittal. c.
 - No extension of Contract Time will be authorized because of failure to transmit d. submittals to the Architect sufficiently in advance of the Work to permit processing.
- C. Submittal Preparation: Place a permanent label or title block on each submittal for identification. Indicate the name of the entity that prepared each submittal on the label or title block.
 - Provide a space approximately 4" x 5" on the label or beside the title block on Shop 1. Drawings to record the Contractor's review and approval markings and the action taken.
 - Include the following information on the label for processing and recording action taken. 2. Project name.
 - a.
 - Date. b.
 - Name and address of Contractor. c.
 - Name and address of subcontractor. d.
 - e. Name and address of supplier.
 - f. Name of manufacturer.
 - Number and title of appropriate Specification Section. g.
 - Drawing number and detail references, as appropriate. h.
 - 3. All shop drawings, samples and/or material or equipment submittals shall bear the Contractor's stamp or seal stating that the Contractor has reviewed the submittals, and they conform to the requirements of the Contract Documents.
 - By submitting shop drawings, product data, samples, and similar submittals, the a. Contractor represents that he has determined and verified:

1)Dimensions, quantities, field dimensions, and relationship to existing Work.

2)Coordination with Work to be installed later.

3)Work on shop drawings is accurate and clearly shown.

4)Work equipment will fit into assigned spaces with sufficient access for servicing and maintenance.

5)Coordination with information on previously accepted shop drawings, product data, samples, or similar submittals.

6)Full compliance with requirements of Contract Documents.

- In reviewing shop drawings, product data, samples and similar submittals, the b. Architect/Engineer shall be entitled to rely upon the Contractor's representation that information in submittals is correct and accurate.
- Submittals that are returned or rejected because of insufficient Contractor review or c. coordination shall not be justification for a claim for an extension of time.
- 4. Provide a similar-size space on the submittal for the Architect's stamp.

- D. Submittal Transmittal: Package each submittal appropriately for transmittal and handling. Transmit each submittal from Contractor to Architect using a transmittal form. Submittals received from sources other than the Contractor will be returned without action.
 - 1. On the transmittal Record relevant information and requests for data. On the form, or separate sheet, record deviations from Contract Document requirements, including minor variations and limitations. Include Contractor's certification that information complies with Contract Document requirements.
- E. All Submittals shall be transmitted electronically, as portable document format (PDF). After Architect's review, final submittals bearing Architect's review stamp shall be forwarded by the Architect to the Contractor, to the Owner, and to the Owner's Representative. The Contractor shall be responsible to distribute the Submittal to the Contractor's Superintendent at the site, and to all interested Contractors, subcontractors and suppliers on project. Organization of electronic submittals shall be as follows, unless agreed differently upon by all parties:
 - 1. Product Data: Collect information into a single submittal for each element of construction and type of product or equipment.
 - a. If information must be specially prepared for submittal because standard published data is not suitable for use, submit as Shop Drawings, not as Product Data.
 - b. Mark each copy of each submittal to show which products and options are applicable.
 - c. Include the following information, as applicable:
 - 1) Manufacturer's catalog cuts.
 - 2) Manufacturer's product specifications.
 - 3) Standard color charts, or if so specified, provide material samples for color selection.
 - 4) Statement of compliance with specified referenced standards.
 - 5) Testing by recognized testing agency.
 - 6) Application of testing agency labels and seals.
 - 7) Notation of coordination requirements.
 - 8) Availability and delivery time information.
 - d. For equipment, include the following in addition to the above, as applicable:
 - 1) Wiring diagrams showing factory-installed wiring.
 - 2) Printed performance curves.
 - 3) Operational range diagrams.
 - 4) Clearances required to other construction, if not indicated on accompanying Shop Drawings
 - 2. Shop Drawings: As with other submittals, Contractor shall submit shop drawing in electronic format (PDF). Prepare Project-specific information, drawn accurately to scale. Do not base Shop Drawings on reproductions of the Contract Documents or standard printed data, unless submittal based upon Architect's digital data drawing files is otherwise permitted.
 - a. Preparation: Fully illustrate requirements in the Contract Documents. Include the following information, as applicable:
 - 1) Identification of products.
 - 2) Schedules.
 - 3) Compliance with specified standards.
 - 4) Notation of coordination requirements.

- 5) Notation of dimensions established by field measurement.
- 6) Relationship and attachment to adjoining construction clearly indicated.
- 7) Seal and signature of professional engineer if specified.
- b. Sheet Size: Except for templates, patterns, and similar full-size drawings, submit Shop Drawings on sheets at least 8-1/2 by 11 inches but no larger than 36 by 48 inches.
- 3. Samples: Submit Samples for review of kind, color, pattern, and texture for a check of these characteristics with other elements and for a comparison of these characteristics between submittal and actual component as delivered and installed.
 - a. Transmit Samples that contain multiple, related components such as accessories together in one submittal package.
 - b. Process with a transmittal and provide the sample with a unique submittal number, in the same format as a shop drawing or product data.
 - c. 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.
 - d. 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. Provide the following number of samples:
 - Initial Submittal: 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.
 - 2) Final Submittal for Selection: Submit four full sets for Architect selection. One sample will be returned to the Contractor for material ordering, one will be retained by the Owner, one will be retained by the Architect, and one will be kept on site.
- 4. 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.
- 5. Product Certificates: Submit written statements on manufacturer's letterhead certifying that product complies with requirements in the Contract Documents.
- 6. Material Certificates: Submit written statements on manufacturer's letterhead certifying that material complies with requirements in the Contract Documents.
- 7. 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.
- 8. Product Test Reports: Submit written reports indicating current product produced by manufacturer complies with requirements in the Contract Documents. Base reports on evaluation of tests performed by manufacturer and witnessed by a qualified testing agency, or on comprehensive tests performed by a qualified testing agency.
- 9. Field Test Reports: Submit 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.

1.3 CONTRACTOR'S CONSTRUCTION SCHEDULE

- A. Bar-Chart Schedule: Each primary Subcontractor shall prepare a fully developed, horizontal barchart type Contractor's construction schedule, and submit same to the General Contractor within 15 working days after the "Notice to Proceed" has been issued. The General Contractor/Project Coordinator will appropriately adjust each Subcontractor's schedule to incorporate it into the Overall Project Construction Schedule as indicated below:
 - 1. Provide a separate time bar for each significant construction activity. Provide a continuous vertical line to identify the first working day of each week. Use the same breakdown of units of the Work as indicated in the "Schedule of Values".
 - 2. Within each time bar indicate estimated completion percentage in 10 percent increments. As Work progresses, place a contrasting mark in each bar to indicate Actual Completion.
 - 3. Prepare the schedule on a sheet, or series of sheets, of stable transparency, or other reproducible media, of sufficient width to show data for the entire construction period.
 - 4. Secure time commitments for performing critical elements of the Work from parties involved. Coordinate each element on the schedule with other construction activities; include minor elements involved in the sequence of the Work. Show each activity in proper sequence. Indicate graphically sequences necessary for completion of related portions of the Work.
 - 5. Coordinate the Contractor's construction schedule with the schedule of values, list of subcontracts, submittal schedule, progress reports, payment requests and other schedules.
 - 6. Indicate completion in advance of the date established for Substantial Completion. Indicate Substantial Completion on the schedule to allow time for the Architect's procedures necessary for certification of Substantial Completion.
- B. Phasing (as applicable): Provide notations on the schedule to show how the sequence of the Work is affected by requirements for phased completion to permit Work by separate Contractors and partial occupancy by the Owner prior to Substantial Completion.
 - 1. Include time in the schedule for work by the Owner, or the Owner's contractors.
- C. Work Stages: Indicate important stages of construction for each major portion of the Work, including testing and installation.
- D. Area Separations: Provide a separate time bar to identify each major construction area for each major portion of the Work. Indicate where each element in an area must be sequenced or integrated with other activities.
- E. Distribution: Following response to the initial schedule submittal, print and distribute copies to the Architect, Owner, Construction Manager, subcontractors, and other parties required to comply with scheduled dates. Post copies in the Project meeting room and field office.
- F. Schedule Updating: Revise the schedule after each meeting or activity, where revisions have been recognized or made. Issue the updated schedule concurrently with report of each meeting.

1.4 CONTRACTOR'S CONSTRUCTION SCHEDULE, GENERAL

- A. Contractor's Construction Schedule Updating: See also "Project Meetings" section. At bi-weekly intervals, update schedule to reflect actual construction progress and activities. Issue schedule to coordinate with distribution of Architect's progress meeting minutes.
 - 1. Include a report with an updated schedule that indicates every change, including, but not limited to, changes in logic, durations, actual starts and finishes, and activity durations.
 - 2. As the Work progresses, indicate final completion percentage for each activity.
- B. Recovery Schedule: When periodic update indicates the Work is 10 or more workdays 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.
- C. Distribution: Distribute copies of approved schedule to Architect, Owner, separate contractors, testing and inspecting agencies, and other parties identified by Contractor with a need-to-know schedule responsibility.
 - 1. Post copies in Project meeting rooms and field offices.
 - 2. When revisions are made, distribute updated schedules to the same parties and post in the same locations. Delete parties from distribution when they have completed their assigned portion of the Work and are no longer involved in performance of construction activities.

1.5 SUBMITTAL SCHEDULE

- A. After development and acceptance of the Contractor's construction schedule, prepare a complete schedule of submittals. Submit the schedule within 20 working days of the Notice to Proceed.
 - 1. Coordinate submittal schedule with the list of subcontracts, schedule of values and the list of products as well as the Contractor's construction schedule.
 - 2. Prepare the schedule in chronological order; include submittals required during the first 45 working days of construction. Provide the following information:
 - a. Scheduled date for the first submittal.
 - b. Related Section number.
 - c. Submittal category.
 - d. Name of subcontractor.
 - e. Description of the part of the Work covered.
- B. Distribution: Following response to initial submittal, print and distribute copies to the Architect, Owner, subcontractors, and other parties required to comply with submittal dates indicated. Post copies in the Project meeting room and field office.
- C. Schedule Updating: Revise the schedule after each meeting or activity, where revisions have been recognized or made. Issue the updated schedule concurrently with report of each meeting.

1.6 DAILY CONSTRUCTION REPORTS

- A. Prepare a daily construction report, recording the following information concerning events at the site; and submit duplicate copies to the Architect at weekly intervals:
 - 1. List of subcontractors at the site.
 - 2. Approximate count of personnel at the site.
 - 3. High and low temperatures, general weather conditions.
 - 4. Accidents and unusual events.
 - 5. Meetings and significant decisions.
 - 6. Stoppages, delays, shortages, losses.
 - 7. Meter readings and similar recordings.
 - 8. Emergency procedures.
 - 9. Orders and requests of governing authorities.
 - 10. Change Orders received, implemented.
 - 11. Services connected, disconnected.
 - 12. Equipment or system tests and start-ups.
 - 13. Partial Completions, occupancies.
 - 14. Substantial Completions authorized.

1.7 SHOP DRAWINGS

- A. Submit newly prepared information, drawn to accurate scale. Highlight, encircle, or otherwise indicate deviations from the Contract Documents. Do not reproduce Contract Documents or copy standard information as the basis of Shop Drawings. Standard information prepared without specific reference to the Project is not considered Shop Drawings.
- B. Shop Drawings include fabrication and installation drawings, setting diagrams, schedules, patterns, templates and similar drawings. Include the following information in electronic format (PDF):
 - 1. Dimensions.
 - 2. Identification of products and materials included.
 - 3. Compliance with specified standards.
 - 4. Notation of coordination requirements.
 - 5. Notation of dimensions established by field measurement.
 - 6. Sheet Size: Except for templates, patterns and similar full- size Drawings, submit Shop Drawings on sheets at least 8-1/2" x 11" but no larger than 36" x 48".
 - 7. To the extent possible, provide files of drawings of like size within a single PDF file, to facilitate printing, should that be necessary. Provide multiple PDF files, should varied page size be necessary.
 - 8. Do not use Shop Drawings without an appropriate final stamp indicating action taken in connection with construction.
- A. Coordination drawings are a special type of Shop Drawing that show the relationship and integration of different construction elements that require careful coordination during fabrication or installation to fit in the space provided or function as intended.

- 1. Preparation of coordination Drawings is specified in section "Project Coordination" and may include components previously shown in detail on Shop Drawings or Product Data.
- 2. Submit coordination Drawings for integration of different construction elements. Show sequences and relationships of separate components to avoid conflicts in use of space.

1.8 PRODUCT DATA

- A. Collect Product Data into a single submittal for each element of construction or system. Submitting links to manufacturer websites in NOT acceptable. Product Data includes printed information such as manufacturer's installation instructions, catalog cuts, standard color charts, roughing-in diagrams and templates, standard wiring diagrams and performance curves. Where Product Data must be specially prepared because standard printed data is not suitable for use, submit as "Shop Drawings."
 - 1. Mark each copy to show applicable choices and options. Where electronic Product Data includes information on several products, some of which are not required, mark copy to indicate the applicable information. Include the following information:
 - a. Manufacturer's printed recommendations.
 - b. Compliance with recognized trade association standards.
 - c. Compliance with recognized testing agency standards.
 - d. Application of testing agency labels and seals.
 - e. Notation of dimensions verified by field measurement.
 - f. Notation of coordination requirements.
 - 2. Do not submit Product Data until compliance with the requirements of the Contract Documents has been confirmed.
 - 3. Submittals: Provide product data submittals as described in 1.2.E.1 above.
 - a. Unless noncompliance with Contract Document provisions is observed, the submittal may serve as the final submittal.
 - 4. Distribution: Furnish copies of final submittal to installers, subcontractors, suppliers, manufacturers, fabricators, and others required for performance of construction activities. Show distribution on transmittal forms.
 - a. Do not proceed with installation until an applicable copy of Product Data applicable is in the installer's possession.
 - b. Do not permit use of unmarked copies of Product Data in connection with construction.

1.9 SAMPLES

- A. Submit full-size, fully fabricated Samples cured and finished as specified and physically identical with the material or product proposed. Samples include partial sections of manufactured or fabricated components, cuts or containers of materials, color range sets, and swatches showing color, texture and pattern. (see also item 1.2.E.3 above)
 - 1. Mount, display, or package Samples in the manner specified to facilitate review of qualities indicated. Include the following:
 - a. Generic description of the Sample.
 - b. Sample source.
 - c. Product name or name of manufacturer.

- d. Compliance with recognized standards.
- e. Availability and delivery time.
- 2. Submit Samples for review of kind, color, pattern, and texture, for a final check of these characteristics with other elements, and for a comparison of these characteristics between the final submittal and the actual component as delivered and installed.
 - a. Where variation in color, pattern, texture or other characteristics are inherent in the material or product represented, submit multiple units (not less than 3), that show approximate limits of the variations.
 - b. Provide actual color samples of colored, dyed, painted materials for review. Printed or electronic images will NOT be acceptable.
 - c. Refer to other Specification Sections for requirements for Samples that illustrate workmanship, fabrication techniques, details of assembly, connections, operation and similar construction characteristics.
- 3. Preliminary submittals: Where Samples are for selection of color, pattern, texture or similar characteristics from a range of standard choices, submit a full set of choices for the material or product.
 - a. Preliminary submittals will be reviewed and returned with the Architect's mark indicating selection and/or other action.
 - b. Final submittal will contain the number of items indicated in 1.2.E.3 above. Follow distribution directions for returned, selected samples.
- 4. Submittals: Except for Samples illustrating assembly details, workmanship, fabrication techniques, connections, operation, and similar characteristics, submit 4 sets.
- 5. Maintain sets of Samples, as returned, at the Project site, for quality comparisons throughout the course of construction.
 - a. Unless noncompliance with Contract Document provisions is observed, the submittal may serve as the final submittal.
 - b. Sample sets may be used to obtain final acceptance of the construction associated with each set.
- B. Distribution of Samples: Prepare and distribute additional sets to subcontractors, manufacturers, fabricators, suppliers, installers, and others as required for performance of the Work. Show distribution on transmittal forms.
 - 1. Field Samples specified in individual Sections are special types of Samples. Field Samples are full-size examples erected on site to illustrate finishes, coatings, or finish materials and to establish the standard by which the Work will be judged.
 - a. Comply with submittal requirements to the fullest extent possible. Process transmittal forms to provide a record of activity.

1.10 ARCHITECT'S ACTION

- A. Except for submittals for record, information or similar purposes, where action and return is required or requested, the Architect will review each submittal, mark to indicate action taken, and return promptly.
 - 1. Compliance with specified characteristics is the Contractor's responsibility.
- B. Action Stamp: The Architect will stamp each submittal with a uniform, self-explanatory action stamp.

- C. Unsolicited Submittals: Unsolicited Submittals and Submittals not required by the Contract Documents may not be reviewed, may be discarded, or returned to the sender without action.
- D. Repetitive Submittals: The Architect will take appropriate action TWO (2) times, for each item submitted. Submittals requiring more than two (2) reviews due to inadequate or incomplete information, shall be subject to a review fee for each subsequent submittal. This fee shall be based upon the hourly rate of the Architect, charged to the Owner, and deducted from the Contract amount.

PART 2 PRODUCTS (Not Applicable).

PART 3 EXECUTION (Not Applicable).

SECTION 01 40 00- QUALITY CONTROL SERVICES

PART 1 GENERAL

1.1 SUMMARY

- A. This Section specifies administrative and procedural requirements for quality control services.
- B. Quality control services include inspections and tests and related actions including reports, performed by independent agencies, governing authorities, and the Contractor. They do not include Contract enforcement activities performed by the Architect.
- C. Inspection and testing services are required to verify compliance with requirements specified or indicated. These services do not relieve the Contractor of responsibility for compliance with Contract Document requirements.
- D. Requirements of this Section relate to customized fabrication and installation procedures, not production of standard products.
 - 1. Specific quality control requirements for individual construction activities are specified in the Sections that specify those activities. Those requirements, including inspections and tests, cover production of standard products as well as customized fabrication and installation procedures.
 - 2. Inspections, test, and related actions specified are not intended to limit the Contractor's quality control procedures that facilitate compliance with Contract Document requirements.
 - 3. Requirements for the Contractor to provide quality control services required by the Architect, Owner, or authorities having jurisdiction are not limited by provisions of this Section.

1.2 **RESPONSIBILITIES**

- A. Contractor Responsibilities: The Contractor shall provide all inspections, tests and similar quality control services, specified in individual Specification Sections and required by governing authorities, except where they are specifically indicated to be the Owner's responsibility, or are provided by another identified entity; these services include those specified to be performed by an independent agency and not by the Contractor. Costs for Contractor-required tests and inspections shall be included in the Contract Sum.
 - 1. The Contractor shall employ and pay an independent agency, to perform specified quality control services.
 - a. Where the Owner has engaged a testing agency or other entity for testing and inspection of a part of the Work, and the Contractor is also required to engage an entity for the same or related element, the Contractor shall not employ the entity engaged by the Owner, unless otherwise agreed in writing with the Owner.
 - 2. Owner Testing and Inspections: The Owner will engage an independent Inspector for Code-required inspections, unless specifically noted otherwise.

- 3. Retesting: The Contractor is responsible for retesting of his tests and inspections, where results of required inspections, tests or similar services prove unsatisfactory and do not indicate compliance with Contract Document requirements, regardless of whether the original test was the Contractor's responsibility.
 - a. Cost of retesting construction revised or replaced by the Contractor is the Contractor's responsibility.
- 4. Associated Services: The Contractor shall cooperate with all agencies performing required inspections, tests and similar services (including those performed by the Owner's independent agency) and provide reasonable auxiliary services as requested. Notify the agency sufficiently in advance of operations to permit assignment of personnel. Auxiliary services required include but are not limited to:
 - a. Providing access to the Work and furnishing incidental labor and facilities necessary to facilitate inspections and tests.
 - b. Taking adequate quantities of representative samples of materials that require testing or assisting the agency in taking samples.
 - c. Providing facilities for storage and curing of test samples, and delivery of samples to testing laboratories.
 - d. Security and protection of samples and test equipment at the Project site.
- B. Coordination: The Contractor and each agency engaged to perform inspections, tests and similar services shall coordinate the sequence of activities to accommodate required services with a minimum of delay. In addition, the Contractor and each agency shall coordinate activities to avoid the necessity of removing and replacing construction to accommodate inspections and tests.
 - 1. The Contractor is responsible for scheduling times for inspections, tests, taking samples and similar activities.

1.3 SUBMITTALS

- A. The independent testing agency shall submit a certified written report of each inspection, test or similar service, to the Architect, in duplicate (or via electronic copy, pdf), unless the Contractor is responsible for the service. If the Contractor is responsible for the service, submit a certified written report of each inspection, test, or similar service through the Contractor. Furnish all reports, initial inspection, interim inspection(s) and final inspection, to the Architect in electronic format (PDF).
 - 1. Submit additional copies of each written report directly to the governing authority, when the authority so directs.

1.4 QUALITY ASSURANCE

- A. Qualification for Service Agencies: Engage inspection and testing service agencies, including independent testing laboratories, which are prequalified as complying with "Recommended Requirements for Independent Laboratory Qualification" by the American Council of Independent Laboratories, and which specialize in the types of inspections and tests to be performed.
 - 1. Each independent inspection and testing agency engaged on the Project shall be authorized by authorities having jurisdiction to operate in the State in which the Project is located.

1.5 TRADESMEN & WORKMANSHIP

A. Ensure that tradesmen performing work at site are skilled and knowledgeable in methods and craftsmanship needed to produce required quality levels for workmanship in completed work. Remove and replace work which does not comply with workmanship standards as specified and as recognized in the construction industry for applications indicated. Remove and replace other work damaged or deteriorated by faulty workmanship or its replacement.

1.6 SPECIAL TESTS AND INSPECTIONS

- A. Special Tests and Inspections: Conducted by a qualified testing agency and special inspector as required by authorities having jurisdiction, 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 re-inspecting corrected work.
- B. Special Inspections Required (as applicable. ICC references provided):
 - 1. Fabrication of Structural Load-Bearing Members/Assemblies, Section 1704.2.5
 - 2. Steel Construction, Section 1705.2
 - a Per N.J.A.C. 5:23-5.3, special inspectors are authorized to carry out field inspections for steel construction using the above-referenced section and the following:
 - 1) Structural Welding Special Inspector: -- Inspections in compliance with AWS D1.1.

2)Structural Steel and Bolting Special Inspector: -- Inspections in compliance with AISC specifications.

- 3. Concrete Construction and Masonry Construction, Sections 1705.3 and 1705.4:
 - a. Also per N.J.A.C. 5:23-5.3
 - b. Special inspectors are authorized to carry out field inspections.
- 4. Concrete Placement, and Reinforced Concrete Inspectors: -- Inspections per the following:
 - a. Reinforced Concrete Only: Inspection of reinforcing steel, including prestressing tendons, and placement.
 - b. Reinforced Concrete Only: Inspection of reinforcing steel welding:
 - 1) Verification of weldability of reinforcing steel other than ASTM A706.
 - 2) Inspect single pass fillet welds, maximum 5/16".
 - 3) Inspect all other welds.
 - c. Inspect anchors cast in concrete.
 - d. Inspect anchors installed in hardened concrete members:

- 1) Adhesive anchors installed in horizontally or upwardly inclined orientations to resist sustained tension loads.
- 2) Mechanical anchors and adhesive anchors not defined above.
- 5. Verification of the use of required design mix.

a. Prior to concrete placement fabricate specimens for strength tests, perform slump and air-content tests, and determine the temperature of the concrete.

- b. Inspection of concrete and shotcrete placement for proper application techniques.
- c. Verify maintenance of specified curing temperature and techniques.

d. Inspection of formwork for shape, location, and dimensions of the concrete member being formed.

- 4. Sprayed, Fire-Resistant Materials, Section 1705.14 (if applicable):
 - a Also, per N.J.A.C. 5:23-5.3, special inspectors are authorized to carry out field inspections for sprayed, fire-resistant materials using the above-referenced sections.

PART 2 PRODUCTS (Not Applicable).

PART 3 EXECUTION

- 3.1 SCHEDULING
 - A. After the required 72-hour notice, the Owner will facilitate the initial inspection visit. Subsequent scheduling for all inspections shall be the Contractor's responsibility. The Contractor shall be responsible to make the worksite and all applicable items of construction available for the work of the Testing Service, and to coordinate his activities to minimize the time required by the Testing Service on site. The Contractor will bear no cost resulting from the first three misschedules due to Contractor cancelation or other field or Contractor related issues. Future misschedules shall be paid at the expense of the Contractor at the Owner's discretion and at the actual cost charged by the Testing Service. The Contractor shall copy the Owner with all communications with the Testing Service and shall provide timely written confirmation of all verbal communications. The Owner shall be so notified so that they can arrange to be present at any, or all tests and inspections.
 - B. All reports (initial, interim, and final) from the Testing Service shall be sent directly to the Owner, with electronic copy to the Contractor, to assure expedient distribution of required information.

3.2 REPAIR AND PROTECTION

- A. General: Upon completion of inspection, testing, sample-taking and similar services, repair damaged construction and restore substrates and finishes to eliminate deficiencies, including deficiencies in visual qualities of exposed finishes. Comply with Contract Document requirements for "Cutting and Patching."
- B. Protect construction exposed by or for quality control service activities and protect repaired construction.

C. Repair and protection is the Contractor's responsibility, regardless of the assignment of responsibility for inspection, testing or similar services.

3.3 REPLACEMENT OF WORK

A. Within 24 hours after rejection of work pursuant to the General Conditions, remove all materials and equipment so rejected and immediately replace work, at the Contractor's cost, to the satisfaction of the Architect. Should the work of the Owner or other Contractors be damaged by such removal or replacement, the Contractor shall reimburse the Owner or other Contractors for all costs incurred for correcting damage.

SECTION 01 42 19 - REFERENCE STANDARDS AND DEFINITIONS

PART 1 GENERAL

1.1 DEFINITIONS

- A. General: Basic Contract definitions are included in the Conditions of the Contract.
- B. Indicated: The term "indicated" refers to graphic representations, notes or schedules on the Drawings, or other Paragraphs or Schedules in the Specifications, and similar requirements in the Contract Documents. Where terms such as "shown," "noted," "scheduled," and "specified" are used, it is to help the reader locate the reference; no limitation on location is intended.
- C. Directed: Terms such as "directed," "requested," "authorized," "selected," "approved," "required," and "permitted" mean "directed by the Architect," "requested by the Architect," and similar phrases.
- D. Approve: The term "approve(d)," where used in conjunction with the Architect's action on the Contractor's submittals, applications, and requests, is limited to the Architect's duties and responsibilities as stated in the Conditions of the Contract.
- E. Regulation: The term "Regulation(s)" includes laws, ordinances, statutes, and lawful orders issued by authorities having jurisdiction, as well as rules, conventions, and agreements within the construction industry that control performance of the Work.
- F. Installer: An "Installer" is the Contractor or an entity engaged by the Contractor, either as an employee, subcontractor, or contractor of lower tier for performance of a particular construction activity, including installation, erection, application, and similar operations. Installers are required to be experienced in the operations they are engaged to perform.
 - 1. The term "experienced," when used with the term "Installer," means having a minimum of five previous projects similar in size and scope to this Project, being familiar with the special requirements indicated, and having complied with requirements of the authority having jurisdiction.
 - 2. Trades: Use of titles such as "carpentry" is not intended to imply that certain construction activities must be performed by accredited or unionized individuals of a corresponding generic name, such as "carpenter." It also does not imply that requirements specified apply exclusively to tradespersons of the corresponding generic name.
 - 3. Assignment of Specialists: Certain Sections of the Specifications require that specific construction activities shall be performed by specialists who are recognized experts in the operations to be performed. The specialists must be engaged for those activities, and assignments are requirements over which the Contractor has no choice or option. Nevertheless, the ultimate responsibility for fulfilling Contract requirements remains with the Contractor.
 - a. This requirement shall not be interpreted to conflict with enforcement of building codes and similar regulations governing the Work. It is also not intended to interfere with local trade union jurisdictional settlements and similar conventions.

- G. Project Site is the space available to the Contractor for performance of construction activities, either exclusively or in conjunction with others performing other work as part of the Project. The extent of the Project Site is shown on the Drawings and may or may not be identical with the description of the land on which the Project is to be built.
- H. Testing Laboratories: A "testing laboratory" is an independent entity engaged to perform specific inspections or tests, either at the Project Site or elsewhere, and to report on and, if required, to interpret results of those inspections or tests.

1.2 SPECIFICATION FORMAT AND CONTENT EXPLANATION

- A. Specification Format: These Specifications are organized into Divisions and Sections based on the Construction Specifications Institute's 50 Division format and MASTERFORMAT numbering system.
- B. Specification Content: This Specification uses certain conventions in the use of language and the intended meaning of certain terms, words, and phrases when used in particular situations or circumstances. These conventions are explained as follows:
 - 1. Abbreviated Language: Language used in Specifications and other Contract Documents is the abbreviated type. Words and meanings shall be interpreted as appropriate. Words that are implied, but not stated shall be interpolated as the sense required. Singular words will be interpreted as plural and plural words interpreted as singular where applicable and the context of the Contract Documents so indicates.
 - 2. Imperative and streamlined language is used generally in the Specifications. Requirements expressed in the imperative mode are to be performed by the Contractor. At certain locations in the text, for clarity, subjective language is used to describe responsibilities that must be fulfilled indirectly by the Contractor, or by others when so noted.

1.3 INDUSTRY STANDARDS

- A. Applicability of Standards: Except where 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. Copies of Standards: Each entity engaged in construction on the Project is required to be familiar with industry standards applicable to that entity's construction activity. Copies of applicable standards are not bound with the Contract Documents.
 - 1. Where copies of standards are needed for the performance of a required construction activity, the Contractor shall obtain copies directly from the publication source.
- C. Abbreviations and Names: Trade association names and titles of general standards are frequently abbreviated. Where such acronyms or abbreviations are used in the Specifications or other Contract Documents, they mean the recognized name of the trade association, standards generating organization, authority having jurisdiction, or other entity applicable to the context of

the text provision. Refer to the "Encyclopedia of Associations," published by Gale Research Co., available in most libraries.

1.4 SUBMISSIONS

For the Owner's records, submit copies of permits, licenses, certifications, inspection reports, releases, jurisdictional settlements, notices, receipts for fee payments, judgments, and similar documents, correspondence and records established in conjunction with compliance with standards and regulations bearing upon performance of the work.

PART 2 PRODUCTS (Not Applicable)

PART 3 EXECUTION (Not Applicable)

SECTION 01 60 00 - MATERIALS AND EQUIPMENT

PART 1 GENERAL

1.1 SUMMARY

- A. This Section specifies administrative and procedural requirements governing the Contractor's selection of products for use in the Project.
- B. The Contractor's Construction Schedule and the Schedule of Submittals are included under Section "Submittals."
- C. Standards: Refer to Section "Reference Standards and Definitions" for applicability of industry standards to products specified.

1.2 DEFINITIONS

- A. Definitions used in this Article are not intended to change the meaning of other terms used in the Contract Documents, such as "specialties," "systems," "structure," "finishes," "accessories," and similar terms. Such terms are self-explanatory and have well recognized meanings in the construction industry.
 - 1. "Products" are items purchased for incorporation in the Work, whether purchased for the Project or taken from previously purchased stock. The term "product" includes the terms "material," "equipment," "system," and terms of similar intent.
 - a. "Named Products" are items identified by manufacturer's product name, including make or model designation, indicated in the manufacturer's published product literature, that is current as of the date of the Contract Documents.
 - b. "Foreign Products", as distinguished from "domestic products," are items substantially manufactured (50 percent or more of value) outside of the United States and its possessions; or produced or supplied by entities substantially owned (more than 50 percent) by persons who are not citizens of nor living within the United States and its possessions.
 - 2. "Materials" are products that are substantially shaped, cut, worked, mixed, finished, refined, or otherwise fabricated, processed, or installed to form a part of the Work.
 - 3. "Equipment" is a product with operational parts, whether motorized or manually operated, that require service connections such as wiring or piping.

1.3 QUALITY ASSURANCE

- A. Source Limitations: To the fullest extent possible, provide products of the same kind, from a single source.
 - 1. When specified products are available only from sources that do not or cannot produce a quantity adequate to complete project requirements in a timely manner, consult with the Architect for a determination of the most important product qualities before proceeding. Qualities may include attributes relating to visual appearance, strength, durability, or

compatibility. When a determination has been made, select products from sources that produce products that possess these qualities, to the fullest extent possible.

- B. Compatibility of Options: When the Contractor is given the option of selecting between two or more products for use on the Project, the product selected shall be compatible with products previously selected, even if previously selected products were also options.
 - 1. Each prime Contractor is responsible for providing products and construction methods that are compatible with products and construction methods of other prime or separate Contractors.
 - 2. If a dispute arises between prime Contractors over concurrently selectable, but incompatible products, the Architect will determine which products shall be retained and which are incompatible and must be replaced.
- C. Foreign Product Limitations: Except under one or more of the following conditions, provide domestic products, not foreign products, for inclusion in the Work:
 - 1. No available domestic product complies with the Contract Documents.
 - 2. Domestic products that comply with the Contract Document are only available at prices or terms that are substantially higher than foreign products that also comply with the Contract Documents.
- D. Nameplates: Except for required labels and operating data, do not attach or imprint manufacturer's or producer's nameplates or trademarks on exposed surfaces of products which 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 after installation, on an accessible surface that is not conspicuous.
 - 2. Equipment Nameplates: Provide a permanent nameplate on each item of serviceconnected or power-operated equipment. Locate on an easily accessible surface which is inconspicuous in occupied spaces. The nameplate shall contain the following information and other essential operating data:
 - a. Name of product and manufacturer.
 - b. Model and serial number.
 - c. Capacity.
 - d. Speed.
 - e. Ratings.

1.4 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store and handle products in accordance with the manufacturer's recommendations, using means and methods that will prevent damage, deterioration, and loss, including theft.
 - 1. Schedule delivery to minimize long-term storage at the 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 the site in the manufacturer's original sealed container or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting and installing.
- 4. Inspect products upon delivery to ensure compliance with the Contract Documents, and to ensure that products are undamaged and properly protected.
- 5. Store products at the site in a manner that will facilitate inspection and measurement of quantity or counting of units.
- 6. Store heavy materials away from the Project structure in a manner that will not endanger the supporting construction.
- 7. Store products subject to damage by the elements above ground, under cover in a weathertight enclosure, with ventilation adequate to prevent condensation. Maintain temperature and humidity within range required by manufacturer's instructions.

PART 2 PRODUCTS

2.1 PRODUCT SELECTION

- A. General Product Requirements: Provide products that comply with the Contract Documents, that are undamaged and, unless otherwise indicated, unused at the time of installation.
 - 1. Provide products complete with all accessories, trim, finish, safety guards and other devices and details needed for a complete installation and for the intended use and effect.
 - 2. Standard Products: Where available, provide standard products of types that have been produced and used successfully in similar situations on other projects.
- B. Product Selection Procedures: Product selection is governed by the Contract Documents and governing regulations, not by previous Project experience. Procedures governing product selection include the following:
 - 1. Proprietary Specification Requirements: Where only a single product or manufacturer is named, provide the product indicated. No substitutions will be permitted.
 - 2. Semi-proprietary Specification Requirements: Where three (3) or more products or manufacturers are named, provide one of the products indicated. No substitutions will be permitted.
 - a. Where products or manufacturers are specified by name, accompanied by the term "or equal," or "or approved equal" comply with the Contract Document provisions concerning "substitutions" to obtain approval for use of an unnamed product.
 - 3. Non-Proprietary Specifications: When the Specifications list products or manufacturers that are available and may be incorporated in the Work, but do not restrict the Contractor to use of these products only, the Contractor may propose any available product that complies with Contract requirements. Comply with Contract Document provisions concerning "substitutions" to obtain approval for use of an unnamed product.
 - 4. Descriptive Specification Requirements: Where Specifications describe a product or assembly, listing exact characteristics required, with or without use of a brand or trade name, provide a product or assembly that provides the characteristics and otherwise complies with Contract requirements.

- 5. Performance Specification Requirements: Where Specifications require compliance with performance requirements, provide products that comply with these requirements, and are recommended by the manufacturer for the application indicated. General overall performance of a product is implied where the product is specified for a specific application.
 - a. Manufacturer's recommendations may be contained in published product literature, or by the manufacturer's certification of performance.
- 6. Compliance with Standards, Codes and Regulations: Where the Specifications only require compliance with an imposed code, standard or regulation, select a product that complies with the standards, codes or regulations specified.
- 7. Visual Matching: Where Specifications require matching an established Sample, the Architect's decision will be final on whether a proposed product matches satisfactorily.
 - a. Where no product available within the specified category matches satisfactorily and also complies with other specified requirements, comply with provisions of the Contract Documents concerning "substitutions" for selection of a matching product in another product category, or for noncompliance with specified requirements.
- 8. Visual Selection: Where specified product requirements include the phrase "...as selected from manufacturer's standard colors, patterns, textures..." or a similar phrase, select a product and manufacturer that complies with other specified requirements. The Architect will select the color, pattern and texture from the product line selected.

PART 3 EXECUTION

3.1 INSTALLATION OF PRODUCTS:

- A. Comply with manufacturer's instructions and recommendations for installation of products in the applications indicated. Anchor each product securely in place, accurately located and aligned with other Work.
- B. Fiber, plastic, lead plugs and shields and any device using wood screws are not acceptable as fastening devices to plaster, tile, concrete or masonry. Use expansion bolts or driven devices in solid construction and toggle bolts in hollow construction.
- C. Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration at time of Substantial Completion.
- D. Tolerances: Monitor fabrication and installation tolerance control of products to produce acceptable Work. Do not permit tolerances to accumulate. Comply with manufacturers' tolerances

3.2 **PROTECTION**

A. Each Prime Contractor shall be responsible for proper care and protection and shall protect and be responsible for damage to his work or materials from the date of the Contract until final payment is made and shall make good, without cost to the Owner, all damage or loss that may

occur during this period. All materials which may be affected by the weather shall be covered and protected to keep them free from damage while they are being transported to and stored on the site. Should any material be found defective or in any way contrary to the contract, this material, no matter in what stage of completion, may be rejected by the Architect and shall be removed from the premises at once.

SECTION 01 70 00 - PROJECT CLOSEOUT

PART 1 GENERAL

1.1 SUMMARY

- A. This Section specifies administrative and procedural requirements for project closeout, including but not limited to:
 - 1. Inspection procedures.
 - 2. Project Record Document and Operating and Maintenance Manual submittal.
 - 3. Submittal of warranties.
 - 4. Final cleaning.
- B. Other administrative submittals required for project closeout (Final Payment) are enumerated in the Division 01 Section, Applications for Payment.
 - 1. See also the General Conditions (AIA A232), and item 1.3.A and 1.4 below, for additional information regarding final payment requirements.
- C. Closeout requirements for specific construction activities are included in the appropriate Sections in Divisions 02 through 28.

1.2 SUBSTANTIAL COMPLETION

- A. Preliminary Procedures: Before requesting inspection for certification of Substantial Completion, complete the following. List exceptions in the request.
 - 1. In the Application for Payment that coincides with, or follows, when Substantial Completion is claimed, show 100 percent completion for the portion of the Work claimed as substantially complete. Include supporting documentation for completion as indicated in these Contract Documents and a statement showing an accounting of changes to the Contract Sum.
 - a. If 100 percent completion cannot be shown, include a list of incomplete items, the value of incomplete construction, and reasons the Work is not complete.
 - 2. Advise Owner of pending insurance change-over requirements.
 - 3. Submit specific warranties, workmanship bonds, maintenance agreements, final certifications and similar documents.
 - 4. Obtain and submit releases enabling the Owner unrestricted use of the Work and access to services and utilities; include occupancy permits, operating certificates and similar releases.
 - 5. Submit record drawings, maintenance manuals, final damage or settlement survey, property survey, and similar final record information.
 - 6. Deliver tools, spare parts, extra stock, and similar items.
 - 7. Complete final clean up requirements, including touch-up painting. Touch-up and otherwise repair and restore marred exposed finishes.

B. Contractor shall prepare a Punchlist, listing incomplete and/or non-conforming work, copy to be provided to the Architect and Owner. Upon receipt of the Contractors completed "Punchlist" the Architect and Owner will schedule the Architect's Punchlist walkthrough and once the "Punchlist" is formulated the Architect will distribute the "Punchlist" to the Contractor in order for the Contractor to address the Punchlist items. Time is of the essence and the "Punchlist" must be completed as promptly as possible; a mutually agreeable timeframe shall be established. Upon completion of the work by the Contractor and sign off by the Contractor verifying the work is complete, and a written request from the Contractor, the Architect and Owner will perform a walkthrough review of the "Punchlist" items for completeness, and will do so up to a total of two (2) times, after which time the Contractor shall pay for the Architect and Owner's time to review the "Punchlist" items for completeness.

1.3 FINAL ACCEPTANCE

- A. Preliminary Procedures: Before requesting final inspection for certification of final acceptance and final payment, complete the following. List exceptions in the request.
 - 1. Contractors' Affidavit of Payments, Debts and Claims. AIA Document G706.
 - 2. Submit Contractors Affidavit of Release of liens AIA DocumentG706A.
 - 3. Submit consent of surety to final payment. AIA Document G707.
 - 4. Submit the final payment request with releases and supporting documentation not previously submitted and accepted. Include certificates of insurance for products and completed operations where required.
 - 5. Submit a certified copy of the Architect's final inspection list (punch list) of items to be completed or corrected, stating that each item has been completed or otherwise resolved for acceptance, and the list has been endorsed and dated by the Architect.
 - 6. Submit Contractor's statement that his final application, as presented, is the final bill and no other claims will be presented.
 - 7. Submit a final liquidated damages settlement statement.
 - 8. Submit evidence of final, continuing insurance coverage complying with insurance requirements.
- B. Reinspection Procedure: The Architect will reinspect the Work upon receipt of notice that the Work, including inspection list items from earlier inspections, has been completed, except items whose completion has been delayed because of circumstances acceptable to the Architect.
 - 1. Upon completion of reinspection, the Architect will prepare a certificate of final acceptance, or advise the Contractor of Work that is incomplete or of obligations that have not been fulfilled but are required for final acceptance.
 - 2. If necessary, reinspection will be repeated, but at the expense of the Contractor who will reimburse the Owner for these services by the Architect.

1.4 RECORD DOCUMENT SUBMITTALS

A. General: Do not use record documents for construction purposes; protect from deterioration and loss in a secure, fire-resistive location; provide access to record documents for the Architect's reference during normal working hours.

- B. Record Drawings: Maintain a clean, undamaged set of blue or black line white prints of Contract Drawings and Shop Drawings. Mark the set to show the actual installation where the installation varies substantially from the Work as originally shown. Mark whichever drawing is most capable of showing conditions fully and accurately; where Shop Drawings are used, record.
 a cross-reference at the corresponding location on the Contract Drawings. Give particular attention to concealed elements that would be difficult to measure and record at a later date.
 - 1. Mark record sets with red erasable pencil; use other colors to distinguish between variations in separate categories of the Work.
 - 2. Mark new information that is important to the Owner but was not shown on Contract Drawings or Shop Drawings. Pay particular attention to construction that will be concealed at the end of the work.
 - 3. Note related Change Order numbers where applicable.
 - 4. Organize record drawing sheets into manageable sets, bind with durable paper cover sheets, and print suitable titles, dates and other identification on the cover of each set.
- C. Record Specifications: Maintain one complete copy of the Project Manual, including addenda, and one copy of other written construction documents such as Change Orders and modifications issued in printed form during construction. Mark these documents to show substantial variations in actual Work performed in comparison with the text of the Specifications and modifications. Give particular attention to substitutions, selection of options and similar information on elements that are concealed or cannot otherwise be readily discerned later by direct observation. Note related record drawing information and Product Data. Upon completion of the Work, submit record Specifications to the Architect for the Owner's records.
- D. Record Product Data: Maintain one copy of each Product Data submittal. Mark these documents to show significant variations in actual Work performed in comparison with information submitted. Include variations in products delivered to the site, and from the manufacturer's installation instructions and recommendations. Give particular attention to concealed products and portions of the Work which cannot otherwise be readily discerned later by direct observation. Note related to Change Orders and mark-up of record drawings and Specifications. Upon completion of mark-up, submit one (1) complete set of record Product Data to the Architect for the Owner's records.
- E. Record Sample Submitted: Immediately prior to the date or dates of Substantial Completion, the Contractor will meet at the site with the Architect and the Owner's personnel to determine which of the submitted Samples that have been maintained during progress of the Work are to be transmitted to the Owner for record purposes. Comply with delivery to the Owner's Sample storage area.
- F. Miscellaneous Record Submittals: Refer to other Specification Sections for requirements of miscellaneous record-keeping and submittals in connection with actual performance of the Work. Immediately prior to the date or dates of Substantial Completion, complete miscellaneous records and place in good order, properly identified and bound or filed, ready for continued use and reference. Submit to the Architect for the Owner's records.

PART 2 PRODUCTS (Not Applicable)

PROJECT CLOSEOUT

PART 3 EXECUTION

3.1 FINAL CLEANING

- A. General: General cleaning during construction is required by the General Conditions and included in Section "Temporary Facilities".
- B. Cleaning: Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to the condition expected in a normal, commercial building cleaning and maintenance program. Comply with manufacturer's instructions.
 - 1. Complete the following cleaning operations before requesting inspection for Certification of Substantial Completion.
 - a. Remove labels that are not permanent labels.
 - b. Clean exposed exterior and interior hard-surfaced finishes to a dust-free condition, free of stains, films, and similar foreign substances. Restore reflective surfaces to their original reflective condition.
 - c. Clean the site of rubbish, litter, and other foreign substances. Sweep paved areas broom clean; remove stains, spills, and other foreign deposits. Rake grounds that are neither paved nor planted, to a smooth even-textured surface.
- C. Removal of Protection: Remove temporary protection and facilities installed for protection of the Work during construction.
- D. Compliance: Comply with regulations of authorities having jurisdiction and safety standards for cleaning. Do not burn waste materials. Do not bury debris or excess materials on the Owner's property. Do not discharge volatile, harmful, or dangerous materials into drainage systems. Remove waste materials from the site and dispose of in a lawful manner.
 - 1. Where extra materials of value remaining after completion of associated Work have become the Owner's property, arrange for disposition of these materials as directed.

3.2 WARRANTIES & GUARANTEES

- A. In connection with Contractor's correction of warranted work which has failed, remove and replace other work of project which has been damaged as a result of such failure, or must be removed and replaced to provide access for correction of warranted work.
- B. Provide a written warranty covering all work performed by him for a period of two years as stipulated in the General Conditions.

SECTION 01 71 23 - FIELD ENGINEERING

PART 1 GENERAL

1.1 SUMMARY

- A. General: Field engineering is not specifically identified in the contractor documents. If such services are required during the course of the Work, this section is provided to clarify the required scope and requirements.
- B. This Section specifies administrative and procedural requirements for field engineering services, including, but not necessarily limited to, the following:
 - 1. Civil engineering services.
 - 2. Structural engineering services.

1.2 SUBMITTALS

- A. Project Record Documents: Submit a record of Work performed and record data as required under provisions of Sections "Submittals" and "Project Closeout".
- B. Provide certified or sealed sketches or similar documents if required by authorities having jurisdiction, or if specifically required by the Architect or Owner.
- 1.3 QUALITY ASSURANCE
 - A. Engineer: Engage a Professional Engineer of the discipline required, registered and insured in the state in which the Project is located, to perform required engineering services.

PART 2 PRODUCTS (Not Applicable)

PART 3 EXECUTION

3.1 EXAMINATION

- A. The Owner will identify existing control points as may be relevant.
- B. Verify layout information shown on the Drawings, in relation to the issue requiring Field Engineering, before proceeding to layout the Work. Locate and protect existing control points, for clear, consistent execution of engineering and ensuing construction work. Preserve permanent reference points during construction.
 - 1. Do not change or relocate control points without prior written approval. Promptly report lost or destroyed reference points, or requirements to relocate reference points because of necessary changes in elevations or locations.

- 2. Promptly replace lost or destroyed project control points. Base replacements on the original survey control points.
- C. If established, maintain a minimum of two permanent control points on the worksite, referenced to data established in the construction drawings.
 - 1. Record locations, with horizontal and vertical data, on Project Record Documents.
- D. Existing utilities and equipment: The existence and location of underground and other utilities and construction indicated as existing are not guaranteed. Before beginning the Work, and only as applicable, investigate and verify the existence and location of underground utilities and other construction.
 - 1. Prior to construction, verify the location and invert elevation at points of connection of sanitary sewer, storm sewer and water service piping.

3.2 PERFORMANCE

- A. Working from lines and levels established by property survey, establish benchmarks and markers to set lines and levels at each story of construction and elsewhere as needed to properly locate each element of the Project that requires Field Engineering. Calculate and measure required dimensions within indicated or recognized tolerances. Do not scale Drawings to determine dimensions.
 - 1. Advise entities engaged in construction activities, of marked lines and levels provided for their use.
 - 2. As construction proceeds, check affected elements for line, level and plumb.
- B. Surveyor's Log: Maintain a surveyor's log of control and other survey Work. Make this log available for reference.
 - 1. Record deviations from required lines and levels and advise the Architect when deviations that exceed indicated or recognized tolerances are detected. On Project Record Drawings, record deviations that are accepted and not corrected.

SECTION 01 73 29 - CUTTING AND PATCHING

PART 1 GENERAL

1.1 SUMMARY

- A. This Section specifies administrative and procedural requirements for cutting and patching.
- B. Refer to other Sections for specific requirements and limitations applicable to cutting and patching individual parts of the Work.
- C. Demolition of selected portions of the building for alterations is included in Section "Selective Demolition."

1.2 SUBMITTALS

- A. Cutting and Patching Proposal: Where approval of procedures for cutting and patching is required before proceeding, submit a proposal describing procedures well in advance of the time cutting and patching will be performed and request approval to proceed. Include the following information, as applicable, in the proposal:
 - 1. Describe the extent of cutting and patching required and how it is to be performed; indicate why it cannot be avoided.
 - 2. Describe anticipated results in terms of changes to existing construction; include changes to structural elements and operating components as well as changes in the building's appearance and other significant visual elements.
 - 3. List products to be used and firms or entities that will perform Work.
 - 4. Indicate dates when cutting and patching is to be performed.
 - 5. List utilities that will be disturbed or affected, including those that will be relocated and those that will be temporarily out-of-service. Indicate how long service will be disrupted.
 - 6. Where cutting and patching involves addition of reinforcement to structural elements, submit details and engineering calculations to show how reinforcement is integrated with the original structure.
 - 7. Approval by the Architect to proceed with cutting and patching does not waive the Architect's right to later require complete removal and replacement of a part of the Work found to be unsatisfactory.

1.3 QUALITY ASSURANCE

- A. Requirements for Structural Work: Do not cut and patch structural elements in a manner that would reduce their load-carrying capacity or load-deflection ratio.
 - 1. Obtain approval of the cutting and patching proposal before cutting and patching the following structural elements:
 - a. Bearing and retaining walls.
 - b. Structural concrete.
 - c. Structural steel.
 - d. Lintels.

- e. Timber and primary wood framing.
- f. Structural decking.
- g. Stair systems.
- h. Miscellaneous structural metals.
- i. Equipment supports.
- j. Piping, ductwork, vessels, and equipment.
- B. Operational and Safety Limitations: Do not cut and patch operating elements or safety related components in a manner that would result in reducing their capacity to perform as intended, or result in increased maintenance, or decreased operational life or safety.
 - 1. Obtain approval of the cutting and patching proposal before cutting and patching the following operating elements or safety related systems:
 - a. Primary operational systems and equipment.
 - b. Air or smoke barriers.
 - c. Water, moisture, or vapor barriers.
 - d. Membranes and flashings.
 - e. Fire protection systems.
 - f. Noise and vibration control elements and systems.
 - g. Control systems.
 - h. Communication systems.
 - i. Electrical wiring systems.
- C. Visual Requirements: Do not cut and patch construction exposed on the exterior or in occupied spaces, in a manner that would, in the Architect's opinion, reduce the building's aesthetic qualities, or result in visual evidence of cutting and patching. Remove and replace Work cut and patched in a visually unsatisfactory manner.

PART 2 PRODUCTS

2.1 MATERIALS

A. Use materials that are identical to existing materials. If identical materials are not available or cannot be used where exposed surfaces are involved, use materials that match existing adjacent surfaces to the fullest extent possible with regard to visual effect. Use materials whose installed performance will equal or surpass that of existing materials.

PART 3 EXECUTION

3.1 INSPECTION

A. Before cutting existing surfaces, examine surfaces to be cut and patched and conditions under which cutting and patching is to be performed. Take corrective action before proceeding, if unsafe or unsatisfactory conditions are encountered.

1. Before proceeding, meet at the site with parties involved in cutting and patching, including mechanical and electrical trades. Review areas of potential interference and conflict. Coordinate procedures and resolve potential conflicts before proceeding.

3.2 PREPARATION

- A. Temporary Support: Provide temporary support of Work to be cut.
- B. Protection: Protect existing construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of the Project that might be exposed during cutting and patching operations.
- C. Avoid interference with use of adjoining areas or interruption of free passage to adjoining areas.
- D. Take all precautions necessary to avoid cutting existing pipe, conduit or ductwork serving the building, but scheduled to be removed or relocated until provisions have been made to bypass them.

3.3 PERFORMANCE

- A. General: A Contractor, subcontractor or sub-subcontractor requiring changes in existing work shall have such changes performed by the trades skilled in performing the particular work and such changes shall be at the expense of the Contractor, subcontractor or sub-subcontractor requiring the change. Review changes with the Architect prior to proceeding with the work and include installation of such reinforcement of the work as the Architect may direct.
- B. Employ skilled workmen to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time and complete without delay.
 - 1. Cut existing construction to provide for installation of other components or performance of other construction activities and the subsequent fitting and patching required to restore surfaces to their original condition.
- C. Cutting: Cut existing construction using methods least likely to damage elements to be retained or adjoining construction. Where possible review proposed procedures with the original installer; comply with the original installer's recommendations.
 - 1. In general, where cutting is required use hand or small power tools designed for sawing or grinding, not hammering and chopping. Cut holes and slots neatly to size required with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
- D. Patching: Patch with durable seams that are as invisible as possible. Comply with specified tolerances.
 - 1. Where feasible, inspect and test patched areas to demonstrate integrity of the installation.
 - 2. 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.
 - 3. Firestopping and draftstopping.

- a. Where fire rated and/or smoke barrier construction (walls, floors, or ceilings) are penetrated, all penetrations shall be fire-safed and sealed using appropriate fire rated materials and approved methods.
- b. Where non-fire rated construction (walls, floors or ceilings) is penetrated, the penetration shall be sealed tight with approved draftstopping materials.

3.4 CLEANING

A. Thoroughly clean areas and spaces where cutting and patching is performed or used as access. Remove completely paint, mortar, oils, putty and items of similar nature. Thoroughly clean piping, conduit and similar features before painting or other finishing is applied. Restore damaged pipe covering to its original condition.

SECTION 01 78 30 - WARRANTIES

PART 1 GENERAL

1.1 SUMMARY

- A. Warranties are hereby defined to include general administrative and procedural requirements required by the Contract Documents, including manufacturer's standard warranties on products, systems and special warranties.
 - 1. Refer to the Instructions to Bidders and the General Conditions for terms of the Contractor's warranty of workmanship and materials. The project Maintenance Bond is to hold good for two (2) years, which is the <u>minimum</u> general standard warranty for the Work, unless specifically indicated to be longer within individual technical specification sections.
 - 2. Specific requirements for warranties, products and installations that are specified to be warranted are included in the individual Sections of Divisions 02 28.
 - 3. Certifications and other commitments and agreements for continuing services to the Owner are specified elsewhere in the Contract Documents.
- B. Disclaimers and Limitations: Manufacturer's disclaimers and limitations on product warranties do not relieve the Contractor of the Warranty on the Work that incorporates the products. A warranty shall not limit the Owner's rights with respect to latent defects, gross mistakes, or fraud.

1.2 DEFINITIONS

- A. Standard Product Warranties are preprinted written warranties published by individual manufacturers for particular products and are specifically endorsed by the manufacturer to the Owner.
- B. Special Warranties are written warranties required by or incorporated in the Contract Documents to extend time limits provided by standard warranties.

1.3 WARRANTY REQUIREMENTS

- A. Contractor shall obtain and assign to Owner all express warranties given to Contractor by any subcontractor or by any vendor or manufacturer supplying materials, equipment, or fixtures to be incorporated into the Project.
 - 1. Contractor expressly warrants to Owner that all materials and equipment to be incorporated into the Work shall be new unless otherwise specified.
 - 2. Contractor expressly warrants to Owner that all Work shall be of good quality, free from all defects and in conformance with the Contract Documents.
 - 3. Contractor further warrants to Owner that all materials and equipment furnished under the Contract Documents shall be applied, installed, connected, erected, used, cleaned and conditioned in accordance with the instructions of the applicable manufacturers, fabricators, suppliers or processors except as otherwise provided for in the Contract Documents.
- B. Related Damages and Losses: Contractor shall promptly correct, upon receipt of written notice from Owner, any portion of the Work which is found to be defective or otherwise not in conformance with the requirements of the Contract Documents.
- 1. In the event that any defective or non-conforming Work is deemed by Owner in its sole discretion to present an immediate threat to security, Owner shall be entitled to correct and fix such defective or non-conforming portions of the Work, and Contractor shall reimburse Owner for all costs and expenses incurred by Owner in performing such Work.
- 2. When correcting warranted Work that has failed, remove, and replace other adjacent Work that has been damaged as a result of such failure or that must be removed and replaced to provide access for correction of warranted Work.
- C. Reinstatement of Warranty: When Work covered by a warranty has failed and been corrected by replacement or rebuilding, reinstate the warranty by written endorsement. The reinstated warranty shall be equal to the original warranty with an equitable adjustment for depreciation.
- D. Replacement Cost: Upon determination that Work covered by a warranty has failed, replace or rebuild the Work to an acceptable condition complying with requirements of Contract Documents. The Contractor is responsible for the cost of replacing or rebuilding defective Work regardless of whether the Owner has benefited from use of the Work through a portion of its anticipated useful service life.
- E. Owner's Recourse: Written warranties made to the Owner are in addition to implied warranties, and shall not limit the duties, obligations, rights, and remedies otherwise available under the law, nor shall warranty periods be interpreted as limitations on time in which the Owner can enforce such other duties, obligations, rights, or remedies.
 - 1. Rejection of Warranties: The Owner reserves the right to reject warranties and to limit selections to products with warranties not in conflict with the requirements of the Contract Documents.
- F. The Owner reserves the right to refuse to accept Work for the Project where a special warranty, certification, or similar evidence is presented that entities required to countersign such commitments are willing to do so.

1.4 WARRANTY MANAGEMENT PLAN

- A. Owner shall be the administrator of the Warranty Management Plan and will monitor all warranties during specified warranty terms.
- B. Contractor shall develop a warranty implementation plan which shall include, but not be limited to:
 - 1. Roles and responsibilities of all personnel associated with the warranty process, including points of contact and telephone numbers within the Contractor's organization, Subcontractors, manufacturers, or suppliers.
 - 2. Listing of all Certificates of Warranty for extended warranty items, to include roof, HVAC test and balance, pumps, motors, transformers, fire protection and alarm system, sprinkler system, lightning protection system, surge suppression, etc.
 - 3. A list for each warranted item, equipment, and feature of construction or system indicating:
 - a. Name of item.
 - b. Model and serial number.
 - c. Installation location.
 - d. Name, address and phone number of manufacturers or suppliers.
 - e. Spare parts source.

- f. Terms of warranty.
- g. Cross reference to warranty certificate.
- h. Starting date and duration of warranty period.
- i. Summary of maintenance procedures required to continue warranty in force.
- j. Cross reference to respective Operations & Maintenance Manual section.
- k. Organization, names and phone numbers of continuously available warranty, service personnel, size of local service area.
- 1. Expected response time and repair time expected for various equipment.
- 4. The Contractor's plan for attendance at warranty inspections.
- 5. Procedure and status of tagging all equipment covered by extended warranties.
- 6. Copies of instructions to be posted near selected pieces of equipment where operation is critical for warranty and/or safety reasons.
- C. Warranty Work Under Performance / Maintenance Bond:
 - 1. In the event the Contractor fails to commence and diligently pursue warranty work, the Owner will have the work performed by others, and after completion of the Work, will have the right to recoup expenses, including administrative expenses, from the bonding company.
 - 2. Following oral or written notification of required warranty work, the Contractor shall respond in a timely manner. Written verification will follow oral instructions. Failure of the Contractor to respond will be cause to proceed against the Contractor.

1.5 SUBMITTALS

- A. Contractor shall submit list of all warranties specified for this project to Architect/Engineer for approval, not later than sixty (60) days after Owner "Notice To Proceed" (NTP). List shall be in electronic format (WORD). List shall include the following:
 - 1. Six (6) digit, CSI Section number of specifications in numerical order.
 - 2. Specification name.
 - 3. Listing of items within the specification section to be warranted.
 - 4. Warranty term (years and months).
- B. Contractor shall submit written warranties to the Architect/Engineer prior to the date of scheduled Substantial Completion. If the Certificate of Substantial Completion designates a commencement date for the warranties other than the date of Substantial Completion for the Work, or a designated portion of the Work, submit written warranties upon request of the Architect.
 - 1. When a designated portion of the Work is completed and occupied or used by the Owner, by separate agreement with the Contractor during the construction period, submit properly executed warranty to the Architect/Engineer within fifteen (15) days of completion of that designated portion of the work.
- C. Special Warranties: When a special warranty is required to be executed by the Contractor, or the Contractor and a subcontractor, or supplier or manufacturer, prepare a written document that contains appropriate terms and identification, ready for execution by the required parties. Submit a draft to the Owner through the Architect/Engineer for approval prior to final execution.
 - 1. Refer to individual Sections of Divisions 02 through 28 for specific content requirements, and particular requirements for submittal of special warranties.
- D. Special Warranty Requirements Reference Guideline

- 1. Contractor shall refer to the "Special Warranty Requirements Reference Guideline" at end of this Section, regarding minimum warranty term requirements that exceeds one (1) year. Contractor shall use this reference guideline as a checklist in addition to other warranties that may be specified in other specification sections. Contractor shall mark an "X" for each applicable warranty in the column indicated.
- E. Form of Submittal: Prior to Final Completion, compile one (1) original of each required warranty properly executed by the Contractor, or by the Contractor, subcontractor, supplier, or manufacturer. Organize the warranty documents into an orderly sequence based on the Table of Contents of the Closeout Documentation Manual. Copies of the warranties shall be incorporated into the Operations and Maintenance Manuals as defined in Division 01 Section "Closeout Procedures".

PART 2 PRODUCTS (Not Applicable)

PART 3 EXECUTION

3.1 WARRANTY ADMINISTRATION

- A. Owner's Contracts Administration Warranty Administrator shall set up and administer jointly with Contractor/CM, Sub-Contractors, Owner's Maintenance, Facilities Director (if appropriate), a warranty inspection walk-through at six (6) months and eleven (23) months after date of Substantial Completion of the Work. (Applicable to the two (2) year warranty period.) Inspections shall be conducted for other special warranties with extended warranty periods, as specified in each specification section. (Note: A similar 23-month warranty inspection (walkthrough) shall be conducted for roofing.)
 - 1. Contractor's warranty excludes remedy for damage or defect caused by Owner's abuse, modifications not performed by Contractor, improper or insufficient maintenance by Owner (unless such maintenance was performed in accordance with the directions from Contractor), improper operation by Owner (unless such operations were performed in accordance with the directions from Contractor), or normal wear and tear under normal usage.
 - 2. Contractor shall only execute warranty work authorized by Owner. All Work executed and/or completed without authorization from Owner's representative will not be recognized by Owner.
 - 3. Contractor shall be required to obtain verification signature from Owner's Authorized Representative upon completion of warranty work. (See Par. 3.B.1 below)
- B. Contractor Warranty Responsiveness Priorities and Codes
 - 1. The Contractor shall submit a report on any warranty item that has been repaired during the warranty period. The report shall include the cause of the problem, date reported, corrective action taken, date completed and verification by Owner's Authorized Representative.
 - 2. Warranty work shall be given a Priority by the Owner to advise the Contractor of the required response:
 - a. Priority 1 (Emergency/Life Safety): Perform onsite inspection to evaluate situation, determine course of action within 4 hours, initiate work within 6 hours, work to be completed within 48 hours.

- b. Priority 2 (Urgent): Perform onsite inspection to evaluate situation, determine course of action within 8 hours, work to be completed within 5 working days.
- c. Priority 3 (Routine): All other work to be initiated within 3 days, work to completion within 28 working days.
- C. Warranty Tags
 - 1. At the time of installation, each warranted item shall be tagged with a durable, oil and water-resistant tag approved by the Owner. Each tag shall be attached with a copper wire and shall be sprayed with a silicone waterproof coating. The date of acceptance and project manager signature shall remain blank until accepted.
 - 2. Each tag shall have the following information:
 - a. Type of Product/Material
 - b. Model Number
 - c. Serial Number
 - d. Contract Number
 - e. Warranty Period
 - f. Inspector's Signature
 - g. Construction Contractor, address, phone
 - h. Warranty Contact, address, phone
 - i. Response Time Priority Code
 - j. Warning: Project personnel to perform only operational maintenance during the Warranty Period

END OF SECTION

SECTION 01 79 00 - DEMONSTRATION AND TRAINING

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes administrative and procedural requirements for instructing Owner's personnel, including the following:
 - 1. Demonstration of operation of systems, subsystems, and equipment.
 - 2. Training in operation and maintenance of systems, subsystems, and equipment.
 - 3. Demonstration and training video recordings.
- B. Related Sections:
 - 1. Divisions 02 through 28 Sections for specific requirements for demonstration and training for products in those Sections.

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 utilizing manufacturer-produced demonstration and training video recordings for systems, equipment, and products in lieu of video recording of live instructional module.
- B. Qualification Data: For instructor and videographer.
- C. Attendance Record: For each training module, submit list of participants and length of instruction time.
- D. Evaluations: For each participant and for each training module, submit results and documentation of performance-based test.

1.3 CLOSEOUT SUBMITTALS

- A. Demonstration and Training Video Recordings: Submit two copies within seven days of end of each training module.
 - 1. Identification: On each copy, provide an applied label with the following information:
 - a. Name of Project.
 - b. Name and address of videographer.
 - c. Name of Architect.
 - d. Name of Construction Manager.
 - e. Name of Contractor.
 - f. Date of video recording.
 - 2. Transcript: Prepared on 8-1/2-by-11-inch paper, punched and bound in heavy-duty, threering, vinyl-covered binders. Mark appropriate identification on front and spine of each binder. Include a cover sheet with same label information as the corresponding video recording. Include name of Project and date of video recording on each page.

3. At completion of training, submit complete training manual(s) for Owner's use.

1.4 QUALITY ASSURANCE

- A. Facilitator Qualifications: A firm or individual experienced in training or educating maintenance personnel in a training program similar in content and extent to that indicated for this Project, and whose work has resulted in training or education with a record of successful learning performance.
- B. Instructor Qualifications: A factory service representative or factory-authorized service representative, complying with requirements in Division 01 Section "Quality Requirements," experienced in operation and maintenance procedures and training.
- C. Videographer Qualifications: A professional videographer who is experienced photographing demonstration and training events similar to those required.
- D. Pre-instruction Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination." Review methods and procedures related to demonstration and training including, but not limited to, the following:
 - 1. Inspect and discuss locations and other facilities required for instruction.
 - 2. Review and finalize instruction schedule and verify availability of educational materials, instructors' personnel, audiovisual equipment, and facilities needed to avoid delays.
 - 3. Review required content of instruction.
 - 4. For instruction that must occur outside, review weather and forecasted weather conditions and procedures to follow if conditions are unfavorable.

1.5 COORDINATION

- A. Coordinate instruction schedule with Owner's operations. Adjust schedule as required to minimize disrupting Owner's operations.
- B. Coordinate instructors, including providing notification of dates, times, length of instruction time, and course content.
- C. Coordinate content of training modules with content of approved emergency, operation, and maintenance manuals. Do not submit instruction program until operation and maintenance data has been reviewed and approved by Architect.

PART 2 PRODUCTS

2.1 INSTRUCTION PROGRAM

- A. Program Structure: Develop an instruction program that includes individual training modules for each system and 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. Operations manuals.
 - c. Maintenance manuals.
 - d. Project record documents.
 - e. Identification systems.
 - f. Warranties and bonds.
 - g. Maintenance service agreements and similar continuing commitments.
- 3. Emergencies: Include the following, as applicable:
 - a. Instructions on meaning of warnings, trouble indications, and error messages.
 - b. Instructions on stopping.
 - c. Shutdown instructions for each type of emergency.
 - d. Operating instructions for conditions outside of normal operating limits.
 - e. Sequences for electric or electronic systems.
 - f. Special operating instructions and procedures.
- 4. Operations: Include the following, as applicable:
 - a. Startup procedures.
 - b. Equipment or system break-in procedures.
 - c. Routine and normal operating instructions.
 - d. Regulation and control procedures.
 - e. Control sequences.
 - f. Safety procedures.
 - g. Instructions on stopping.
 - h. Normal shutdown instructions.
 - i. Operating procedures for emergencies.
 - j. Operating procedures for system, subsystem, or equipment failure.
 - k. Seasonal and weekend operating instructions.
 - 1. Required sequences for electric or electronic systems.
 - m. Special operating instructions and procedures.
- 5. Adjustments: Include the following:
 - a. Alignments.
 - b. Checking adjustments.
 - c. Noise and vibration adjustments.
 - d. Economy and efficiency adjustments.
- 6. Troubleshooting: Include the following:

- a. Diagnostic instructions.
- b. Test and inspection procedures.
- 7. Maintenance: Include the following:
 - a. Inspection procedures.
 - b. Types of cleaning agents to be used and methods of cleaning.
 - c. List of cleaning agents and methods of cleaning detrimental to product.
 - d. Procedures for routine cleaning
 - e. Procedures for preventive maintenance.
 - f. Procedures for routine maintenance.
 - g. Instruction on use of special tools.
- 8. Repairs: Include the following:
 - a. Diagnosis instructions.
 - b. Repair instructions.
 - c. Disassembly; component removal, repair, and replacement; and reassembly instructions.
 - d. Instructions for identifying parts and components.
 - e. Review of spare parts needed for operation and maintenance.

PART 3 EXECUTION

3.1 PREPARATION

- A. Assemble educational materials necessary for instruction, including documentation and training module. Assemble training modules into a training manual.
- B. Set up instructional equipment at instruction location.

3.2 INSTRUCTION

- A. Facilitator: Engage a qualified facilitator to prepare instruction program and training modules, to coordinate instructors, and to coordinate between Contractor and Owner for number of participants, instruction times, and location.
- B. Engage qualified instructors, other than Contractor's Project Manager or Superintendent, 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 the start of each season.
 - 1. Schedule training with Owner, through Architect, with at least seven days' advance notice.
- D. Evaluation: At conclusion of each training module, assess and document each participant's mastery of module by use of oral, written, or demonstration performance-based testing, as appropriate.

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.

3.3 DEMONSTRATION AND TRAINING VIDEO RECORDINGS

- A. General: Engage a qualified commercial videographer to record demonstration and training video recordings. Record each training module separately. Include classroom instructions and demonstrations, board diagrams, and other visual aids, but not student practice.
 - 1. At the beginning of each training module, record each chart containing learning objective and lesson outline.
- B. Video Recording Format: Provide high-quality color video recordings with menu navigation in format acceptable to Architect.
- C. Recording: Mount camera on tripod before starting recording, unless otherwise necessary to show area of demonstration and training. Display continuous running time.
- D. Narration: Describe scenes on video recording by dubbing audio narration off-site after video recording is recorded. Include description of items being viewed.
- E. Transcript: Provide a transcript of the narration. Display images and running time captured from videotape opposite the corresponding narration segment.
- F. Pre-Produced Video Recordings: Provide video recordings used as a component of training modules in same format as recordings of live training.

END OF SECTION

DRAFT AIA Document A201[™] - 2017

General Conditions of the Contract for Construction

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

New Jerse State Police Barracks Building Block 183, Lot 14 aka 2007 Highland St Port Norris, NJ 08349

THE OWNER: (Name, legal status and address)

Cumberland County Improvement Authority 745 Lebanon Road Millville, New Jersey 08332

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

« Design Professional: Manders Merighi Portadin Farrell 1138 E Chestnut Ave, Building 4 Vineland, NJ 08360

With supporting documents from

Consulting Engineer Services 645 Berlin-Cross Keys Road, Suite 1 Sicklerville, NJ 08081»

ADDITIONS AND DELETIONS:

The author of this document has added information needed for its completion. The author may also have revised the text of the original AIA standard form. An Additions and Deletions Report that notes added information as well as revisions to the standard form text is available from the author and should be reviewed.

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

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





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ARTICLE 1 GENERAL PROVISIONS

§ 1.1 Basic Definitions

§ 1.1.1 The Contract Documents

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

§ 1.1.1.1 The term "Addenda issued prior to execution of the Contract", shall be understood to refer to Addenda numbered consecutively 1, 2, 3, etc. These Addenda will incorporate all changes made to the Contract up to the execution of the Agreements.

§ 1.1.1.2 "All instructions to bidders requiring on-site investigation or precontract performance relating to the work and material to be supplied by the subject contractor shall be and form a part of the Contract Documents."

§ 1.1.1.3 "Public Notice, Instructions To Bidders, and Agreements are also part of the Contract Documents".

§ 1.1.1.4 Written Notice shall be deemed to have been duly served if delivered in person to the individual or to a member of the firm or to an officer of the corporation for whom it is intended, or if the former procedure cannot be utilized, then notice will be served if delivered at or sent by registered mail to the last business address known to the one giving notice.

§ 1.1.1.5 It is the intent of these documents to infer and to require the Contractor to recognize the phrase "Owner, through the Architect" as applicable to all submittals, requests and all such other administrative items as arise on this Project.

§ 1.1.1.6 The Contract Documents executed or identified in accordance with Section 1.5.1 shall prevail in case of an inconsistency with subsequent versions made through manipulatable electronic operations involving computers.

§ 1.1.2 The Contract

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

§ 1.1.3 The Work

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

§ 1.1.4 The Project

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

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§ 1.1.5 The Drawings

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

§ 1.1.5.1 Construction Drawings prepared by the Architect are intended to show the scope of work, including but not limited to general arrangement of stairs, equipment, ducts, piping and other elements of the structure, and approximate locations and sizes of equipment. This does not relieve the Contractor from providing all connections and accessories necessary to make the Work complete, ready to operate, in compliance with all applicable codes, laws and other regulations, and acceptable to the Architect. As such, they are not to serve as Shop Drawings.

§ 1.1.5.2 Locations and arrangements of items are designated by dimensions at less than full scale, unless otherwise noted. Such reductions of scale may vary and will be noted.

§ 1.1.5.3 Designs, information, reports and other materials and/or data may be performed and/or provided for the project by other than the Architect. Such designs, information, reports and other materials and/or data may include, without limitation, designs, information, reports and other materials and/or data performed and/or provided by the Contractor(s) or by subcontractors and/or other consultants retained by the Contractor(s) and/or the Owner. Such designs, information, reports and other materials and/or data may include without limitation the locations, quantities, sizes, conditions and scope of specific items of the construction Work required to be provided for the Project. The Contractor shall immediately notify the Owner and Architect in writing upon its discovery or knowledge of any errors, omissions or defects in any designs, information, reports and other materials and/or data prepared or provided by the Contractor or on the Contractor's behalf which are provided to the Architect for the Architect's preparation of its design documentation for the Project. The Contractor shall also be required to immediately notify the Architect in writing in the event that it discovers or becomes aware of any errors, omissions, or defects in any designs, information, reports or other materials or data that are provided to the Architect by others for the preparation of the Architect's design documentation. The Contractor shall also be required to immediately notify the Owner and Architect in writing if it discovers or becomes aware of any discrepancies between any design documentation prepared by the Architect and any designs, information, reports or other materials and/or data provided to the Architect by the Contractor(s), the Owner, subcontractors or consultants retained by the Contractor(s) or Owner, or by others. In such event, the Contractor shall promptly submit a written request for resolution of such discrepancy to the Architect and Owner

§ 1.1.6 The Specifications

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

§ 1.1.6.1 Specification Standards - Wherever in the specifications, reference is made to ANSI or ASTM Standards, Federal Specifications, U.L., Factory Mutual, Consumer Product Standards, or similar recognized standards, the latest edition of the respective publishing agency shall be accepted as establishing the technical requirements which shall be complied with, unless date of publication is recorded in the Specifications.

§ 1.1.7 Instruments of Service

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

§ 1.1.8 Initial Decision Maker

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

§ 1.1.9 The Project Manual

The project manual is the volume usually assembled for the Work which may include the bidding requirements, sample forms, Conditions of the Contract and Specifications.

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§ 1.1.10 Enumeration Of The Drawings, Specifications And Addenda

The Drawings and Specifications which form a part of this Contract are enumerated in the List of Drawings and the Table of Contents of the Project Manual. The Addenda which form a part of this Contract are enumerated in Article 9 of the Owner-Contractor Agreement.

§ 1.2 Correlation and Intent of the Contract Documents

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

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

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

§ 1.2.3 Unless otherwise stated in the Contract Documents, words that have well-known technical or construction industry meanings are used in the Contract Documents in accordance with such recognized meanings.
§ 1.2.3.1 In the event of a conflict or an inconsistency in or among the Contract Documents, or between the Contract Documents and applicable codes in effect at the time the Contract Sum is bid or negotiated, the Contractor shall, unless directed otherwise in writing by an Addendum or Change Order, provide the greatest quantity, highest quality, highest degree of safety, and most stringent material, equipment or Work.

§ 1.2.3.2 In all cases, detail drawings shall take precedence over scale drawings and figure dimensions on the drawings shall govern the setting out of work. Figure dimensions take precedence over designated scales, and Contractor shall carefully study and compare figure dimensions to verify them. Do not scale drawings to obtain figure dimensional information.

§ 1.2.3.3 Should the Drawings or the Specifications disagree in themselves or with each other, the Contractor shall provide the better quality or greater quantity of work and/or materials unless otherwise directed by written modification to the Contract in accordance with applicable provisions of these Conditions.

§ 1.2.3.4 Whenever the terms "approval" or "approved", "acceptable", "satisfactory", "proper" or other general qualifying terms are used in the Contract Documents, it shall be understood that reference is made to the ruling judgment of the Architect and Owner. The terms "approved" or "approval" mean written approval.

§ 1.2.3.5 The word "provide" includes furnishing, installing and connecting the item cited; the word "furnish" means delivery to the building; the word "install" means proper placement, hooking-up and/or adjustment, if hooking-up and/or adjustment is required.

§ 1.2.3.6 Any material or operation specified by reference to published specifications of Society, Association, Code or other published standard shall comply with requirements of the listed document thirty (30) days prior to receipt of bids. In a conflict between referenced document and Project Specifications, Project Specifications shall govern. In a conflict between referenced documents, the more stringent requirements shall govern. Abbreviations of technical organization titles, not defined in the Project Specifications, shall be interpreted by the Architect.

§ 1.3 Capitalization

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

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§ 1.4 Interpretation

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

§ 1.4.2 The Architect shall be the sole interpreter of the Plans and Specifications and the Contractor's performance therewith. It is the intent of the Plans and Specifications to provide materials of a quality consistent with the quality as specified for this Project. The Architect shall be the sole authority in making such determination.

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

§ 1.5.1 The Architect and the Architect's consultants shall be deemed the authors and owners of their respective Instruments of Service, including the Drawings and Specifications and will retain all common law, statutory and other reserved rights, including copyrights. The Contractor, Subcontractors, Sub-subcontractors, and material or equipment suppliers shall not own or claim a copyright in the Instruments of Service. Submittal or distribution to meet official regulatory requirements or for other purposes in connection with this Project is not to be construed as publication in derogation of the Architect's or Architect's consultants' reserved rights. Notwithstanding the foregoing, upon receipt of payment for the creation of the Instruments of Service, the Architect hereby grants to the Owner an irrevocable and unlimited license to use, retain, copy, and reproduce the Instruments of Service for its use in connection with the Project.

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

§ 1.5.3 The Architect may, in the course of providing services under the terms of the Owner Architect Agreement, provide copies of drawings, specifications or other documents, including the documents of the Architect's Consultants, in electronic or digital format (tapes, diskettes, CDs, electronic copies, or file attachments to electronic mail), to the Owner or others, for convenience or informational purposes. Electronic files of the documents are not substitutes for the signed and sealed Contract Documents in printed, hard copy form issued by the Architect. Electronic files are not Contract Documents. The Owner (or other user, with permission of the Owner), referring to electronic files should be particularly alert for inaccuracies, which may result from electronic transmission or translation, or inappropriate use or modification of electronic files without the Architect's knowledge. Any information or data obtained or derived from electronic files to create shop drawings or other submissions must be compared with the hard paper Construction Documents issued by the Architect for construction. Use of electronic documents for any reason is at the user's sole risk. In all cases the hard paper Construction Documents shall be given precedence in the event any discrepancies between the hard copy copies issued by the Architect and any electronic transmitted documents are discovered. The user of such electronic transmitted documents shall notify the Architect immediately upon its knowledge of such discrepancies.

§ 1.5.3.1 The Architect, will, upon request of the Contractor and execution of an electronic document release by Contractor and Owner, transfer computer aided drafting (CAD) files on electronic media for convenience of the Contractor in preparing shop fabrication drawings. The electronic versions of the Contract Documents shall not be used in lieu of Shop Drawings. Information set forth on the CAD files is considered part of the Architect's instruments of service and shall not be used by Contractor for any purpose other than as a convenience in the preparation of shop fabrication drawings for the referenced project and any reuse, misuse or unauthorized modification of this information is prohibited. The file or files may be compressed for ease of transfer. Transfer is a one-time transfer of the media and does not include transfers in the future to include addenda or revisions to the drawings.

§ 1.5.3.2 Due to the potential that the information set forth on the CAD files can be modified unintentionally or otherwise, the Architect reserves the right to remove all indications of its ownership and/or involvement from each electronic file provided electronically.

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§ 1.5.3.3 The Contractor shall not use the Architect's plans, reflected ceiling plans, sections and details in his submittals; Contractor shall review them and recreate them as necessary as part of his Shop Drawing submittal. Architect's floor plans may be used providing borders and other information identifying or pertaining to the Architect and/or his Consultants is removed.

§ 1.5.3.4 The Architect's CAD files will be prepared using various electronic software. The Architect makes no representation as to the compatibility of their files with any hardware or software of the user of any electronically transmitted files provided hereunder.

§ 1.5.3.5 The use of electronic files as a basis for the preparation of shop drawings shall not relieve the preparer from the obligation to properly verify and coordinate all field dimensions and conditions.

§ 1.5.4 Any individual opening or using electronic files provided by the Architect acknowledges that he has read and understands the above additional terms and conditions to the standard General Conditions, agrees to abide by such terms and conditions and has the written authorization of the Owner and Architect to access and/or use these documents. Unauthorized use of these documents is strictly prohibited.

§ 1.6 Notice

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

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

§ 1.7 Digital Data Use and Transmission

The parties shall agree upon protocols governing the transmission and use of Instruments of Service or any other information or documentation in digital form. The parties will use AIA Document E203TM–2013, Building Information Modeling and Digital Data Exhibit, to establish the protocols for the development, use, transmission, and exchange of digital data.

§ 1.8 Building Information Models Use and Reliance

Any use of, or reliance on, all or a portion of a building information model without agreement to protocols governing the use of, and reliance on, the information contained in the model and without having those protocols set forth in AIA Document E203TM–2013, Building Information Modeling and Digital Data Exhibit, and the requisite AIA Document G202TM–2013, Project Building Information Modeling Protocol Form, shall be at the using or relying party's sole risk and without liability to the other party and its contractors or consultants, the authors of, or contributors to, the building information model, and each of their agents and employees.

ARTICLE 2 OWNER

§ 2.1 General

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

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

§ 2.2 Intentionally Deleted

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§ 2.3 Information and Services Required of the Owner

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

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

§ 2.3.3 Intentionally Deleted

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

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

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

§ 2.4 Owner's Right to Stop the Work

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

§ 2.5 Owner's Right to Carry Out the Work

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

ARTICLE 3 CONTRACTOR

§ 3.1 General

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

§ 3.1.1.1 Where the term 'Contractor' is modified in any way in the Contract Documents, such as, without limit, 'this Contractor', 'General Contractor', Prime Contractor', 'HVAC Contractor', 'Plumbing Contractor', 'Electrical

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§ 3.1.1.2 The plural term "Contractors" refers to persons or entities who perform construction under Conditions of the Contract that are administered by the Owner.

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

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

§ 3.2 Review of Contract Documents and Field Conditions by Contractor

§ 3.2.1 Execution of the Contract by the Contractor is a representation that the Contractor has visited the site, become generally familiar with local conditions under which the Work is to be performed and correlated personal observations with requirements of the Contract Documents. The Contractor shall carefully study and compare the Contract Documents with each other and with information furnished by the Owner pursuant to Section 2.2.3 and shall at once report to the Owner and Architect errors, inconsistencies or omissions discovered as a Request For Information in such form as the Architect or the Owner may require. The Contract Documents unless the Contractor recognized such error, inconsistency or omission and knowingly failed to report it to the Owner and Architect. If the Contractor performs any construction activity knowing it involves a recognized error, inconsistency or omission in the Contractor shall assume total responsibility for such performance and shall bear total amount of the attributable costs for correction.

§ 3.2.2 Although the Contractor is not required to ascertain that the Contract Documents are in accordance with applicable laws, statutes, ordinances, building codes, and rules and regulations, any nonconformity discovered by or made known to the Contractor shall be reported promptly to the Architect and Owner, in writing.

§ 3.2.3 The Contractor shall, prior to starting the work on any single portion and at frequent intervals during the progress of the work, carefully study and compare the Agreement, Conditions of the Contract, Drawings, Specifications and other Contract Documents and shall at once report to the Architect and Owner any error, inconsistency or omission he may discover. Any necessary change, as a result of this discovery, shall be ordered as provided in Article 7, subject to the requirements of paragraph 1.2 and other provisions of the Contract Documents. Should the Contractor proceed with the work, without such notice to the Architect, having discovered such errors, inconsistencies or omissions, all costs arising therefrom shall be borne by the Contractor. If the Contractor fails to perform the requirement for reporting any non-conformity in documents or conditions, the Contractor shall be responsible for costs and damages caused by the delay or non-reporting of the issue.

§ 3.2.4 Intentionally deleted.

§ 3.2.5 The Contractor shall perform no portion of the Work at any time without Contract Documents or, where required, approved Shop Drawings, Product Data or Samples for such portion of the Work.

§ 3.2.6 Should the Contractor elect to release work without approvals, same shall be at his own risk and expense. Such work, if it is determined by the Architect and Owner to not be in accordance with the requirements of the Contract Documents, shall be removed and replaced without additional cost or extension of time.

§ 3.2.7 The Contractor shall give the Architect timely notice of any additional design drawings, specifications, or instructions required to define the Work in greater detail, or to permit the proper progress of the Work and the Architect shall provide such information with reasonable promptness. Such interpretations may, at the Architect's option, be issued in the form of additional drawings or instructions indicating in greater detail the construction or design of the various parts of the Work; such drawings or instructions may be effected by Field Directive (as defined in 7.1.1.1) or other notice to the Contractor, and provided such drawings or instructions are reasonably consistent with the previously existing Contract Documents, the Work shall be executed in accordance with such additional drawings or instructions of contract time."

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§ 3.2.8 In the event of any conflict among the Contact Documents, the Contractor shall notify the Owner and the Architect of same and follow and comply with Architect's interpretation of the Contract Documents. In the event that the Owner and Architect fail to respond to the Contractor's notification within a reasonable period of time, then the Documents shall be construed according to the following priorities:

Highest Priority:	Better Quality or Larger Quantity shall be provided.
Second Priority:	Change Orders.
Third Priority:	Modifications to the Agreement.
Fourth Priority:	Agreement.
Fifth Priority:	Specifications.
Sixth Priority:	Schedules.
Seventh Priority:	Large scale detail drawings (detail drawings having a scale of 3/4" and over).
Eighth Priority:	Large scale plan and section drawings (plan and section drawings having a scale equal
	to or larger than that used for the basic floor plan, as a case may be).
Nineth Priority:	Small scale detail drawings (detail drawings having a scale less than 3/4").
Tenth Priority:	Small scale plan and section drawings (plan and Section drawings having a scale less
	than that used on the basic floor plan, as a case may be).

§ 3.3 Supervision and Construction Procedures

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

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

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

§ 3.3.6 The Contractor shall cooperate and provide access, samples, material and other services to the Owner's testing agency at the Owner's or Architect's request during construction at no cost to the Owner.

§ 3.4 Labor and Materials

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

§ 3.4.4 The Contractor shall be responsible for safe storage and protection against theft or damage of all materials until they have been properly incorporated in the project and of all tools and equipment owned by himself or his subcontractors during the construction period and until removed from premises at the completion of the project.

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§ 3.4.6 Substitutions if permitted are subject to provisions of the Specifications and will only be considered within forty (40) days after Owner's award of the Project.

§3.4.6.1 The Contractor may make substitutions only with the consent of the Owner, after evaluation by the Architect, and in accordance with the Owner's written approval and the Project Manual.

§ 3.4.6.2 By making requests for substitutions, 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. Any request for substitution shall include a written statement that highlights and brings to attention of Owner and Architect the differences between the proposed substituted product and the required item.

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

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

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

§3.4.7 All materials delivered to the premises which are to form a part of the work are to be considered the property of the Owner and must not be removed without the Owner's consent. Material not incorporated in the work shall become the Contractor's property and shall be removed from the Project Site at or prior to Substantial Completion, unless other arrangements are made with the Owner.

§3.4.8 No Contractor, nor Subcontractor, shall subcontract, sublet, sell, transfer, assign, purchase work or materials from an organization other than his/her own, or otherwise dispose of the contract or contracts or any portion thereof, or of his/her right, title or interest therein, without written permission from the Owner, or as otherwise provided by law.

§ 3.5 Warranty

§ 3.5.1 The Contractor warrants to the Owner and Architect that materials and equipment furnished under the Agreement will be of good quality and new unless the Contract Documents require or permit otherwise. The Contractor further warrants that the Work will conform to the requirements of the Contract Documents and will be free from defects, except for those inherent in the quality of the Work the Contract Documents require or permit. Work, materials, or equipment not conforming to these requirements may be considered defective. The Contractor's warranty excludes remedy for damage or defect caused by Owner's abuse, alterations to the Work not executed by the Contractor, improper or insufficient maintenance, or improper operation by the Owner, or normal wear and tear and normal usage. If required by the Architect or the Owner, the Contractor shall furnish satisfactory evidence as to the kind and quality of materials and equipment. All warranties shall run from the Date of Substantial Completion with the exception of items or systems deemed to be incomplete, not operating as designed, or defective at the time of Substantial Completion, for which the warranties shall run from the date such items or systems are complete, operating properly or no longer defective.

§ 3.5.2 The Contractor represents that all manufacturer and supplier warranties shall run directly to or be specifically assignable to the Owner. The Contractor warrants that all portions of the Work that will be covered by a manufacturer's or supplier's warranty shall be performed in such a manner so as to preserve all rights under such warranties. The Contractor hereby assigns to the Owner effective upon the termination of this Contract all manufacturer's and supplier's warranties relating to the Work, and the Contractor shall upon request of Owner,

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§ 3.5.3 Any applicable warranties shall be transferred to the Owner by the Contractor at no additional cost or expense to the Owner.

§ 3.5.4 The Contractor agrees that all warranties in the Contract Documents survive acceptance of, delivery of, and payment for, the goods, whether any defect shall be latent or patent. The Contractor agrees to correct, without expense to, and to the satisfaction of the Owner, any defects that may develop in the Work. Any facilities, including buildings and their contents which have been damaged either directly or indirectly by the Work performed by the Contractor shall be repaired within ten (10) working days after receipt of written notice of the defect from the Owner by the Contractor at no cost to the Owner.

§ 3.6 Taxes

All Contractors, subcontractors, suppliers, etc. are required to pay all applicable taxes as required by law, except those taxes for which the Cumberland County Improvement Authority is exempt. In the event that taxes are due for any component of this Project, the Contractor shall pay sales, consumer, use and similar taxes for the Work provided by the Contractor that are legally enacted when bids are received or negotiations concluded, whether or not yet effective or merely scheduled to go into effect.

§ 3.7 Permits, Fees, Notices and Compliance with Laws

§ 3.7.1 The Owner shall pay for, and Contractor shall secure, the building, mechanical, electrical and plumbing permits, the health and environmental impact fees due to water and sewer connections, and the zoning regulation fees and permits. The Contractor shall secure and pay for all other permits and governmental fees, licenses and inspections necessary for proper execution of and completion of the Contract which are legally required when Bids are received, or negotiations concluded.

§ 3.7.2 The Contractor shall comply with and give notices required by applicable laws, statutes, ordinances, codes, rules and regulations, and lawful orders of public authorities applicable to performance of the Work. The Contractor shall arrange and pay for any inspections by governmental authorities needed to obtain any necessary occupancy permits.

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

§ 3.7.3.1 Prior to application for Final Payment, Contractor shall furnish a written certification that the Work is in conformance with applicable laws, ordinances, rules, regulations and lawful orders.

§ 3.7.4 Concealed or Unknown Conditions. If the Contractor encounters conditions at the site that are (1) subsurface or otherwise concealed physical conditions that differ materially from those indicated in the Contract Documents or (2) unknown physical conditions of an unusual nature, that differ materially from those ordinarily found to exist and generally recognized as inherent in construction activities of the character provided for in the Contract Documents, the Contractor shall promptly provide notice to the Owner and the Architect before conditions are disturbed and in no event later than 21 days after first observance of the conditions. The Architect will promptly investigate such conditions. If the Architect determines that the conditions at the site are not materially different from those indicated in the Contract Documents and that no change in the terms of the Contract is justified, the Architect shall promptly notify the Owner and Contractor in writing, stating the reasons. If either party disputes the Architect's determination or recommendation that party may proceed as provided in Article 15. No adjustment in the Contract Time or Contract Sum shall be permitted, however, in connection with a concealed or unknown condition which does not differ materially from those conditions disclosed by the Contractor's prior inspections, tests, reviews, the Geotechnical Report provided to Contractor or from the Contract Documents.

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§ 3.7.6 Although it is not the Contractor's responsibility to ascertain that the Contract Documents are in accordance with applicable laws, statutes, ordinances, building codes, and rules and regulations, if the Contractor observes that portions of the Contract Documents are at variance therewith, the Contractor shall promptly notify the Architect and Owner in writing, and necessary changes shall be accomplished by appropriate modification.

§ 3.7.6.1 The requirements of Section 3.7.3 do not waive the Contractor's responsibility of complying with the requirements of the Contract Documents when such requirements exceed those of any laws, ordinances, rules, regulations and orders of any public authority bearing on the Work.

§ 3.7.7 The Contractor shall pay all highway fees and for all damages to sidewalks, streets, building commercial areas and other tenant areas or other public property, or to public utilities.

§ 3.8 Allowances

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

§ 3.8.2 Unless otherwise provided in the Contract Documents,

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

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

§ 3.9 Superintendent

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

§ 3.9.1.1 The Contractor's superintendent shall be present at the job site at all times that work is being performed, including work performed during overtime. Contractor's superintendent shall perform only supervisory work, and shall not be an active tradesman, or be assigned to any manual work on the premises. The designated superintendent shall not be changed without the written consent of the Owner.

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§ 3.9.3 The Owner reserves the right to require the Contractor to replace any employee, project manager and/or superintendent at no additional cost.

§ 3.9.4 The Contractor shall employ a superintendent or an assistant to the superintendent who will perform as a coordinator for mechanical and electrical Work. The coordinator shall be knowledgeable in mechanical and electrical systems and capable of reading, interpreting and coordinating Drawings, Specifications, and Shop Drawings pertaining to such systems. The coordinator shall assist the Subcontractors in arranging space conditions to eliminate interference between the mechanical and electrical systems and other Work and shall supervise the preparation of coordinator drawings documenting the spatial arrangements for such systems within restricted spaces. The coordinator shall assist in planning and expediting the proper sequence of delivery of mechanical and electrical to the site.

§ 3.10 Contractor's Construction and Submittal Schedules

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

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

§ 3.10.3 The Contractor shall prepare and keep current, for the Architect's approval, a schedule of submittals which is coordinated with the Contractor's Construction Schedule and allows the Architect reasonable time to review submittals.

§ 3.10.4 The Contractor shall conform to the most recent schedules submitted to, and approved by, the Owner and Architect.

§3.10.5 The Owner shall have the right to require a Recovery Schedule. The detail and format of the Recovery Schedule shall be determined by Owner or Architect.

§ 3.11 Documents and Samples at the Site

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

§ 3.12 Shop Drawings, Product Data and Samples

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

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

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

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

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

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

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

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

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

§ 3.12.10.1 If professional design services or certifications by a design professional related to systems, materials, or equipment are specifically required of the Contractor by the Contract Documents, the Owner and the Architect will specify all performance and design criteria that such services must satisfy. The Contractor shall be entitled to rely upon the adequacy and accuracy of the performance and design criteria provided in the Contract Documents. The Contractor shall cause such services or certifications to be provided by an appropriately licensed design professional, whose signature and seal shall appear on all drawings, calculations, specifications, certifications, Shop Drawings, and other submittals prepared by such professional. Shop Drawings, and other submittals related to the Work, designed or certified by such professional, if prepared by others, shall bear such professional's written approval when submitted to the Architect. The Owner and the Architect shall be entitled to rely upon the adequacy

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and accuracy of the services, certifications, and approvals performed or provided by such design professionals, provided the Owner and Architect have specified to the Contractor the performance and design criteria that such services must satisfy. Pursuant to this Section 3.12.10, the Architect will review and approve or take other appropriate action on submittals only for the limited purpose of checking for conformance with information given and the design concept expressed in the Contract Documents.

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

§ 3.13 Use of Site

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

§ 3.14 Cutting and Patching

§ 3.14.1 The Contractor shall be responsible for cutting, fitting, or patching required to complete the Work or to make its parts fit together properly. All areas requiring cutting, fitting, or patching shall be neatly done by mechanics or contractors skilled in these trades, and to the satisfaction of the Architect.

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

§ 3.14.3 Contractor shall not perform any cutting that will impair the strength of the structure. Any cutting that he considers too extensive or that will impair the strength of construction, shall be reported to the Owner and Architect.

§ 3.14.4 All work that may be cut, damaged, disturbed or otherwise interfered with during the progress of the work of the various trades shall be fully, properly and carefully patched, repaired and made good in a first class manner satisfactory to the Architect by the Contractor whose work has been cut or damaged and requires repair.

§ 3.15 Cleaning Up

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

§ 3.15.1.1 The Contractor shall provide for the continual removal of rubbish and debris from the building until final completion of the Project ("Final Completion") and shall provide a dumpster on site, as required. Contractor shall also maintain 6 - 55-gallon drums (or equivalent) around the Project site for accumulation of trash. Contractor shall clean up the site on a daily basis, including the cleanup of all trash (including coffee cups, Styrofoam, insulation, etc.) and shall empty the 55-gallon drums as necessary and no less frequently than daily.

§ 3.15.1.2 The Contractor shall sweep up and gather together daily, all his own rubbish and deposit same at a location(s) as directed in dumpsters provided by the Contractor.

§ 3.15.1.3 Final cleaning at the completion of the work shall generally include, but not be limited to:

- a. Removal of all paint, putty and other stains from all glass, and washing of glass on both sides.
- b. Removal of all broken or scratched glass and replacement with new glass of the same type.
- c. Removal of all temporary protections (tape, oil, etc.).
- d. Removal of all dirt, mortar droppings, fingerprints, dust, spots, etc. from finish surfaces.
- e. Cleaning of all floors.
- f. Cleaning of fixtures and equipment.

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- g. Cleaning and polishing of all hardware, grilles and architectural metal.
- h. All other cleaning as required to turn the portions of the building where work has been performed over to the Owner in a spotless and orderly condition.

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

§ 3.16 Access to Work

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

§ 3.16.2 The Contractor shall promptly notify the Owner and Architect of the presence of hazardous conditions at the site, including the start of hazardous operations or the discovery or exposure of hazardous substances.

§ 3.16.3 The Contractor is to maintain reasonable access to site for structural steel erection including crane, steel deliveries, etc. Structural Steel Contractor will be responsible to coordinate requirements with the Contractor and the Owner a minimum of 30 days prior to deliveries.

§ 3.16.4 The Contractor shall keep only necessary equipment on site and shall cooperate with the Owner regarding location of stored material. No Contractor shall be allowed to unreasonably encumber the Project site (or building) with equipment and stored material and shall afford other contractors reasonable opportunity for introduction and storage of their materials and for execution of other work.

§ 3.17 Royalties, Patents and Copyrights

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

§ 3.18 Indemnification

§ 3.18.1 To the fullest extent permitted by law, the Contractor shall indemnify and hold harmless the Owner, Architect, Architect's consultants, and agents and employees of any of them from and against claims, damages, losses, and expenses, including but not limited to attorneys' fees, arising out of or resulting from performance of the Work, provided that such claim, damage, loss, or expense is attributable to bodily injury, sickness, disease or death, or to injury to or destruction of tangible property (other than the Work itself), including loss of use resulting therefrom, for the wrongful or negligent acts or omissions of the Contractor, a Subcontractor, anyone directly or indirectly employed by them or anyone for whose acts they may be liable and for the fault or negligence of Owner (except for the sole negligence or willful misconduct of Owner), regardless of whether or not such claim, damage, loss or expense is caused in part by a party indemnified hereunder. The Contractor shall also indemnify defend and hold the Owner harmless from and against any assertion of claims for mechanics' or construction liens or similar liens by any party that provided labor or materials for the Project except to the extent any such claims are the result of Owner's wrongful withholding of payment due under the Contract Documents. The Contractor's obligations under this Section 3.18.1, shall not be construed to negate, abridge, or reduce other rights or obligations of indemnity that would otherwise exist as to a party or person described in this Section 3.18. This indemnification shall not cover the sole negligence or willful misconduct of Owner. Contractor's obligations under this Section 3.18 shall arise at the time written notice of a claim is first provided to Owner regardless of whether claimant has filed suit on the claim. Contractor's obligations shall exist even if Owner is the only party sued by claimant. The obligations of Contractor under this Section 3.18.1 shall survive the expiration or earlier termination of the Contract and shall bind. Contractor for itself, successors and assigns.

§ 3.18.2 In claims against any person or entity indemnified under this Section 3.18 by an employee of the Contractor, a Subcontractor, anyone directly or indirectly employed by them or anyone for whose acts they may be liable, the indemnification obligation under this Section 3.18 shall not be limited by a limitation on amount or type of damages, compensation or benefits payable by or for the Contractor or a Subcontractor under workers' compensation acts, disability benefit acts or other employee benefit acts. To the extent permitted by law, Contractor, for itself, its successors and assigns, hereby expressly agrees to waive any provision of the applicable State's

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Workers' Compensation Act, including Section 303(b), whereby the Contractor could preclude its joinder as an additional defendant or avoid liability for damages.

§ 3.18.3 The Contractor's indemnity obligations under this Paragraph 3.18 shall also specifically include, without limitation, all fines, penalties, damages, liability, costs, expenses (including, without limitation, reasonable attorneys' fees) and punitive damages (if any) arising out of, or in connection with any (i) violation of or failure to comply with any law, statute, ordinance, rules, regulation, code, or requirement of a public authority that bears upon the performance of the work by the Contractor, a subcontractor, or any person or entity for whom either is responsible, (ii) means, methods, procedures, techniques, or sequences of execution or performance of the Work, and (iii) failure to secure and pay for permits, fees, approvals, licenses and inspections as required under the Contract Documents, or any violation of any permit or other approval of a public authority applicable to the Work, by the Contractor, a Subcontractor, or any person or entity for whom either is responsible.

ARTICLE 4 ARCHITECT

§ 4.1 General

§ 4.1.1 The Architect is the person or entity retained by the Owner pursuant to Section 2.3.2 lawfully licensed to practice architecture or an entity lawfully practicing architecture and identified as such in the Agreement.

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

§ 4.2 Administration of the Contract

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

§ 4.2.2 The Architect will determine in general that the Work is being performed in accordance with the requirements of the Contract Documents, will keep the Owner informed of the progress of the Work, and will endeavor to guard the Owner against defects and deficiencies in the Work.

§ 4.2.3 The Owner will provide for coordination of the activities of other Contractors and of the Owner's own forces with the Work of the Contractor and any other contractor, who shall cooperate with them. The Contractor shall participate with other Contractors and the Architect and Owner in reviewing their construction schedules when directed to do so. The Contractor shall make any revisions to the construction schedule deemed necessary after a joint review and mutual agreement. The construction schedules shall constitute the schedules to be used by the Contractor, other Contractors, the Architect and the Owner until subsequently revised.

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

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

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§ 4.2.4 Communications

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

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

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

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

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

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

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

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

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

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

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

ARTICLE 5 SUBCONTRACTORS

§ 5.1 Definitions

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

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

§ 5.1.3 A Supplier is a person or entity who has a direct or indirect contract with the Contractor, Subcontractor or Sub-subcontractor to furnish materials or equipment for the Work. The term "Supplier" is referred to throughout the Contract Documents as if singular in number and masculine in gender and means a Supplier or an authorized representative of the Supplier.

§ 5.1.4 The term "Specialist" or "Specialty Contractor" as used in these specifications shall mean an individual or firm of established reputation, or, if newly organized, whose personnel have previously established a reputation in the same field, which is regularly engaged in, and which maintains a regular force of workmen skilled in either manufacturing or fabricating items required by the Agreement, installing items required by the Agreement, or otherwise performing work required by the Agreement. Where the Agreement Specifications require installation by a "Specialist", that term shall also be deemed to mean either the manufacturer of the item, an individual or firm licensed by the manufacturer, or an individual or firm who will perform the work under the manufacturer's direct supervision. All other requirements and provisions contained in these documents pertaining to subcontractors and Sub-subcontractors are applicable to Specialty Contractors.

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

§ 5.2.1 Within 20 days after Notice to Proceed, the Contractor shall furnish to the Architect in writing for review by the Owner, and Architect, a list of the names of all Subcontractors, Sub-subcontractors, fabricators, manufacturers, sources of supply, articles, devices, fixtures, pieces of equipment, materials, and processes proposed for each item of Work on List of Subcontractors, AIA Document G705. The Architect will promptly notify the Contractor in writing if either the Owner, or Architect, after due investigation, has reasonable objection to any names on such list. Failure of the Owner, and Architect, to make objection promptly to any name on the list shall constitute acceptance of such name. The Contractor shall obligate each Subcontractor to comply with the Public Works Contractor Registration Act of the State of New Jersey and all other laws and regulations governing work on public construction projects.

§ 5.2.1.1 In submitting the names of subcontractors, the Contractor shall list: 1) the extent or limitations of the trades or work included by Specification paragraph number; 2) the name and address of the Subcontractor; 3) the name and address of all Sub-subcontractors for each significant subdivision of the trade or work, and if required by the Architect or Owner; 4) reference in the form of a list of at least three jobs similar in size and quality to this Project performed in the last five (5) years, with name and location of work, dollar value and names of the Owner and Architect.

§ 5.2.1.2 In submitting sources of supply of materials, articles and pieces of equipment including those under subcontracts and sub-subcontracts, the Contractor shall list: 1) the extent or limitations of the trades or work included by Specification section number; 2) the name and address of the source of supply; and 3) the name of the manufacturer of the item.

§ 5.2.1.3 Upon approval of Subcontractors, the Contractor shall award its Subcontracts as soon as possible after the signing of the Contract and see that all materials, its own and those of its Subcontractors, are promptly ordered so that the work will not be delayed by failure of materials to arrive on time.

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

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

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

§ 5.2.5 The Subcontracts shall be the same as those specified in AIA Document G705.

§ 5.3 Sub-contractual Relations

§ 5.3.1 By appropriate written agreement, the Contractor shall require each Subcontractor, to the extent of the Work to be performed by the Subcontractor, to be bound to the Contractor by terms of the Contract Documents, and to assume toward the Contractor all the obligations and responsibilities, which the Contractor, by these Contract Documents, assumes toward the Owner and Architect. Each subcontract agreement shall preserve and protect the rights of the Owner and Architect under the Contract Documents with respect to the Work to be performed by the Subcontractor so that subcontracting thereof will not prejudice such rights, and shall allow to the Subcontractor, unless specifically provided otherwise in the subcontract agreement, the benefit of all rights. Where appropriate, the Contractor shall require each Subcontractor to enter into similar agreements with Sub-subcontractors. The Contractor shall make available to each proposed Subcontractor, prior to the execution of the subcontract agreement, copies of the Contract Documents to which the Subcontractor will be bound, and, upon written request of the Subcontractor, identify to the Subcontractor terms and conditions of the proposed subcontract agreement which may be at variance with the Contract Documents. Subcontractors shall similarly make copies of applicable portions of such documents available to their respective proposed Sub-subcontractors. The Contractor shall contractually obligate each Subcontractor to comply with the Public Works Contractor Registration Act of the State of New Jersey and to provide the insurance and other mandatory provisions required of Subcontractors as set forth in the Contract Documents.

§ 5.3.2 Where Contractor subcontracts portions of the Work, the entire responsibility for the subdividing of Work rests with the Contractor except where undivided responsibility is specified. The Owner and Architect are not responsible for the manner of the subdivision of the Work and neither will enter into or settle disagreements or disputes between Contractor and Subcontractor.

§ 5.4 Contingent Assignment of Subcontracts

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

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

ARTICLE 6 CONSTRUCTION BY OWNER OR BY SEPARATE CONTRACTORS

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

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

to those of this Contract, including those provisions of the Conditions of the Contract related to insurance and waiver of subrogation.

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

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

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

§ 6.1.5 The Owner may be awarding other contracts for different portions of the project or other work on the site. In such case the Contractor shall fully cooperate with such other contractors and all Owner's agents and representatives and carefully fit his own work to such corresponding work on the site as may be directed by the Architect. The Contractor shall not commit or permit any act, which will interfere with the performance of work by any other contractor or by the Owner's agents and representatives.

§ 6.2 Mutual Responsibility

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

§ 6.2.2 If part of the Contractor's Work depends for proper execution or results upon construction or operations by the Owner or a Separate Contractor, the Contractor shall, prior to proceeding with that portion of the Work, promptly notify the Architect of apparent discrepancies or defects in the construction or operations by the Owner or Separate Contractor that would render it unsuitable for proper execution and results of the Contractor's Work. Failure of the Contractor to notify the Architect of apparent discrepancies or defects prior to proceeding with the Work shall constitute an acknowledgment that the Owner's or Separate Contractor's completed or partially completed construction is fit and proper to receive the Contractor's Work. The Contractor shall not be responsible for discrepancies or defects in the construction or operations by the Owner or Separate Contractor that are not apparent. Should the Contractor be damaged by any other separate Contractor on the work by reason of such other Contractor's failure to perform properly its Contract with the Owner, no action will lie against the Owner and the Owner shall have no liability therefore, but the Contractor may assert its claim for damage against such separate Contractor as a third party beneficiary under the Contract between such other Contractor and the Owner.

§ 6.2.3 Costs caused by delays or by improperly timed activities or defective construction shall be borne by the Contractor.

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

§ 6.2.5 The Contractor shall promptly remedy damage wrongfully caused by the Contractor to completed construction or partially completed construction or to property of the Owner or other contractors as provided in Section 10.2.5 or to other completed or partially completed construction or property on the site or to property of any adjourning Owner or other party.

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§ 6.2.5.1 Should the Contractor cause damage to the Work or property of any other Contractor on the Project, the Contractor shall, after notice to Owner and Architect, resolve the issue with such other Contractor. If such other Contractor makes any claim against the Owner, or the Architect or initiates litigation on account of any damage alleged to have been so sustained, the Contractor agrees that it will hold the Owner, Architect and Owner's Representatives harmless against any such suit, and that it will reimburse to the Owner, Architect and Owner's Representatives as the case may be, the cost of defending such suit, including reasonable attorney's fee and if judgment against Owner or Architect arises there from, the Contractor shall pay all judgment cost and interest incurred by the Owner, Architect and Owner's Representatives.

§ 6.2.6 Claims and other disputes and matters in question between the Contractor and other Contractors shall be subject to the provisions of this Agreement, provided the other Contractors have reciprocal obligations.

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

§ 6.3 Owner's Right to Clean Up

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

ARTICLE 7 CHANGES IN THE WORK

§ 7.1 General

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

§ 7.1.1.1 A Field Directive is a directive issued by Architect to proceed with a portion of the Work, when the directive is non-material, has no impact on Contract Sum or Contract Time (the "Field Directive"). The Contractor shall have no claim as a result of the Field Directive unless it shall, prior to complying with same and in any event no later than five (5) working days from the date such direction or order was given, submit to the Owner for the Owner's approval its change proposal.

§ 7.1.1.2 When submitting its change proposal, the Contractor shall include and set forth in clear and precise detail breakdowns of labor and materials for all trades involved and the estimated impact on the construction schedule, based upon an impact analysis of the current schedule. The Contractor shall furnish spreadsheets from which the breakdowns were prepared, plus spreadsheets if requested of any Subcontractors.

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

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

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

§ 7.1.5 Prior to submitting a Change Order, Contractor shall deliver to Owner and Architect a proposal to resolve the outstanding issue through a no cost solution to resolve the problem. If Contractor and Architect mutually decide there is no reasonable no cost solution, Contractor may proceed with the Change Order process.

§ 7.2 Change Orders

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

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

§ 7.2.2 The methods used in determining adjustments to the Contract Sum shall be acceptable to the Architect and Owner and may include those listed in Paragraph 7.3.3.

§ 7.2.2.1 The Architect and Owner require itemized pricing certifications on all change order proposals from the Contractor, subcontractors and sub-subcontractors regardless of their tier, including detailed line item estimates showing materials take-offs, materials prices by item and related labor-hour pricing information and extensions (by line item or by drawing, as applicable).

§7.2.2.2 No separate allowances for warranty expense will be allowed as a direct cost of a change order.

§ 7.2.2.3 Estimated materials costs shall reflect the Contractor's reasonably anticipated actual net cost of the purchase of the materials needed for the change order work. Estimated materials costs shall reflect cost reductions available due to trade discounts, free materials credits, and/or volume rebates "Cash" discounts available on materials purchased for change order work shall be credited to the Owner if the Owner provides such cash to the Contractor in time for the Contractor to take advantage of any such cash discounts. Price quotations from materials suppliers must be itemized with unit prices for each specific item to be purchased. "Lot Pricing" quotations will not be considered sufficient substantiating detail.

§ 7.2.2.4 Estimated labor costs shall be based on the actual cost per hour paid for those workers who the Contractor reasonably anticipates will perform the change order work.

§ 7.2.3 In Section 7.2.1.2 above, the allowance for overhead and profit combined, included in the total cost to the Owner, shall be based on the schedule contained in Section 7.3.10.1 through 7.3.10.5, and shall be indicated as separate line items on the Contractor's Cost Breakdown.

§ 7.2.4 The Contractor agrees it is responsible to submit accurate, correct and complete cost and pricing data to support its change order proposals or other contract price adjustments under the Agreement. The Contractor agrees that any designated Owner's representative will have the right to examine the records of the Contractor to verify the accuracy and the appropriateness of the pricing data used to price change order proposals.

§ 7.2.5 When a Change Order involves both additions and deletions in material, the net quantity is to be determined and the appropriate overhead and profit is to be applied to the net quantity.

§ 7.3 Construction Change Directives

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

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

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

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

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

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

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

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

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

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

§ 7.3.9 Pending final determination of the total cost to the Owner, amounts not in dispute may be included in Applications for Payment accompanied by a fully executed Change Order indicating the parties' agreement with part or all of such costs. The amount of credit to be allowed by the Contractor to the Owner for a deletion or change which results in a net decrease in the Contract Sum shall be actual net cost as confirmed by the Owner. When both additions and credits covering related Work or substitutions are involved in a change, the allowance for overhead and profit shall be figured on the basis of net increase, if any, with respect to that change.

§ 7.3.10 In Sections 7.3.6 and Clause 7.3.3.1, the allowance for overhead and profit combined, included in the total cost to the Owner, shall be based on the following schedule:

- .1 For the Contractor, for any Work performed by the Contractor's own forces, ten percent (10%),
- .2 For the Contractor, for Work performed by his Subcontractor, five percent (5%) of the amount due the Subcontractor.
- .3 For each Subcontractor or Sub-subcontractor involved, for any Work performed by that Subcontractor's own forces, ten percent (10%) of the cost.
- .4 For each Subcontractor, for Work performed by his Sub-subcontractors, five percent (5%) of the amount due the Sub-subcontractors.
- .5 Cost to which overhead and profit is to be applied shall be determined in accordance with Clauses 7.3.10.1 through 7.3.10.5.

§ 7.3.11 In order to facilitate checking of quotations for extras or credits, all proposals, except those so minor that their propriety can be seen by inspection, shall be accompanied by a complete itemization of costs including labor, hours, materials and subcontracts. Labor and materials shall be itemized in the manner prescribed above; labor costs

shall be actual costs (wages and benefits), not standardized billing rates. Where major cost items are subcontracts, they shall be itemized also. Labor hours shall be completely broken down. In no case will a change involving over \$1,500.00 be approved without such itemization.

§ 7.4 Minor Changes in the Work

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

ARTICLE 8 TIME

§ 8.1 Definitions

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

§ 8.1.2 The Contract Time shall commence as of the date of the Notice to Proceed unless otherwise specified in the Agreement. However, the Work to be performed under this Agreement shall not commence until the required insurance has been obtained and approved. The date shall not be postponed by the failure to act of the Contractor or of persons or entities for whom the Contractor is responsible.

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

§ 8.1.4 The term "day" shall mean a calendar day of twenty-four (24) hours beginning at 12:00 Midnight. The term "working day" (or "business day") shall mean any calendar day except Saturdays, Sundays and legal holidays at the place of the Project. A time limit ending on a weekend or holiday shall be automatically extended to the succeeding working day.

§ 8.2 Progress and Completion

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

§ 8.2.2 The Contractor shall not knowingly, except by agreement or instruction of the Owner in writing, commence the Work prior to the effective date of insurance required to be furnished by the Contractor and Owner. The date of commencement of the Work shall not be changed by the effective date of such insurance. Unless the Date of Commencement is established by a notice to proceed given by the Owner, the Contractor shall notify the Owner in writing not less than five days or other agreed period before commencing the Work to permit the timely filing of mortgages, mechanic's liens and other security interests.

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

§ 8.2.4 The Owner in coordination with the Contractor will set work hours. Contractor will be required to work nights, weekends, or holidays as necessary to complete the work in accordance with the Schedule. NOTE: Standard work hours for this project may be affected by local Noise Ordinance. Contractor shall be responsible to adhere to the Noise Ordinance, including night, weekend and holiday work. All utility shutdowns, interruptions, work in or adjacent to an existing building will be coordinated through the Architect and may have to be performed during dictated hours.

§ 8.3 Delays and Extensions of Time

§ 8.3.1 If the Contractor is delayed at any time in the commencement or progress of the Work by an act or neglect of the Owner or changes ordered in the Work; or by other causes that the Architect determines may justify delay, then at Owner's sole option, the Contractor shall: (a) be entitled to an extension of the Contract Time; (b) be ordered by the Owner to accelerate the schedule to make up the lost time comprising the delay, including second shift work; or

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(c) a combination of (a) and (b), which shall be memorialized by Change Order, subject to the provisions of this Article 8.3.

§ 8.3.2 Intentionally Deleted.

§ 8.3.3 Except as set forth herein, this Section 8.3 does not preclude recovery of damages for delay by either party under other provisions of the Contract Documents.

§ 8.3.4 Where the cause of delay is due to weather conditions, extension of time shall be granted only for unusually severe weather, as determined by reference to historical data. The term "historical data" as used in the preceding sentence shall be construed according to this formula: Average rainfall (or snow or extreme low temperature) for the past five (5) years for the month in question, plus twenty (20) percent. In other words, weather is not deemed to be unusually severe unless it is twenty (20) percent worse than the average for that month over the last five years.

§ 8.3.5 No payment or allowance of any kind or extension of time shall be made to the Contractor as compensation for damages on account of hindrance or delay from any cause in the progress of the Work, when the Architect or Owner determines the delay to be: (i) avoidable; (ii) caused in whole or in part by Contractor's negligence or intentional misconduct; or (iii) to be Contractor's fault (in whole or in part) for the delay, including but limited to any delay attributable to lack of coordination or cooperation by or between the Contractor and his Subcontractors.

§ 8.3.6 The Owner shall have the right to defer the beginning or to suspend in whole or in any part, of the Work herein contracted to be done, whenever, in the opinion of the Owner or Architect, it may be necessary or expedient for the Owner to do so. If the Contractor is delayed in completion of the Work by a reason not set forth in Section 8.3.5, then for all such delays and suspensions the Contractor shall be entitled to compensation for the delay in accordance with Section 8.3.6.2.

§ 8.3.6.1 The Contractor shall not be entitled to make a claim for delay (regardless of the cause of the delay) unless within two (2) business days after the beginning of such delay or delays, Contractor files a written request providing notification of the delay (including specific explanation as to the cause) with the Architect and Owner. In case of a continuing cause of delay, only one request is necessary.

§ 8.3.6.2 Notwithstanding anything else contained herein, Contractor's remedy for the Owner's negligence, bad faith, active interference, tortuous conduct, or other reasons uncontemplated by the parties that delay the Contractor's performance, Contractor shall be entitled to an extension of the Contract Time and for such additional compensation as determined by the Owner. The Owner may also order the Contractor to accelerate the schedule to make up the lost time comprising the delay, including second shift work and for additional compensation as determined by the Owner which shall be memorialized by Change Order subject to the provisions of this Article 8.3.

§ 8.4 Completion and Liquidated Damages

§ 8.4.1 The Contractor shall achieve Substantially Completion of all the Work included in the Contract Documents ready for the Owner's utilization and occupancy as defined in Section 8.1.3 of the General Conditions within the time required by this Contract.

§ 8.4.2 Pursuant to the provisions of Section 8.4.1, for each calendar day delay in either (a) Substantial Completion of the Work or (b) any of the milestones for the Project as set forth in the Contract Documents and as set forth on Contractor's Form of Proposal, the Contractor shall pay to the Owner as liquidated damages, and not as a penalty, the sum set forth of as noted in the Form of Proposal, the Specifications (Summary of Work) and as set forth on Contractor's Form of Proposal and each Contractor and its surety shall be liable for the amount thereof and the sum may be deducted by the Owner from any monies outstanding.

§ 8.4.3 It is hereby understood and mutually agreed, by and between the Contractor and the Owner, that the date of beginning and the time for completion as specified in the Contract of the Work to be done hereunder are ESSENTIAL CONDITIONS of this Contract; and it is further mutually understood and agreed that the Work required in this Contract shall be commenced on a date to be specified in the "Notice to Proceed".

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§ 8.4.3.1 The Contractor agrees that said Work shall be prosecuted regularly, diligently, and uninterruptedly at such rate of progress as will ensure full completion thereof within a reasonable time for the completion of the same, taking into consideration the average climatic change and usual industrial conditions prevailing in this locality.

§ 8.4.4 If the said Contractor shall neglect, fail or refuse to complete the Work within the time herein specified, or any proper extension thereof granted by the Owner, then the Contractor does hereby agree, as a part consideration for the awarding of this contract, to pay to the Owner the amount specified, not as a penalty but as Liquidated Damages, for each and every calendar day that the Contractor shall fail to achieve Substantial Completion.

§ 8.4.4.1 The amount of the Liquidated Damages has been fixed and agreed upon by and between the Contractor and the Owner because of the impracticability and extreme difficulty of fixing and ascertaining the actual damages the Owner would in such event sustain, and said amount is agreed to be the amount of damages which the Owner would sustain should the Contractor not achieve Substantial Completion by the required date.

§ 8.4.4.2 It is further agreed that time is of the essence of each and every portion of this Contract and of the specifications wherein a definite and certain length of time is fixed for performance of any act whatsoever; and where under the Contract an additional time is allowed for completion of any task or the Work, the new time limit, fixed by such extension should shall be of the essence of this Contract.

§ 8.4.5 If job progress has been adversely affected by the non-attendance of any Contractor at a scheduled job meeting of which he has been duly notified, such adverse effect shall be considered as job delay; and the Contractor shall be subject to payment of damages to the Owner in an amount not to exceed \$500.00 for each occurrence, unless the Contractor was excused by the Architect prior to the meeting and the Owner shall have the right to deduct this from any payments due Contractor

ARTICLE 9 PAYMENTS AND COMPLETION

§ 9.1 Contract Sum

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

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

§ 9.2 Schedule of Values

Before the first Application for Payment and, if necessitated by Change Orders, from time-to-time thereafter, the Contractor shall submit to the Architect and Owner, through the Architect, a schedule of values allocated to various portions of the Work, prepared in such form and supported by such data to substantiate its accuracy as the Architect and the Owner may require. This schedule, unless objected to by the Architect or the Owner, shall be used as a basis for reviewing the Contractor's Application for Payment. Each line item on the schedule of values shall be broken down into labor and material. All items shall be referenced by both item name and number, and shall include at least the minimum items in the Schedule of Values:

- Punch list work Minimum of 1% of contract value •
- Value for Record Drawings
- Value for daily clean-up
- Value for final clean-up
- Value for equipment start-up and Commissioning
- Value for shop drawings
- Value for attic stock
- Value for safety protections
- Value for CPM schedule and monthly updates
- Value for Winter protection
- Value of required allowances
- Value for Testing and Balancing HVAC System



§ 9.3 Applications for Payment

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

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

§ 9.3.1.2 Applications for Payment shall not include requests for payment for portions of the Work for which the Contractor does not intend to pay a Subcontractor or supplier, unless such Work has been performed by others whom the Contractor intends to pay. Application for Payment shall be prepared on the standard AIA Application for Payment Form G702 and shall be submitted with five (5) copies.

§9.3.1.3 With each Application for Payment, the Contractor shall (i) Certify that the Application for Payment represents a just estimate of Work performed and material supplied during the period covered by the Application for Payment; (ii) Certify that there are no known construction liens outstanding at the date of the Application for Payment, except for such bills not paid but so included there is no known basis for the filing of any construction liens on the Work and that waivers from all Subcontractors and all material suppliers have been obtained in such form as to constitute an effective waiver of lien under applicable state laws; (iii) Provide Contractor's waiver of lien for all amounts requested in such Application for Payment; (iv) Provide waivers of lien from each Subcontractor, Sub-subcontractor, material supplier, and all other parties that provided labor or material for which payment was requested under previous Applications for Payment and that also have statutory lien rights; (v) Provide any other information reasonably requested by Owner or Owner's title insurance company as a prerequisite for such title insurance company to insure over mechanic's liens, construction liens and all other similar liens attributable to the Work covered by the applicable Application for Payment; and (vi) evidence that any union wages and benefits are current.

§ 9.3.1.4 If any claim or lien is made or filed with or against the Owner, the Project, or the Premises where the Work is being performed, by any person claiming that the Contractor or any Subcontractor or other person under it has failed to make payment for any labor, services, materials, equipment, taxes, or other items or obligations furnished or incurred for or in connection with the Work, or if at any time there shall be evidence of such nonpayment or of any claim or lien for which, if established, the Owner might become liable and which is chargeable to the Contractor, or if the Contractor or any Subcontractor or other person under it causes damage to the Work or to any other work on the Project and Contractor fails to rectify same in a timely manner and within no later than 30 days, the Architect may withhold certification of payment and Owner shall withhold payment which the Architect shall deem sufficient to (1) satisfy, discharge, and/or defend against any such claim or lien or any action which may be brought or judgment which may be recovered thereon, (2) make good any such nonpayment, damage, failure or default, and (3) compensate the Owner for and indemnify it against any and all losses, liability, damages, costs and expenses, including reasonable attorneys' fees and disbursements, which may be sustained or incurred by the Owner in connection therewith. The Owner shall have the right to apply and charge against the Contractor so much of the amount retained as may be required for the foregoing purposes. If such amount is insufficient therefor, the Contractor shall be liable for the difference and pay the same to the Owner.

§ 9.3.2 Payments on account of materials or equipment not incorporated in the Work but delivered and suitably stored at the site, or at some other location agreed upon in writing, will be made by the Owner subject to the following conditions:

§ 9.3.2.1 Such materials or equipment shall have been fabricated or assembled specifically for the Project and delivered to storage no earlier than needed for the orderly progress of the Work as demonstrated by the Progress Schedule. Nothing herein contained is to limit or prejudice the right of the Owner to undertake claim for damages due to delay in delivery and installation of any such material or equipment prepaid prior to the delivery by Contractor.

§ 9.3.2.2 Title to such materials or equipment shall pass to the Owner pursuant to the Contractor's bill of sale which shall contain guarantee of replacement thereof in the event of damage thereto or disappearance thereof due to any cause. The Contractor shall also affirm that he will pay for such materials or equipment immediately upon receipt of payment from the Owner.

§ 9.3.2.3 In the case of offsite storage, the Contractor shall also provide Consent of Surety to such payment and insurance of such materials or equipment against the perils set forth in Article 11, both while in storage and during transportation to the site.

§ 9.3.2.4 Raw materials or other materials or equipment readily duplicated or usable on other projects will be paid for only after the materials are incorporated in the construction.

§ 9.3.2.5 Partial or complete payment for materials and equipment stored either on or off site shall not be construed as relieving the Contractor of its responsibility for the care and protection of such materials and equipment used. Contractor shall be responsible for any and all damage to such materials and equipment occurring prior to the incorporation of such materials and equipment into the Work on the Project Site and Owner shall have the right in addition to all other remedies available to Owner under the Contract to reject any such materials and equipment damaged prior to the incorporation thereof in to the work on the project site. Materials and equipment stored either on or off-site requiring protection from weather, heat, cold or moisture shall be suitably protected by Contractor as required by the material manufacturer. The materials and equipment shall be labeled as the property of the Owner and shall be accessible to the Owner for inspection at all times and shall be segregated from other materials and equipment at the storage facility. If the Contractor requests payment for material stored either on or off site, Owner shall be entitled to receive, at the minimum, the following prior to make payment: (i) receipt of a Bill of Sale; (ii) proof of suitable and convenient storage, and (iii) receipt of a certificate of insurance naming the Owner as loss payee which insurance should cover the stored materials in an amount equal to the full replacement value of such materials.

§ 9.3.3 The Contractor warrants that title to all Work covered by an Application for Payment will pass to the Owner by incorporation of the Work into the construction and upon receipt of payment by the Contractor, free and clear of all liens, claims, security interests or encumbrances. The Contractor further agrees that receipt of payment for any Application for Payment shall, upon receipt of such payment and to the fullest extent permitted by law, be conclusively deemed to waive all liens with respect to said Work, materials and labor to which the Contractor then may be entitled; provided, however, that in no event shall such waiver of lien rights waive right to payment for said Work, materials and labor.

§ 9.3.4 Each Application for Payment or periodic estimate requesting payment must be accompanied by a certification that each subcontractor, vendor or supplier has been paid all amounts due him on the basis of the previous periodic payment to the Contractor, or else stating the amount not so paid and the reason for the discrepancy. In the event of any such discrepancy, the Contractor shall be required to furnish his own written explanation.

§ 9.4 Certificates for Payment

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

§ 9.4.2 The issuance of a Certificate for Payment will constitute a representation by the Architect to the Owner, based on the Architect's evaluation of the Work and observations at the site and the data in the Application for Payment, that, to the best of the Architect's knowledge, information, and belief, the Work has progressed to the point indicated, the quality of the Work is in accordance with the Contract Documents, and that the Contractor is entitled to payment in the amount certified. The foregoing representations are subject to an evaluation of the Work

for conformance with the Contract Documents upon Substantial Completion, to results of subsequent tests and inspections, to correction of minor deviations from the Contract Documents prior to completion, and to specific qualifications expressed by the Architect. However, the issuance of a Certificate for Payment will not be a representation that the Architect has (1) made exhaustive or continuous on-site inspections to check the quality or quantity of the Work; (2) reviewed construction means, methods, techniques, sequences, or procedures; (3) reviewed copies of requisitions received from Subcontractors and suppliers and other data requested by the Owner to substantiate the Contractor's right to payment; or (4) made examination to ascertain how or for what purpose the Contractor has used money previously paid on account of the Contract Sum.

§ 9.5 Decisions to Withhold Certification



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

- .1 defective Work not remedied;
- .2 third party claims filed or reasonable evidence indicating probable filing of such claims, unless security acceptable to the Owner is provided by the Contractor;
- .3 failure of the Contractor to make payments properly to Subcontractors or suppliers for labor, materials or equipment;
- .4 reasonable evidence that the Work cannot be completed for the unpaid balance of the Contract Sum;
- .5 damage to the Owner or a Separate Contractor;
- .6 reasonable evidence that the Work will not be completed within the Contract Time, and that the unpaid balance would not be adequate to cover actual or liquidated damages for the anticipated delay; or
- .7 failure to carry out the Work in accordance with the Contract Documents.
- .8 failure to maintain the site in a safe and satisfactory manner in accordance with construction practices as determined by the Owner or Architect;
- .9 any labor strike or labor disruption whatsoever which impacts the progress of the Work;
- .10 failure to maintain Record Drawings.

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

§ 9.5.3 When the reasons for withholding certification are removed, certification will be made for amounts previously withheld. The Owner shall not be deemed in default of the Contract by reason of withholding payment while any of the above grounds remain uncured.

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

§ 9.6 Progress Payments

§ 9.6.1 After the Architect has issued a Certificate for Payment, the Owner shall make payment in the manner and within the time provided in the Contract Documents and shall so notify the Architect. Owner shall comply with the New Jersey Prompt Payment Act when making payments, subject to Section 5.1.10 of the AIA A101.

§ 9.6.2 The Contractor shall pay each Subcontractor, no later than ten (10) calendar days after receipt of payment from the Owner, out of the amount paid to the Contractor on account of such Subcontractor's portion of the Work,

the amount to which said Subcontractor is entitled, reflecting percentages actually retained from payments to the Contractor on account of the Subcontractor's portion of the Work. The Contractor shall, by appropriate agreement with each Subcontractor, require each Subcontractor to make payments to Sub-subcontractors in a similar manner.

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

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

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

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

§ 9.7 Failure of Payment

§ 9.7.1 If, through no fault of the Contractor, 1) the Owner and Architect do not issue a Certificate for Payment within fourteen (14) days after Architect's receipt of the Contractor's Application for Payment, or 2) the Owner does not either (a) notify the Contractor and the Architect of the existence of a Claim or (b) pay the Contractor within seven days after the date established in the Contract Documents the amount certified by the Architect, then the Contractor may, upon fourteen (14) additional days' written notice to the Owner and Architect, stop the Work until payment of the amount owing has been received. The Contract Time shall be extended appropriately, and the Contract Sum shall be increased by the amount of the Contract Documents.

§ 9.7.2 If the Owner is entitled to reimbursement or payment from the Contractor pursuant to the Contract Documents, such payment shall be made promptly upon demand by the Owner. Notwithstanding anything contained in the Contract Documents to the contrary, if the Contractor fails to promptly make any payment due the Owner or if the Owner incurs any costs and expenses to cure any default of the Contractor or to correct defective Work, the Owner shall have an absolute right to offset such amount against the Contract Sum and may, in the Owner's sole discretion, elect either to (i) deduct an amount equal to that which the Owner is entitled from any payment then or thereafter due the Contractor from Owner, or (ii) issue a written notice to the Contractor reducing the Contract Sum by an amount equal to that which the Owner is entitled.

§ 9.8 Substantial Completion

§ 9.8.1 Substantial Completion is the stage in the progress of the Work when the Work or designated portion thereof is sufficiently complete in accordance with the Contract Documents so that the Owner can occupy and utilize the Work for its intended use, provided, however, that as a condition precedent to Substantial Completion, the Contractor shall deliver to the Architect, with a copy to the Owner, all final and unconditional certificates of occupancy and any other permits or approvals necessary for Owner to occupy the entire Project or designated portions thereof.

§9.8.1.1 The issuance of a final, unconditional Certificate of Occupancy issued by the state or local authority having jurisdiction is a prerequisite to Substantial Completion.

§ 9.8.2 Upon receipt of notice from the Contractor that it deems that Substantial Completion has been achieved, the Architect, will conduct a site visit to determine whether the Work or designated portion thereof is substantially

complete. If the Architect's site visit discloses any item, which is not sufficiently complete in accordance with the Contract Documents so that the Owner can occupy or utilize the Work or designated portion thereof for its intended use, the Contractor shall complete or correct such item upon notification by the Architect. In such case, the Contractor shall then submit a request for another site visit by the Architect, to determine Substantial Completion.

§ 9.8.3 Upon acceptance of the Certificate of Substantial Completion of the Work or designated portion thereof and upon application by the Contractor and certification by the Owner and Architect, the Owner shall make payment, reflecting adjustment in retainage, if any, for such Work or portion thereof as provided in the Contract Documents.

§ 9.8.4 The Architect's Certificate of Substantial Completion shall be subject to the Owner's final approval.

§ 9.9 Partial Occupancy or Use

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

§ 9.9.1.1 It shall be mutually understood and agreed that such occupancy does not relieve the Contractor from completing the Work within the time period specified.

§ 9.9.1.2 The occupancy of any portion of the building does not constitute an acceptance of any work as the Project will be accepted as a whole and not in units.

§ 9.9.1.3 Further, such occupancy alone shall not determine when Substantial Completion has been reached.

§ 9.9.1.4 Substantial Completion shall be as defined in Sections 9.8.1 and 9.8.2 of these AIA General Conditions.

§ 9.9.2 Immediately prior to such partial occupancy or use, the Owner, Contractor, and Architect shall jointly inspect the area to be occupied or portion of the Work to be used in order to determine and record the condition of the Work. Prior to such occupancy; however, the Architect, a representative of the Owner, and the Contractor shall fully review the portions of the building to be occupied and Architect shall prepare a complete punch list of omissions of materials, faulty workmanship, or any items to be repaired, torn out or replaced.

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

§ 9.10 Final Completion and Final Payment

§ 9.10.1 Upon completion of the Work, the Contractor shall forward to the Owner and Architect written notice that the Work is ready for a final site visit and acceptance and shall also forward to the Owner and Architect a final Contractor's Application for Payment. Upon receipt, the Architect will promptly make such site visit and, when the Architect, based on the recommendation of the Architect, determines the Work is acceptable under the Contract Documents and the Contract has been fully performed, the Architect will promptly issue a final Certificate for Payment stating that to the best of the Architect's knowledge, information and belief, and on the basis of the Architect's on-site visits and the representations made and documentation provided by the Contractor, the Work has been completed in accordance with terms and conditions of the Contract Documents and that the entire balance found to be due the Contractor and noted in the said final Certificate is due and payable. The Architect's final Certificate for Payment will constitute a further representation that conditions listed in Section 9.10.2 as precedent to the Contractor's being entitled to final payment have been fulfilled. All warranties and guarantees required under or pursuant to the Contract Document shall be assembled and delivered by the Contractor to the Architect as part of the

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final Application for Payment. The final Certificate for Payment will not be issued by the Architect and Owner until all warranties and guarantees have been received and approved by the Architect and Owner.

§ 9.10.2 Neither final payment nor any remaining retained percentage shall become due until the Contractor submits to the Architect (1) an affidavit that payrolls, bills for materials and equipment, and other indebtedness connected with the Work for which the Owner or the Owner's property might be responsible or encumbered (less amounts withheld by Owner) have been paid or otherwise satisfied, (2) a certificate evidencing that insurance required by the Contract Documents to remain in force after final payment is currently in effect and will not be canceled or allowed to expire until at least 30 days' prior written notice has been given to the Owner, (3) a written statement that the Contractor knows of no substantial reason that the insurance will not be renewable to cover the period required by the Contract Documents, (4) consent of surety, if any, to final payment (5), if required by the Owner, other data establishing payment or satisfaction of obligations, such as receipts, releases and waivers of liens from Contractor, Subcontractors, Sub-subcontractors and any other entity or person having Statutory lien rights, claims, security interests or encumbrances arising out of the Contract, to the extent and in such form as may be designated by the Owner, (6) three sets of the final as-built Drawings showing the as-built project and all components thereof, including, but not limited to all utility lines and all other terms required to be disclosed thereon pursuant to Section 3.11.1 above, (7) two sets of operating and maintenance manuals for all equipment installed and such other items required in the Specifications; and (8) two (2) sets of signed and sealed drawings prepared by a civil engineer retained by Contractor licensed in State of New Jersey verifying all utilities and site improvements have been installed in accordance with the Contract Documents. If a Subcontractor refuses to furnish a release or waiver required by the Owner, the Contractor may furnish a bond satisfactory to the Owner to indemnify the Owner against such lien. If such lien remains unsatisfied after payments are made, the Contractor shall refund to the Owner all money that the Owner may be compelled to pay in discharging such lien, including all costs and reasonable attorneys' fees. The Contractor must also supply evidence showing that all Labor Unions are paid in full for wages and benefits.

§ 9.10.2.1 The Contractor shall deliver to the Architect, for delivery to the Owner, before final payment is due on the Contract, all required written guarantees/warranties in form acceptable to the Architect properly sworn to and signed by a responsible officer of the Contractor's firm, warranting all work and materials included in his Contract against all defects not due to ordinary wear and use for a period of two (2) years from the Substantial Completion unless the Contract Documents require a longer date.

§ 9.10.4 Intentionally Deleted.

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

PROTECTION OF PERSONS AND PROPERTY **ARTICLE 10**

§ 10.1 Safety Precautions and Programs

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

§ 10.2 Safety of Persons and Property

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

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

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

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

§ 10.2.3.1 Contractor shall comply with all applicable provisions of governing agencies (State, Federal & Municipal). All machinery, openings, excavations and other physical hazards shall be guarded in accordance with OSHA requirements. In case of conflicts, the most stringent restrictions will apply.

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

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

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

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

§ 10.2.8 Injury or Damage to Person or Property

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

§ 10.2.9 No equipment, other than equipment with rubber tires, will be allowed on any existing or new pavement within the limits of the contract, UNLESS THE PAVEMENT HAS BEEN FIRST PROTECTED WITH PLANKING OR BY OTHER MEANS APPROVED BY THE ARCHITECT.

§ 10.3 Intentionally Deleted.

§ 10.4 Emergencies

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

§ 10.4.1.1 The Contractor and each Subcontractor shall report immediately to the Architect and/or Owner's Representative every accident to persons or damage to property and shall furnish in writing full information, including testimony of witnesses regarding any and all accidents. In addition, the Contractor shall complete the Architect's and/or Owner's accident report form within 24 hours of the accident and submit it to the party designated by the Owner.

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§ 10.4.2 Accidents: The Contractor shall provide such equipment and facilities as are necessary or required, in case of accident, for first-aid service to anyone who may be injured in the progress of the Work and he shall have standing arrangements for the removal and hospital treatment of any employee who may be injured or who may become ill.

ARTICLE 11 INSURANCE AND BONDS § 11.1 GENERAL INSURANCE REQUIREMENTS

§ 11.1.1 The Contractor shall not commence work until the Contractor has obtained at the Contractor's own expense all of the insurance required hereunder and such insurance has been provided to the Owner; nor shall the Contractor allow any subcontractor to commence work on any subcontract until all insurance required of the Subcontractor has been so obtained and approved by the Contractor and the Contractor and Subcontractors shall submit to the Owner of original certificates of insurance signed by authorized representatives of the insurers or, at the Owner's request, certified copies of the required insurance policies.

§ 11.1.2 Insurance as required hereunder shall be in force throughout the term of the Contract and for one (1) year after final acceptance of the Project by Owner in accordance with Section 11.1.12.iv. Original certificates signed by authorized representatives of the insurers or, at the Owner's request, certified copies of insurance policies, evidencing that the required insurance is in effect, shall be maintained with the Owner throughout the term of the Contract and for one (1) year after final acceptance of the Project by Owner.

§ 11.1.3 The Contractor shall require all Subcontractors to maintain during the term of the Contract commercial general liability insurance, business auto liability insurance, and workers' compensation and employer's liability insurance (and umbrella excess or excess liability insurance) to the same extent required of the Contractor in Sections 11.1.12, 11.1.13, 11.1.14 and 11.1.15 unless any such requirement is expressly waived or amended by the Owner in writing. The Contractor shall furnish Subcontractors' certificates of insurance prior to the Subcontractor's commencement of Work at the Property and from time to time upon request, which shall demonstrate that Subcontractors are naming Owner and the other parties required by Section 11.1.19 as additional insured on a primary and non-contributory basis.

§ 11.1.3.1 Furnish, in duplicate, certificates herein called for and specifically set forth evidence of all coverage required by Sections 11.1.12, 11.1.13, 11.1.14, 11.1.15, 11.1.16, 11.1.17 and 11.1.18 and furnish to the Owner copies of any endorsements that are subsequently issued amending coverage or limits.

§ 11.1.4 All insurance policies required hereunder shall be endorsed to provide that the policy is not subject to cancellation, non-renewal or material reduction in coverage until sixty (60) days prior written notice has been given to the Owner.

§ 11.1.5 No acceptance and/or approval of any insurance by the Owner shall be construed as relieving or excusing the Contractor or the Contractor's Surety from any liability or obligation imposed upon either or both of them by the provisions of this contract.

§ 11.1.6 It is recognized that in some instances that insurance may be acceptable which is underwritten by an insurance company that is not reported in the A.M. Best Rating Guide, or the coverage is extended under a self-insured program. This insurance, or self-insurance, must be in conformity with the rules and regulations of the Commissioner of Banking and Insurance of the State of New Jersey. Any insurance or self-insurance of this type is subject to the review and acceptance by the Authority's Risk Manager or the Authority's Counsel. Furthermore written proof of acceptability by the Office of the Commissioner of Banking and Insurance may be necessary.

§ 11.1.7 All required insurance coverages must be underwritten by insurers allowed to do business in the State of New Jersey and acceptable to the Owner. The insurers must also have a policyholders' A.M. Best Company Financial Strength Rating (FSR) of "A" or better, and be Financial Size Category (FSC) of "VII" or higher in accordance with the latest evaluation by A.M. Best Company, unless Owner grants specific approval for an exception.

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§ 11.1.8 Any deductibles or retentions in excess of \$10,000 shall be disclosed by the Contractor, and are subject to Owner's written approval. Any deductible or retention amounts elected by the Contractor or imposed by the Contractor's insurer(s) shall be the sole responsibility of the Contractor.

§ 11.1.9 Any and all return premiums and/or dividends for insurance coverage directly charged to the Owner by the Contractor in connection with this Contract shall belong to and be payable to the Owner.

§ 11.1.10 If the Owner is damaged by the failure or neglect of the Contractor to purchase and maintain insurance as described and required herein, without so notifying the Owner, then the Contractor shall bear all costs properly attributable thereto.

§ 11.1.11 The Contractor shall purchase and maintain the following insurance coverages which will insure against claims which may arise out of or result from the Contractor's operations under the Contract and for which the Contractor may be legally liable, whether such operations be by the Contractor or by a Subcontractor or by anyone directly or indirectly employed by any of them, or by anyone for whose acts any of them may be liable. Insurance shall be written for not less than the limits specified below or required by law, whichever is greater.

§ 11.1.12 Commercial General Liability insurance or its equivalent for bodily injury, personal injury and property damage including loss of use, with minimum limits of:

\$1,000,000 each occurrence;
\$1,000,000 personal and advertising injury;
\$2,000,000 general aggregate per project;
\$2,000,000 products/completed operations aggregate;
\$100,000 damage to rented or leased properties; and
\$5,000 medical expense.

This insurance shall include:

- General aggregate limit applying on a per-project basis;
- Liability arising from premises and operations;
- Liability arising from the actions of independent contractors;

• Liability arising from products and completed operations with such coverage to be maintained for two (2) years after completion of the work;

• Contractual liability including protection for the Contractor from bodily injury and property damage claims arising out of liability assumed under this contract;; and

§ 11.1.13 Business auto liability insurance or its equivalent with a minimum limit of \$1,000,000 per accident and including coverage for all of the following:

i. Liability arising out of the ownership, maintenance or use of any auto whether owned, hired/leased or non-owned;

- ii. Automobile contractual liability; and
- iii. endorsed to include pollution coverage.

§ 11.1.14 Workers' compensation insurance or its equivalent with statutory benefits as required by any State or Federal law, including "other states" coverage; employer's liability insurance with minimum limits of:

- \$1,000,000 each accident for bodily injury by accident;
- \$1,000,000 each employee for bodily injury by disease; and
- \$1,000,000 policy limit for bodily injury by disease.

§ 11.1.15 Umbrella excess liability or excess liability or its equivalent to be purchased by Contractor and Sub-Contractors with minimum limits:

Contractor:

(\$5,000,000) per occurrence: (\$5,000,000) aggregate for other than products/completed operations and auto liability and

(\$5,000,000) products/completed operations aggregate.

Sub-Contractor: (\$2,000,000) per occurrence: (\$2,000,000) aggregate for other than products/completed operations and auto liability and (\$2,000,000) products/completed operations aggregate.

And including all of the following coverages which shall, in each instance, be at least as broad as the underlying coverage, on the applicable schedule of underlying insurance:

- i. Commercial general liability;
- ii. Business auto liability; and
- iii. Employer's liability.

§ 11.1.16 Pollution liability – only applicable to Sub-Contractors (demolition, foundation, grading, excavation and concrete) with minimum limits:

\$1,000,000 per pollution incident: \$3,000,000 annual aggregate



During the life of this contract the Contractor shall procure and maintain Pollution Liability Insurance with limits of liability not less than \$1,000,000 per pollution incident and \$3,000,000 annual aggregate. This insurance shall provide coverage pollution incidents that cause bodily injury, including death; loss or damage to property, including loss of use of damaged property or of property that has not been physically injured; cleanup and monitoring costs; and costs and expenses incurred in the investigation, defense, or settlement of claims. If coverage is on "claims made" basis, Contractor must maintain comparable coverage and limits for a minimum of four (4) years following the expiration date of said contract.

§ 11.1.17 Owners and Contractors Protective Liability Coverage to be purchased by Contractor in the amount of \$5,000,000 per occurrence. This insurance shall provide coverage for bodily injury, including death; loss or damage to property, including loss of use of damaged property or of property that has not been physically damaged; cleanup costs; and costs and expenses incurred in the investigation, defense, or settlement of claims. This coverage shall be maintained in force for the full period of this agreement.

§ 11.1.18 Intentionally deleted.

§ 11.1.19 Cumberland County Improvement Authority, and their elected and appointed officials, officers, consultants, agents, employees and assigns shall be named as additional insureds on the Contractor's commercial general liability insurance and umbrella excess or excess liability insurance policies with respect to liability arising out of the Contractors products, installation, and/or services provided under this Contract. Such coverage shall extend to cover the additional insureds for liability arising out of the following:

- i. Ongoing operations;
- ii. Owner's general supervision and/or services as provided by the Contractor under this Contract; and
- iii. Products and completed operations.

The commercial general liability policy and the umbrella liability or excess liability policies, if required herein, must include additional insured language in i., ii., and iii., as follows:

"This policy is endorsed to include as insureds Owner, and Owner's elected and appointed officials, officers, consultants, agents and employees, but only for liability arising out of 'your product' or 'your work' for the Owner by or for you."

Special note: The policy must include CG2010 ed. 10 01 and CG2037 ed. 10 01. Copy of the endorsement is to be included with all certificates of insurance.

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§ 11.1.20 Insurance or self-insurance provided to the Owner and Owner's elected and appointed officials, officers, consultants, agents and employees under any Contractor's liability insurance or self-insurance required herein, including, but not limited to, umbrella or excess liability policies, shall apply separately to each insured against whom claim is made or suit is brought, except with respect to the limits of insurance or self-insurance. (Any cross suits or cross liability exclusion shall be deleted from Contractor's liability insurance policies required herein.)

§ 11.1.21 Insurance or self-insurance provided to the Owner and Owner's elected and appointed officials, officers, consultants, agents and employees as specified herein shall be primary, and any other insurance, self-insurance, coverage or indemnity available to the Owner and Owner's elected and appointed officials, officers, consultants, agents and employees shall be excess of and non-contributory with insurance or self-insurance provided to the Owner and Owner's elected and employees as specified herein.

§ 11.1.22 [Reserved]

§ 11.1.23 All Certificates of Insurance shall be submitted when required by the Contract Documents, but in no event later than the commencement of Work. The Certificates of Insurance shall be subject to review by the Owner and shall show the Certificate Holder as follows:

Cumberland County Improvement Authority 745 Lebanon Road Millville, New Jersey 08332

Certificates of Insurance not reading as per above will not be acceptable and delay contract approval.

Questions regarding these insurance requirements may be directed to Christina Violetti at Hardenbergh Insurance Group, 856-890-7100.

Certificates showing insurance companies with A.M. Best rate which have been reduced below the minimum required "A:VII" WILL NOT BE ACCEPTED.

It is suggested that any Contractor or subcontractor, before submitting a Certificate of Insurance to Cumberland County Improvement Authority, check with their insurance agent to assure that the Insurance Company shown on their certificate has a proper spread of risk, soundness of reinsurance, quality of assess, adequacy of loss reserves and experience of management which qualifies it to receive the A.M. Best Rate as described in the Cumberland County Improvement Authority Insurance Requirements.

§ 11.2 OWNER'S LIABILITY INSURANCE

§ 11.2.1 The Owner shall be responsible for purchasing and maintaining the Owner's usual liability insurance, or solely at the Owner's option, the Owner may self-insure the Owner's liability exposures.

§ 11.3 Intentionally deleted.

§ 11.4 BUILDER'S RISK INSURANCE (OWNER TO PURCHASE)

§ 11.4.1 The Owner shall purchase and maintain builder's risk insurance on a replacement cost basis with a limit at least equal to the initial Contract Sum. This insurance shall be maintained until final acceptance of the Project by the Owner or until no person or entity other than the Owner has an insurable interest in the covered property, whichever is earlier. This builder's risk insurance shall include the interests of the Owner, Contractor, Subcontractors, and Sub-subcontractors in the Project as set forth in Owner's builders risk policy.

§ 11.4.2 Insurance shall be on an "all-risk" or equivalent policy form and shall insure against the perils of fire, extended coverage, theft, vandalism, malicious mischief, collapse and windstorm. Coverage is to apply for debris removal including demolition occasioned by a covered loss. This insurance shall cover reasonable compensation for Architect's and Contractor's services and expenses required as a result of such covered loss. Coverage for other perils such as flood and earthquake or for loss caused by the enforcement of any applicable ordinance or law shall not be required unless otherwise provided in the Contract.

§ 11.4.3 This builder's risk insurance shall cover all of the following types of property:

- i. All structures to be constructed, under construction, and/or already constructed;
- ii. All materials and supplies which are to be incorporated into the Project; and
- iii. Temporary structures of any nature whatsoever.

§ 11.4.4 The Contractor shall be responsible for payment of any deductibles applicable under this builder's risk insurance, boiler and machinery insurance or other property insurance applicable to this Project.

§ 11.4.5 Unless otherwise provided in the Contract Documents, this builder's risk insurance shall cover materials to be incorporated into the Work and the Project which are off the site, and also such materials in transit.

§ 11.4.6 The Owner and Contractor waive all rights against each other and against the Architect, Owner's representatives, if any, Owner's other Contractors and own forces described in Article (insert), if any, and the Subcontractors, sub-subcontractors, elected and appointed officials, officers, agents, employees and consultants of any of them, for property damage to or loss of use of the Work to the extent that such property damage or loss of use is covered by this builder's risk insurance, boiler and machinery insurance or other property insurance applicable to the Work. The policies shall provide such waivers of subrogation by endorsement or otherwise.

§ 11.4.7 Any loss covered under this builder's risk insurance or other property insurance applicable to the Work shall be payable to the Owner as fiduciary for the insureds, as their interests may appear, subject to any mortgagee clause. The Contractor shall pay Subcontractors their just shares of insurance proceeds received by the Contractors, and by appropriate agreements, written where legally required for validity, shall require Subcontractors to make payment to their Sub-subcontractors in similar manner.

§ 11.4.8 Owner, as fiduciary, shall have the power to adjust and settle a loss with insurers.

§ 11.4.9 The builders risk insurance required by this Section 11.4 is not intended to cover machinery, tools or equipment owned or rented by the Contractor, or its Subcontractors, which are utilized in the performance of the Work but not incorporated into the permanent improvements. The Contractor and its Subcontractors shall, at their own expense, purchase and maintain property insurance coverage for owned, leased, or rented machinery, tools or equipment. The Contractor and its Subcontractors hereby waive all rights against the Owner and its elected and appointed officials, officers, agents, employees and consultants for property damage to or loss of use of such machinery, tools or equipment to the extent that such property damage or loss of use is covered by the Contractor's or Subcontractor's property or equipment floater insurance or other similar property insurance maintained by the Contractor or its Subcontractors. The policies shall provide such waivers of subrogation by endorsement or otherwise.

§ 11.5 PERFORMANCE BOND, PAYMENT BOND and MAINTENANCE BOND REQUIREMENTS

§ 11.5.1 The Contractor shall furnish bonds covering faithful performance of the Contract and payment of obligations arising thereunder. Bonds shall be obtained from a company lawfully authorized to do business in the State of New Jersey and have an A.M. Best and Company rating of "A" or better; and the cost of all of the bonds shall be included in the Contract Sum. The amount of each bond shall be equal to 100 percent of the Contract Sum.

§ 11.5.2 The Contractor shall deliver the required payment and performance bonds to the Owner in accordance with the Contract Documents.

§ 11.5.3 The Contractor shall post a two (2) year Maintenance Bond covering 100 percent of the Contract Sum after acceptance of the Work by Owner and prior to the release of the Payment and Performance Bond.

§ 11.5.4 The Contractor shall require the attorney who executes the required bonds on behalf of the surety to affix thereto a certified and current copy of the Power of Attorney, indicating the monetary limit of such power.

§ 11.5.5 The Contractor shall provide Owner and Architect with the name, address, phone number and other contact information of the local agent of the Company issuing the Project bonds.

§ 11.6 WAIVERS OF SUBROGATION

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The Owner and Contractor waive all rights against (1) each other and any of their subcontractors, subsubcontractors, agents and employees, each of the other, and (2) the Architect, Architect's consultants, separate contractors described in Article 6, if any, and any of their subcontractors, sub-subcontractors, agents and employees, for damages caused by fire or other causes of loss to the extent covered by property insurance obtained pursuant to this Section 11.6 or other property insurance applicable to the Work, except such rights as they have to proceeds of such insurance held by the Owner as fiduciary. The Owner or Contractor, as appropriate, shall require of the Architect, Architect's consultants, separate contractors described in Article 6, if any, and the subcontractors, subsubcontractors, agents and employees of any of them, by appropriate agreements, written where legally required for validity, similar waivers each in favor of other parties enumerated herein. The policies shall provide such waivers of subrogation by endorsement or otherwise. A waiver of subrogation shall be effective as to a person or entity even though that person or entity would otherwise have a duty of indemnification, contractual or otherwise, did not pay the insurance premium directly or indirectly, and whether or not the person or entity had an insurable interest in the property damaged.

§ 11.6.1 A loss insured under the Owner's property insurance shall be adjusted by the Owner as fiduciary and made payable to the Owner as fiduciary for the insureds, as their interests may appear, subject to requirements of any applicable mortgagee clause and of Section 11.6. The Contractor shall pay Subcontractors their just shares of insurance proceeds received by the Contractor, and by appropriate agreements, written where legally required for validity, shall require Subcontractors to make payments to their Sub-subcontractors in similar manner.

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

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

§ 11.6.5 The Contractor shall provide Owner and Architect with the name, address, phone number and other contact information of the local agent of the Company issuing the Project bonds.

ARTICLE 12 UNCOVERING AND CORRECTION OF WORK

§ 12.1 Uncovering of Work

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

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

§ 12.2 Correction of Work

§ 12.2.1 The Contractor shall promptly correct Work rejected by the Architect or failing to conform to the requirements of the Contract Documents, whether observed before or after Substantial Completion and whether or

not fabricated, installed or completed. The Contractor shall bear the costs of correcting such Work, including additional testing and inspections and compensation for the Architect's services and expenses made necessary thereby, and any cost, loss, or damages to the Owner resulting from such failure or defect. Correction of non-conforming or defective work shall include correction of other work damaged as a result of such nonconformance or defect.

§ 12.2.2 In addition to the Contractor's obligations under Section 3.5, if, within two (2) years after the date of Substantial Completion of the Work or designated portion thereof, or after the date for commencement of warranties established under Section 9.9.1, or by terms of an applicable special warranty required by the Contract Documents, any of the Work is found to be not in accordance with the requirements of the Contract Documents, the Contractor at its sole cost and expense, shall correct it promptly after receipt of written notice from the Owner to do so unless the Owner has previously given the Contractor a specific written acceptance of such condition.

§ 12.2.2.1 This period of two (2) years shall be extended with respect to portions of Work first performed after Substantial Completion by the period of time between Substantial Completion and the actual completion of performance of the Work.

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

§ 12.2.4 If the Contractor fails to correct nonconforming Work within a reasonable time, the Owner may correct it in accordance with Section 2.4 hereof. In addition to correcting the nonconforming Work, Owner may also remove the nonconforming Work and store the salvageable materials or equipment at the Contractor's expense. If the Contractor does not pay costs of such removal and storage within ten (10) days after written notice, the Owner may upon ten (10) additional days' written notice sell such materials and equipment at auction or at private sale and shall account for the proceeds thereof, after deducting costs and damages that should have been borne by the Contractor, including compensation for the Architect's services and expenses made necessary thereby. If such proceeds of sale do not cover costs which the Contractor should have borne, the Contract Sum shall be reduced by the deficiency. If payments then or thereafter due the Contractor are not sufficient to cover such amount, the Contractor shall pay the difference to the Owner.

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

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

§ 12.2.7 If, in the opinion of the Architect, the Contractor delays Final Completion of its Work beyond a reasonable time after the Date of Substantial Completion of the Project to such extent that the period between the Date of Substantial Completion of the end of the guarantee period becomes less than eleven months, the start of the guarantee period shall be the date of the final Project Certificate of Payment in lieu of the Date of Substantial Completion of the Project.

§ 12.3 Acceptance Of Nonconforming Work

§ 12.3.1 If the Owner prefers to accept Work which is not in accordance with the requirements of the Contract Documents, the Owner may do so instead of requiring its removal and correction, in which case the Owner will have the right to deduct such sum, or sums, of money from the amount of the Contract Sum as it determines to be appropriate and equitable. Such adjustment shall be affected whether or not final payment has been made.

ARTICLE 13 MISCELLANEOUS PROVISIONS

§ 13.1 Governing Law

The Contract shall be governed by the law of the State of New Jersey.

§ 13.2 Successors and Assigns

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

§ 13.3 Rights and Remedies

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

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

§ 13.3.3 The invalidity of any part or provision of the Contract Documents shall not impair or affect in any manner the validity, enforceability or effect of the remaining parts and provisions of the Contract Documents.

§ 13.4 Tests and Inspections

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

§ 13.4.1.1 When work has been installed contrary to any contract requirement and the Contractor requests the privilege of testing in lieu of removal, such testing shall be at the Contractor's expense.

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

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

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

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

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

§ 13.5 Third Party Testing

§ 13.5.1 Inspections and Tests required to establish compliance with the Contract Documents and specified to be "by Owner", will be made by an independent testing agency selected and paid for by the Owner. Retesting required as a result of first test showing non-compliance with the Contract Documents will be performed by the same agency, with costs paid for by the Contractor. Representatives of the testing agency shall have access to the Work at all times. The Contractor shall provide facilities for such access in order that the agency may properly perform its function.

§ 13.5.2 The independent agency, employed by the Owner, shall prepare the test reports, logs and certificates applicable to the specific inspection and test and promptly deliver the specified number of copies of same to the designated parties. Other required certificates of inspections, testing, or approval shall be secured by the Contractor and delivered by Contractor to the Architect and/or Owner's Representative, in such time as not to delay progress of the Work of final payment thereof.

§ 13.6 Interest

§ 13.6.1 The Contractor shall not be entitled to any payment of interest for any reason, action or inaction by the Architect or the Owner.

§ 13.6.2 Any payments withheld for time delays, faulty materials, or workmanship, or any other reason provided by this Contract, shall not bear interest for period of delay or non-acceptance.

§ 13.8 New Jersey Prevailing Wage Act

§ 13.8.1 This project is subject to the provisions of the New Jersey Prevailing Wage Act and the general prevailing minimum wage for each craft or classification as determined by the Commissioner of the New Jersey Department of Labor and Workforce Development.

§ 13.9 Discrimination Prohibited

§ 13.9.1 In compliance with NJSA 10:2-1 et seq. agrees:

§ 13.9.1.1 In the hiring of persons for the performance of work under this contract by the Contractor or any subcontract hereunder, or for the procurement, manufacture, assembling or furnishing of any such materials, equipment, supplies or services to be acquired under this contract, no contractor, nor any person acting on behalf of such contractor or subcontractor, shall, by reason of race, creed, color, national origin, ancestry, marital status, gender identity or expression, affectional or sexual orientation or sex, discriminate against any person who is qualified and available to perform the work to which the employment relates; b. No contractor, subcontractor, nor any person on his behalf shall, in any manner, discriminate against or intimidate any employee engaged in the performance of work under this contract or any subcontract hereunder, or engaged in the procurement, manufacture, assembling or furnishing of any such materials, equipment, supplies or services to be acquired under such contract, on account of race, creed, color, national origin, ancestry, marital status, gender identity or expression, affectional or sexual orientation or sex; c. There may be deducted from the amount payable to the contractor by the contracting public agency, under this contract, a penalty of \$ 50.00 for each person for each calendar day during which such person is discriminated against or intimidated in violation of the provisions of the contract; and d. This contract may be canceled or terminated by the contracting public agency, and all money due or to become due hereunder may be forfeited, for any violation of this section of the contract occurring after notice to the contractor from the contracting public agency of any prior violation of this section of the contract.

§ 13.9.1.2 That this Contract may be cancelled or terminated by the government agency and all money due, or to become due under the Contract, may be forfeited for a violation of the terms or conditions of that portion of the Contract.

§ 13.10 Intentionally Deleted

ARTICLE 14 TERMINATION OR SUSPENSION OF THE CONTRACT § 14.1 Termination by the Contractor

14.1.1 The Contractor may terminate the Contract if the Work is stopped for a period of 60 consecutive days through no act or fault of the Contractor, a Subcontractor, a Sub-subcontractor, their agents or employees, or any other persons or entities performing portions of the Work, for any of the following reasons:

- 1. Issuance of an order of a court or other public authority for all Work to stop;
- 2. An act of government, such as a declaration of national emergency for all Work to stop.

§ 14.1.2 If one of the above reasons exists, the Contractor may, upon seven additional days' written notice to the Owner and Architect, terminate the Contract and recover from the Owner payment for Work properly executed and for payment of costs directly related to Work thereafter performed by Contractor in terminating the Contract, including reasonable demobilization and cancellation charges, proven loss with respect to materials, equipment, tools, and construction equipment and machinery, including reasonable overhead and profit thereon.

§ 14.1.3 If all of the Work is stopped for a period of 60 days through no act or fault of the Contractor or a Subcontractor or their agents or employees or any other persons performing portions of the Work under contract with the Contractor because the Owner has persistently failed to fulfill the Owner's obligations under the Contract Documents with respect to matters important to the progress of the Work, the Contractor may, upon seven additional days' written notice to the Owner and the Architect, terminate the Contract and recover from the Owner as provided in Section 14.1.2.

§ 14.2 Termination by the Owner for Cause

§ 14.2.1 The Owner may, after providing Contractor with seven (7) days' notice and opportunity to cure (the "Cure Period"), terminate the Contract upon seven (7) days additional notice, if the Contractor:

- .1 refuses or fails to supply enough properly skilled workers or proper materials;
- .2 fails to make payment to Subcontractors for materials or labor in accordance with the respective agreements between the Contractor and the Subcontractors;
- .3 disregards laws, ordinances, or rules, regulations, or orders of a public authority having jurisdiction;
- .4 otherwise is guilty of breach of a provision of the Contract Documents;
- .5 is adjudged bankrupt or insolvent, subject to the provision of the Bankruptcy Laws and specifically 11 U.S.C., Paragraph 365;
- .6 makes a general assignment for the benefit of creditors;
- .7 has a trustee or receiver appointed for Contractor or for any of Contractor's property;
- .8 files a petition to take advantage of any debtor's act, or to reorganize under the bankruptcy or similar laws;
- .9 disregards the authority of the Owner or Architect; or.
- .10 is debarred from performing public work in New Jersey or any other jurisdiction or is otherwise guilty of a breach of a provision of the New Jersey's Local Public Contracts Law and all other laws or regulations applicable to construction of public projects;
- .11 abandons the Work;
- .12 fails or refuses to perform a material obligation under the Agreement;
- .13 fails without cause to make prompt payment duly owing to a Subcontractor, provided that Owner is current on all of its payment obligations owing to Contractor;
- .14 fails to remove any lien or claim of lien filed against the Project by any of its Subcontractors, material suppliers, or any Sub-subcontractor provided that Owner has paid the Contractor for the amount sought in such lien by the Subcontractor or material supplier and that Owner is current on all of its payment obligations owing to Contractor; or
- .15 fails to achieve Final Completion within thirty (30) days of the date of Final Completion.

Contractor shall have the right to cure to the defaults within the Cure Period. If Contractor cures the default within the Cure Period, then Owner may not terminate the Agreement.

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

- .1 Take possession of the site and materials, equipment, tools, and construction equipment and machinery thereon owned by the Contractor;
- .2 Accept assignment of subcontracts pursuant to Section 5.4; and
- .3 Finish the Work by whatever reasonable method the Owner may deem expedient.

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

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

§ 14.3 Suspension by the Owner for Convenience

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

§ 14.3.2 An adjustment shall be made for any increases in the cost of performance of the Work under the Agreement, including profit through the date of suspension on the increased cost of performance on the remaining Work, caused by suspension, delay or interruption. No adjustment shall be made to the extent

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

§ 14.3.3 Adjustments made in the cost of performance may have a mutually agreed fixed or percentage fee.

§ 14.4 Termination By The Owner For Convenience

§ 14.4.1 The Owner may, at any time, terminate the Contract for the Owner's convenience and without cause. At any time, the Owner may free itself from all obligations hereunder and terminate such contract by satisfying the following conditions:

- .1 Give written notice of cancellation to Contractor;
- .2 Reimburse Contractor for all labor and engineering costs that it has incurred in connection with the Work prior to its receipt of written notice of cancellation by Owner;
- .3 Reimburse Contractor for the cost of all material and equipment that was purchased specifically for the Work; provided, if certain of said material and equipment is of such nature that Contractor can readily and promptly use it in fabrication of other material and equipment and/or other Work not covered by the Contract, then Contractor shall not be reimbursed by Owner for the cost of said reusable equipment;
- .4 Reimburse Contractor for all reasonable cancellation charges paid by it on account of commitments made specifically for materials and equipment in connection with the Work; and
- .5 Pay to Contractor a percentage on all costs reimbursable to Contractor under Subsections .2, .3, and .4 above to cover overhead and profit (but not, as set forth in 14.4.3, for overhead and profit on uncompleted Work not otherwise covered by .2, .3, and .4 herein); however, in no event shall the total amount of a payment or payments made in accordance with Paragraphs 2, 3, 4, and 5 of this Section 14.4 exceed the Contract Sum.

ARTICLE 15 CLAIMS AND DISPUTES

§ 15.1 Claims

§ 15.1.1 Definition

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

§ 15.1.2 Time Limits on Claims

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

§ 15.1.3 Notice of Claims

§ 15.1.3.1 Claims by either the Owner or Contractor, where the condition giving rise to the Claim is first discovered prior to expiration of the period for correction of the Work set forth in Section 12.2.2, shall be initiated by notice to the other party and to the Initial Decision Maker with a copy sent to the Architect, if the Architect is not serving as the Initial Decision Maker. Claims by either party under this Section 15.1.3.1 shall be initiated within 7 days after occurrence of the event giving rise to such Claim or within 2 days after the claimant first recognizes the condition giving rise to the Claim, whichever is later.

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

§ 15.1.4 Continuing Contract Performance

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

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

§ 15.1.5 Claims for Additional Cost

§ 15.1.5.1 If the Contractor wishes to make a Claim for an increase in the Contract Sum, written notice as provided herein shall be given before proceeding to executing Work for which the Claim relates. If the Contractor believes additional cost is involved for reasons including but not limited to (1) a written interpretation from the Architect, (2) an order by the Owner to stop the Work where the Contractor was not at fault, (3) a written order for a minor change in the Work issued by the Architect, (4) failure of payment by the Owner, (5) termination of the Contract by the Owner, (6) Owner's suspension or (7) any other reasonable grounds, Claim shall be filed in accordance with the procedure established herein. Failure to file a Claim in accordance with this Section shall constitute a waiver thereof.

§ 15.1.5.2 Prior notice is not required for Claims relating to an emergency endangering life or property arising under Section 10.4.

§ 15.1.5.3 The required notice shall include, to the extent then known by the Contractor, full details and substantiating data to permit evaluation by the Owner and the Architect. If further, or other, information subsequently becomes known to the Contractor, it shall promptly be furnished to the Owner and the Architect in writing.

§ 15.1.5.4 In determining the validity of costs for additional work, the Architect will be guided by such standard referenced as "Means cost data", current construction costs, or any other standard construction industry references, all as issued for the year during which work was performed." The maximum allowance for overhead and profit on change order work shall be as scheduled under Section 7.3.10.

§ 15.1.6 Claims for Additional Time

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

§ 15.1.6.2 If adverse weather conditions are the basis for a Claim for additional time, such Claim shall be governed by Section 8.3.4 and is demonstrated to have caused an adverse effect on the scheduled construction.

§ 15.1.6.3 The required notice shall include, to the extent then known by the Contractor, full details and substantiating data to permit evaluation by the Owner and the Architect. If further, or other, information subsequently becomes known to the Contractor, it shall promptly be furnished to the Owner and the Architect in writing.

§ 15.1.7 Waiver of Claims for Consequential Damages

The Contractor waives Claims against Owner for consequential damages arising out of or relating to this Contract. This waiver includes:

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

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

§ 15.1.7.1 Injury or Damage to Person or Property. If either party to the Contract for Construction suffers injury or damage to person or property because of an act or omission of the other party, of any of the other party's employees or agents, or of others for whose acts such party is legally liable, written notice of such injury or damage, whether or not insured, shall be given to the Architect and the other party within a reasonable time not exceeding 7 days after first observance. The notice shall provide sufficient detail to enable the other party to investigate the matter. If a Claim for additional cost or time related to this Claim is to be asserted, it shall be filed as provided in Sections 15.1.4 or 15.1.5.

§ 15.2 Initial Decision

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

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

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

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

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

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

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

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

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

§ 15.3 Mediation

§15.3.1 Pursuant to N.J.S.A. 40A-11-50, all claims, disputes and other matters in question between the Contractor and the Owner arising out of, or relating to, the Contract Documents or the breach thereof, except with respect to the Architect's decisions on matters relating to artistic effect, and except for claims which have been waived by the making or acceptance of final payment as provided by Sections 9.10.1 through 9.10.4, inclusive, shall to the extent required by the Prompt Payment Act, be submitted to non-binding mediation in accordance with the Construction Industry Mediation Rules of the American Arbitration Association currently in effect.

§15.3.1.1 Notwithstanding industry rules or any provision of law to the contrary, whenever a dispute concerns more than one contract, such as when a dispute in a contract involving construction relates to a contract involving design, architecture, engineering or management, upon the demand of a contracting party, other interested parties to the dispute shall be joined unless the arbitrator, mediator or other person appointed to resolve the dispute determines that such joinder is inappropriate. Notwithstanding industry rules or any provision of law to the contrary, whenever more than one dispute of a similar nature arises under a construction contract, or related construction contracts, upon the demand of a contracting party, the dispute shall be joined unless the arbitrator, mediator or other person appointed to resolve the dispute determines that the disputes are inappropriate for joinder.

§ 15.3.1.2 In the event a claim or dispute or other matter in question between the Contractor and the Owner cannot be resolved by non-binding mediation, the matter shall be decided in a court of competent jurisdiction.

§ 15.3.1.3 No litigation arising out of or relating to the Contract Documents shall include, by consolidation, joinder or in any other manner, the Architect, its employees or consultants except by written consent of containing a specific reference to the Owner-Contractor Agreement and signed by the Architect, the Owner, the Contractor and any other person sought to be joined. No litigation shall include by consolidation, joinder or in any other manner, parties other than the Owner, the Contractor and any other persons substantially involved in a common question of fact or law, whose presence is required if complete relief is to be accorded in the litigation. No person other than the Owner or Contractor shall be included as an original third party or additional third party to a litigation whose interest or responsibility is insubstantial. Any consent to litigation involving an additional person not named or described therein. The foregoing agreement to litigate and any other agreement to litigate with an additional person or persons duly consented to by the parties to the Owner-Contractor Agreement shall be specifically enforceable under prevailing law.

§ 15.3.2 Notice of litigation shall be filed in writing with the other party to the Agreement and with the court having competent jurisdiction, and a copy shall be filed with the Architect and the Owner. The litigation shall be made

within the time limits specified in this Agreement, where applicable, and in all other cases within a reasonable time after the claim, dispute and other matter in question has arisen, and in no event shall it be made after the date when institution of legal or equitable proceedings based on such claim, dispute or other matter in question would be barred by the applicable statute of limitations.

§ 15.3.3 Unless otherwise agreed in writing, the Contractor shall carry on the Work and maintain its progress during any proceedings, and the Owner shall continue to make payments to the Contractor in accordance with the Contract Documents.

ARTICLE 16 MECHANICS LIENS

§ 16.1 Contractor shall promptly pay for all materials furnished, labor supplied or performed by others, rental for equipment employed, and services rendered by public utilities in or in connection with the prosecution of the work, whether or not the said material, labor, equipment and services entered into and become component parts of the work or improvement contemplated. This provision is intended to assure payment of every person, co-partnership, association or corporation who, as subcontractor or otherwise has furnished material, supplied or performed labor, rented equipment or supplied services in connection with the prosecution of the work as aforesaid, and shall preclude the filing by any such person, co-partnership, association or corporation of any mechanic's lien claim against Owner for such material, labor or rental of equipment.

§ 16.2 The Contractor, for any and all subcontractors and parties acting through or under them or any of them, covenants and agrees by and with the Owner that no mechanic's liens or claims shall be filed or maintained by the said Contractor or any subcontractors or other party acting through or under it, them or any of them against the aforesaid building and/or the lot of ground or cartilage appurtenant thereto, or against the interests of the Owner on account of any work done or materials furnished by them or any of them, whether prior to the execution of this Contract, under the aforesaid contract or under any supplemental contract thereto for extra or additional work or otherwise for, toward, in or about the work on the lot of ground herein described above, or any work or material therefore, and the said Contractor for itself and its subcontractors and all persons acting for or under it, them or any of them hereby expressly waives and relinquishes the right to have, file of maintain any mechanic's claim or lien against the said building and/or the lot of ground herein described above or cartilage appurtenant thereto; to the interest of the Owner, it being the intent of the parties hereto that Contractor shall only possess those rights and remedies against Owner which are created by the terms and provision of this Agreement and are based upon the contractual relationship between Owner and Contractor as defined and limited by this Agreement and any changes or modifications thereto.

§ 16.3 Contractor further agrees that if, notwithstanding Owner's payment of all amounts not in dispute, the foregoing, any suit, lien or claim occasioned by the Contractor's performance of this Contract, whether directly or indirectly, or is filed by the Contractor, its Subcontractor, sub-subcontractors, materialmen or suppliers in any court having jurisdiction of the premises and the same matures into a lien against the property, Contractor shall immediately cause such lien to be discharged as to such property by posting bond or by such other means as may be provided under the applicable statues and rules of court or shall otherwise indemnify, defend and save Owner harmless on account of any such claims, liens or suits.

ARTICLE 17 INTERPRETATIONS IN WRITING

§ 17.1 Neither the price bid for the Work of any Contract nor the Contract Sum, shall be based in any manner upon oral opinions or real or alleged instructions of an oral nature, regardless of whether such opinions or instructions are expressed by the Owner, the Architect, the Contractor, or agents or representatives of any of them.

§ 17.2 These provisions do not intend to deny normal discussion, recommendations, explanations, suggestions, approvals, rejections, and similar activity in pursuit of the Work of the Project on an oral basis, such as at job conferences and otherwise at the site. In such instances the written reports, correspondences, shop drawing records, written Field Directives and other written data shall govern over personal claims regarding statements made contrary to the written data.

§ 17.3 Interpretations of Contract Documents, to be effective for claim purposes or for justification as to proper procedure in performing the Work, must be obtained in writing before such claim is made or such work begun.

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NJ STATE POLICE BARRACKS BUILDING COMMERCIAL TOWNSHIP, NJ Project Schedule/Milestones/Timelines

January 16, 2024

ITEM	DATE
Bid Documents Available	Tuesday, January 16, 2024
Pre-Bid Meeting & Site Visit	2:00pm, Wednesday, January 24, 2024
Deadline for Questions #1	1:00pm, Wednesday, January 31, 2024
Addendum #1 (if required)	Friday, February 2, 2024
Deadline for Questions #2	1:00pm, Wednesday, February 14, 2024
Addendum #2 – Final (if required)	Friday, February 16, 2024
Bids Due	1:00pm, Tuesday, March 12, 2024
Attorney Review	Wednesday, March 13, 2024
Recommendation	Wednesday, March 20, 2024
Award – CCIA Board Meeting	Wednesday, March 27, 2024
Notice of Award	Tuesday, April 2, 2024
Contractor Deadline to Execute Contract and Submit Req'd Docs	Tuesday, April 9, 2024
Owner Deadline to Execute Contract	Tuesday, April 16, 2024
Pre-Construction Conference	Wednesday, April 17, 2024
Deadline to Issue Notice to Proceed (Unless Mutually Agreed)	Wednesday, April 24, 2024
Mobilization (Pre-Construction Activities)	On or before Wednesday, April 24, 2024
Construction Activities Start (On Site)	Wednesday, May 1, 2024
Substantial Completion	Thursday, May 1, 2025
1-Year Warranty Period Ends	Friday, May 1, 2026
2-Year Warranty Period Ends	Saturday, May 1, 2027

Construction period is 365 days (12 months)

Labor Rate Breakdown

	The following Labor Rates sh and as a basis for any additic taxes. Overhead and profit s	e following Labor Rates shall be used to adjust the actual value the Subcontract d as a basis for any additional work. These Labor Rates shall include, insurance and xes. Overhead and profit shall be added as outlined in the project documents.				
	A SEPARATE RATE BREAKDOWN MUST BE COMPLETED FOR EACH TRADE CLASSIFICATION AND ANNIVERSARY DATE. UPDATED LABOR RATE SHEET MUST BE SUBMITTED 30 DAYS PRIOR TO ANY NEW ANNIVERSARY DATE FOR ALL TRADES AND CLASSIFICATIONS. CONTRACTOR					
	PROJECT NAME					
	TRADE CLASSIFICATION					
	LOCAL LINION # (If applicable)					
				Double		
Base rate		Straight time	Time and or	e half time		
taxable benefits	Vacation fund					
Total tavable	Holiday/paid vacation					
Other benefits						
Name& amount						
	Welfare Fund					
	Pension Fund					
	Annuity Fund					
				· · · · · · · · · · · · · · · · · · ·		
				· · · · · · · · · · · · · · · · · · ·		
Total other bene	fits					
Total wages & b	enefits					
package						
				· · · · · · · · · · · · · · · · · · ·		
Taxes	FICA					
Name& amount	Medicare					
	FUTA					
	SUTA					
	SUI/SDI					
Ingurance						
msurance	General Liability					
	Endbilly					
				·		
	Workers Comp					
	_					
Total rate per ho	our					



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GENERAL PROJECT REQUIREMENTS - BUILDING

Notwithstanding anything to the contrary and as may be additionally described in the Contract Documents the following "General Requirements" shall be a minimum requirement for this Contract for Construction. These "General Requirements" are intended to outline requirements not noted elsewhere in the Contract Documents and to supplement and clarify requirements already noted elsewhere in the Contract Documents. Where there is discrepancy between the requirements listed herein and other Documents comprising the Contract for Construction the more stringent requirements shall apply.

JOB SITE CONDITIONS:

Prior to ordering material or undertaking any work, the Contractor shall verify all measurements & elevations at the site. No extra compensation will be allowed because of the difference between actual measurements of existing conditions and dimensions shown, but such a difference shall be referred to the Architect/Engineer for consideration before proceeding with the work.

The Contractor, as part of his responsibilities, shall take every reasonable precaution to protect the work and to avoid delay from issues arising from weather related events.

Protect all materials for ongoing and completed work from rain, snow, ice, and cold or hot weather conditions. Cover soil stockpiles with plastic sheeting. Use insulated blankets or other means when necessary to protect the work or to maintain progress of the work. Cover staged materials, and raise off the ground as appropriate, or store in appropriate storage units. The Contractor shall be responsible to remove rain, snow, ice or other weather-related impacts from the work area to avoid delay and continue progress of the work. All work must be protected from water infiltration by covering or diversion in the case of site excavation and grading work. Trenches and other excavated areas shall be protected by temporary grading or other means of diversion, or removal, to avoid filling the open work areas with rainwater or water from any other source. The Contractor is responsible to remove water, snow, ice and other weather-related issues promptly and by whatever means to allow continued progress of the work. Water trucks or other means will be utilized, at no additional cost, to control the dust as an ongoing project requirement until permanent cover is in place and no further dust is generated. *(if due to the Contractor's lack of adequate precautions, neighboring properties are damaged, as result of dust, dirt, or other site-related contaminant, then the Contractor shall be responsible to correct such damage at no additional cost)*

AS BUILT DRAWINGS SITE WORK:

The Contractor shall engage the services of a professional surveyor to record the as built locations, including but not limited to all, structures, pipes, conduits, junction boxes, rim heights, pipe inverts, etc. Document physical location, distance, and depth of all buried items for future reference from an easily identifiable benchmark. Confirm grade and location of parking areas included in this scope. Confirm as built condition of grades, basins and other work on site conforming to the contract documents. The electronic version of final as-built drawings are to be turned over to the owner in CAD and PDF formats.



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STABILIZATION:

Project site shall be protected per the Soil Erosion Control plan and maintained to meet the standards set by the Soil Conservation District. The Soil and Erosion control permit will be obtained by the owner's agent. All control measures shall be maintained until the work of this scope is completed and accepted. Controls shall remain in place for the duration of the construction project including the building phase. The site shall be stabilized as needed throughout the course of the work and shall be fully stabilized to prevent erosion at the completion and turnover of the site to the Phase II contractor. Prior to turnover the erosion controls shall be reviewed and accepted by the owner and the entire site or completed portion thereof will be turned over to the Phase II contractor no sooner than 90 days after the work of this contract has commenced.

SEEDING, SOD, AND PLANTING MAINTENANCE:

Prior to final acceptance the contractor shall be required to establish 95% ground coverage and shall provide a minimum of six mowing's of all grass areas whether seeded or Sod. All planted areas shall be regularly watered and maintained by the contractor until permanently established, a minimum of 95% ground coverage has been established and is healthy and growing as intended for the particular species. Watering and mowing may take place by the contractor after the construction is completed and owner has occupied the property. No additional compensation will be approved related to fulfillment of these requirements.

EMERGENCY CONTACT INFORMATION:

The Contractor shall provide a list of phone numbers where the job superintendent and two responsible members of the organization can be reached in an emergency by the Owner or the Architect. These contact numbers shall include 24-hour, 7 days per week contacts for use in an emergency. If Contractor does not respond to an emergency, the Owner reserves the right to respond and charge the Contractor for any costs incurred to resolve emergency issue in the absence of the Contractor's response. The Owner shall be provided with keys for all gate locks.

PERMITS, LICENSES, AND CERTIFICATIONS:

The contractors shall apply for and procure all applicable permits and licenses and give all notices necessary for the commencement of their work. It shall be the Owner's responsibility to reimburse the Contractor for a local "building" permit. All other permits and contractor registration fees and licenses shall be obtained and paid for by the contractors. The contractors are responsible for contacting the designated Municipal local jurisdiction, authorities, and inspectors to determine all permits, licenses, applications, etc. which are required as part of this project.

CONSTRUCTION SCHEDULE:

The General Contractor will be responsible for producing and distributing a comprehensive Project Schedule, within 2 (two) weeks after the Award of the Project, and before any work is to commence on the site, to the Owner and the Architect.



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A final schedule, incorporating all appropriate feedback, shall be distributed no later than 4 (four weeks) after the Award of the Project. Contractor shall prepare a Construction Schedule using the "Critical Path Method" that indicates all construction activities and related activities in the sequence required for construction and designed to result in an "on time completion". Schedule showing the project being completed in the time allotted shall be updated and distributed to the Owner on a no less than Monthly basis. Owner and Architect reserve the right to ask for an update at any time if progress appears to be slipping and to require a recovery schedule if the project completion date comes into question by the Owner.

The following is minimally required:

- Mobilizations for major Subcontractors and GC
- Permit acquisition and other administrative activities critical to the progress of the work.
- The start and completion of all major work activities broken down to the level of detail in the specification sections minimally and further as required to effectively monitor the progress of the work.
- Critical procurement items and deliveries
- A full submittal schedule integrated with the Construction schedule accounting for lead times and Professional review time
- Major Utility tie ins and/or disruptions
- Major Project Milestones for deliveries and completions
- Punchlist
- Inspections/Final Inspections
- Other items as outlined in A201 article 9.2

CLEAN UP:

Clean up shall be performed on a daily basis on the job site overall, including removing project trash blown out onto the local roadways. The truck tire cleaner shall be maintained, and dirt or mud must be removed from the road the same day it is deposited. The public roadways and entrance to the project shall be kept clean by power sweeping or other means. Contractor shall clean and sweep the road at the owner's direction when in the Owner's view the road has accumulated debris from the project and is in an unacceptable condition. Materials shall be stacked neatly and disposed of promptly when no longer needed for the work.

Refer to A 201 Article 3

THIRD PARTY TESTING:

Notwithstanding anything to the contrary and as may be additionally described in the Contract Documents the Owner will provide "Third Party Testing" including but not limited to the following:

- Asphalt: Thickness, smoothness, and density.
- Soils: Density testing for Subgrade and backfill.
- Concrete: For items field-installed, the Owner's Inspection and Testing Service shall evaluate


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concrete

- forms and concrete reinforcing and shall take concrete cylinders and perform and evaluate breaks.
- Precast: Welds and connections, random shop visits.
- Masonry: Mortar, reinforcing and Grout cubes and field mix proportions (if needed).
- Structural steel: Welds and connections.
- Spray fireproofing: Thickness and bond.
- Resistivity testing: Static on Control floors.
- Earthwork:
- Refer to A201 Article 13

When testing is required, and after the required 72-hour notice, the Owner will facilitate the initial Inspection visit. Subsequent scheduling for all inspections shall be the Contractor's responsibility. The Contractor shall be responsible for making the worksite and all applicable items of construction available for the work of the Testing Service, and to coordinate his activities to minimize the time required by the Testing Service on site.

The Contractor will bear no cost resulting from the first three mis-schedules due to Contractor cancelation or other field or Contractor related issues. Future mis-schedules shall be paid at the expense of the Contractor at the Owner's discretion and at the actual cost charged by the Testing Service. The Contractor shall copy the Owner with all communications with the Testing Service and shall provide timely written confirmation of all verbal communications. The Owner shall be so notified so that they can arrange to be present at any, or all tests and inspections.

Reports by the Testing Service shall be sent directly to the Owner, with electronic copy to the Contractor, to assure timely distribution of required information.

SAFETY:

The General Contractor is the "Controlling Contractor" on the Project.

The General Contractor shall be responsible for Safety on the project and shall follow the standard requirements outlined in OSHA 1926, subpart R. A jobsite specific Safety Plan must be submitted to the Owner's Construction Manager prior to Mobilizing to the project site. This will be considered to be for record purposes. The Owner's Construction Manager has the right to stop the work at any time if in the Construction Manager's view people or property are in harm's way, This in no way shifts responsibility for Safety to the Construction Manager and the General Contractor remains fully responsible for Safety and is responsible to make any corrections in means or methods required to ensure the safety of the workers and protect the project and or property surrounding the project site. Refer to A 201 Article 10

CRANE AND LIFT PLANS:

Crane picks of every kind will require a "Lift Plan". Lift plans shall show position of crane, loads imposed, crane size and boom height and radius and other relevant information. Crane lift plans shall be reviewed by the General Contractor and in cases where the loads imposed exceed the established bearing capacity of the subgrade additional review will be provided by the Soils and/or Structural Engineer, in no case will



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cranes be permitted to pick or install materials without having a reviewed and approved Crane Lift plan. In the event of a critical lift (lift exceeding 75% of crane capacity or requiring more than one crane) a Critical Lift meeting must be held, and the Owner's Construction Manager shall be invited to said meeting. In the event of crane boom height exceeding the FAA height requirements, Contractor shall be responsible for filing and permitting when necessary, including all associated costs. The contractor is responsible for notifying interested parties, such as local Airports, of the Mobilization and duration of cranes working on the project site.

SCHEDULE OF VALUES/BILLING INSTRUCTIONS/LABOR RATE SHEETS:

Bonds, Insurance, and items similar in nature shall be listed separately and billed at the actual cost. Backup such as invoices, or other verification, may be requested by the owner from time to time, for these and other items. Such backup shall not be unreasonably withheld. Schedule of Values must be submitted on AIA G702/G703, or identical similar form.

SCHEDULE OF VALUES:

Notwithstanding anything to the contrary and as may be additionally described in the Contract Documents;

- The Schedule of Values shall be provided by the Contractor in the same format as billing will be made, and on either an AIA G702/703, or a replica of these forms.
- The Schedule of Values shall be broken down by trade and specification section in sufficient detail to
- quickly evaluate and confirm that the billing actually represents the work in place.
- Additionally, Bonds, Insurance and like items shall be listed separately on the Schedule of Values and at
- the actual cost.
- Breakdowns shall show Labor and Material separately. Failure to provide said breakdown will necessitate all materials to be installed as part of the work prior to billing for any part of the work.
- Breakdowns shall be by area to allow for a timely evaluation of the work in place and so as to not delay
- the review and payment process.
- The Owner reserves the right to require additional or more detailed breakdowns on the Schedule of Values when it is deemed to be in the interest of project and/or to assist in the evaluation of the request for payment.
- General Conditions and like items shall be divided by the length of the project in months and billed in equal increments.

LABOR RATE BREAKDOWN SHEETS:

Labor rate breakdown sheets shall be submitted for each trade and each classification under the various trades. Labor rate sheets are for the purposes of verifying labor rates for additional work requests and are not intended to increase the base contract related to scheduled CBA increases or any other purpose. Annual CBA increases shall be submitted on a separate Labor Breakdown sheet and shall reflect the



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published increase in rate and benefits only and no other increases in the overall rate will be accepted. Labor breakdown sheets shall be submitted with the executed contract, but, no later than such time as the Schedule of Values for the project is submitted. Schedule of Values will not be approved prior to receiving all rate sheets for trades being utilized or expected to be utilized by the contractor. Approved labor rate sheets are to be submitted with all change order requests along with all other backup as described in "Change Orders" below.

STORED MATERIALS:

In order to be reimbursed for Stored Materials, the required documentation shall include at a minimum the following:

- Bill of Sale totaling the amount of the stored material payment request. Invoice shall name the Owner and others to be determined throughout the course of the project.
- Pictures of the Materials showing labels indicating the material is designated for the Project.
- Inventory list of the materials and value whenever possible.
- Materials stored off-site must be housed in a bonded warehouse or other similar facility. Submit verification showing the warehouse to be bonded, and Insurance Certificate for the stored materials, naming the Owner, and others to be named, as additionally insured and as indicated in the contract documents.
- Access to the storage facility shall be afforded to the Owner's inspector upon 48-hour prior notice.

CHANGE ORDERS:

The following information shall be provided as backup for all Change Order Requests, Failure to provide complete information as described below shall be cause for rejection.

Provide the following, including but not limited to:

- A clear description of the Change and reason for the Change Order Request
- A cost estimate spreadsheet broken down as follows to show:
- Labor, material, and equipment costs for all Contractors and Subcontractors
- Labor rate sheets, showing actual rate paid including fringe benefit costs for the total Labor rate
- Material costs, provide actual invoices or estimates to verify all material costs
- Equipment costs for hours worked including delivery, provide actual rental receipts or Bluebook rates for Contractor owned equipment
- Add Bond and Insurance costs at actual cost or percentages used in the original bid
- Any other actual costs and explanation of costs
- Allowable profit of 10% for work performed by Contractors own forces
- Allowable profit of 5% on work performed by a Subcontractor
- Total requested amount to be added or Deleted from the Contract
- Explanation and reasoning for anticipated schedule impact if any.
- Refer to A201 Article 7.2



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ALLOWANCES:

This section clarifies A201 3.8.2.1, the Allowance shall be added to the base contract with no additional overhead or profit related to the Allowance included in the base contract. The Allowance shall be reduced by the value of the additional approved work including overhead and profit at a maximum 15% combined when the GC and one or more Subcontractors are involved in the work, per the AIA 201, Article 7, paragraph 7.3.10 items 1 thru 5 when such work is requested and approved. The Allowance shall stand alone as a complete funding source for additional approved work including overhead and profit. Any portion of the Allowance remaining at the conclusion of the work shall be returned to the owner in its entirety with no additional overhead and profit due to the Contractor as a result of returned allowance funds.

PUNCHLIST:

The Contractor shall prepare a Punchlist listing incomplete and/or non-conforming work, copy to be provided to the Architect and Owner. Upon receipt of the Contractors completed "Punchlist" the Architect and Owner will schedule the Architect's Punchlist walkthrough and once the "Punchlist" is formulated the Architect will distribute the "Punchlist" to the Contractor in order for the Contractor to address the Punchlist items. Time is of the essence and the "Punchlist" must be completed as promptly as possible, a mutually agreeable timeframe shall be established. Upon completion of the work by the Contractor and sign off by the Contractor verifying the work is complete, and a written request from the Contractor, the Architect and Owner will perform a walkthrough review of the "Punchlist" items to verify that the work is complete The Architect and Owner will review the "Punchlist" items for completeness, and will do so up to a total of two times, after which time the Contractor shall pay for the Architect and Owner's time to review the "Punchlist" items for completeness.

PROJECT MANAGEMENT SOFTWARE:

Procore will be the project management software utilized for the project. Contractors are required to participate in the use of Procore (www.procore.com) to submit, track, distribute and collaborate on project documentation and action items. The cost for this service will be paid by the Owner.

(End of General Project Requirements)

EXHIBIT F

1 GENERAL INSURANCE REQUIREMENTS (Required on all Bids)

- 1.1 The Contractor(s) shall provide and pay for insurance coverage of such type and in such amounts as will completely protect the Contractor and the County, its elected officials, officers, agents, servants, employees and assigns against any and all risks of loss (including costs of defense) or liability arising out of this contract.
- 1.2 The insurance should be furnished by insurance companies with and "A (Excellent) VII" or better or better rating as published in the most recent editions of Best Insurance Key Rating and shall be authorized to conduct business in the State of New Jersey.
- 1.3 It is recognized that in some instances that insurance may be acceptable which is underwritten by an insurance company that is not reported in the BEST GUIDE, or the coverage is extended under a self-insured program. This insurance, or self-insurance, must be in conformity with the rules and regulations of the Commissioner of Insurance of the State of New Jersey. Any insurance or self-insurance of this type is subject to the review and acceptance by the County Risk Manager or the County Counsel. Furthermore, written proof of acceptability by the Office of the Commissioner of Insurance may be necessary.
- 1.4 The Contractor(s) shall furnish the Improvement Authority with Certificates of Insurance, as shown under "B" Specific Coverage Requirements, policies for General Liability must be endorsed to include the County of Cumberland, its elected officials, officers, agents, servants, employees, and assigns, as an Additional Insured, a copy of ISO Endorsements CG 20 10 is required along with the certificate. The Certificates of Insurance shall set out the types of coverage, the limits of liability and describe the operation by reference to this contract. All of the Contractor's deductibles or retentions shall be the sole responsibility of the contractor, those in excess of \$10,000 are to be disclosed and are subject to approval by the County. If requested actual policy copies or incurred loss information may be required.
- 1.5 The policies and specified limits of coverage must be effective prior to the commencement of work and must remain in force until final acceptance of the work under the contract. Contracts that involve construction, installation, or maintenance repair must maintain completed operations insurance, endorsing the County as an additional insured for a term of two (2) years beginning on the date of the final acceptance. They also must include a copy of ISO Endorsement CG 20 37, or its equivalent.
- 1.6 The Contractor(s) shall obtain, and furnish to the County, certificates of insurance from their subcontractor(s) or sub subcontractor(s) showing policies in force with coverage and limits as described under these insurance requirements.
- 1.7 The Certificate of Insurance with a COPY OF THE ADDITIONAL INSURED ENDORSEMENTS, are to be signed by a person authorized by the insuring company(s) to bind coverage on its behalf. Neither approval by the County nor failure to disapprove Certificates of Insurance/ furnished by the Contractor shall release the Contractor from full responsibility for all liability including costs of defense. Insurance is required as a measure of protection and the Contractor's liability is not limited thereby.
- 1.8 The Certificates of Insurance must be submitted to the County and shall be subject to the review and approval of the County Counsel or Risk Manager.
- 1.9 If at any time during the term of this contract or any extension thereof, if any of the required policies of insurance should expire, change or be canceled, it will be the responsibility of the Contractor, prior to the

expiration, change or cancellation, to furnish to the County a Certificate of Insurance indicating renewal or an acceptable replacement of the policy so that there will be no lapse in any coverage. In the event of interruption of any coverage for any reason, all payments and work under the contract shall cease and not be resumed until coverage has been restored and a current Certificate of Insurance received and approved.

- 1.10 Any policy of insurance that is written on a claims made basis shall, under the terms of this contract, be renewed or the coverage extended for a period of not less than three years and shall provide coverage for the period operations were performed by the contractor. Proof of such extension shall annually be presented to the Risk Manager for the County of Cumberland and indicate the retroactive date of coverage or indicate that all prior acts coverage is provided.
- 1.11 Insurance or Risk Funding maintained by the County shall be considered as Excess over Contractors Insurance. Insurance or Risk Funding Maintained by the County of Cumberland does not provide protection for Contractor's liability.
- 1.12 Certificates of Insurance and Evidence of Property Forms shall show the Certificate Holder as follows:

CUMBERLAND COUNTY IMPROVEMENT AUTHORITY 745 LEBANON RD MILLVILLE, NJ 08332 ATTN.: Jerry Velazquez, President/CEO

- 1.13 Certificates of Insurance not reading as above will not be acceptable and will delay contract signature and/or payment.
- 1.14 Questions regarding these insurance requirements may be directed to David C. DeWoody, Purchasing Agent at (856) 453-2132. Certificates for approval may be preliminarily submitted via fax to (856) 451-0967.
- 1 The following items are the minimum mandatory types of insurance coverage to be carried under the requirements as provided herein, CONTRACTORS INSURANCE REQUIREMENTS:
- 2.1 Workers Compensation Statutory Limits.
- 2.2 General Liability in a comprehensive form, with minimum limits as follows:
- 2.2.1 Each Occurrence \$1,000,000
- 2.2.2 Personal & Adv. Injury \$1,000,000
- 2.2.3 General Aggregate \$2,000,000
- 2.2.4 Products-Completed Operations Aggregate \$2,000,000
- 2.2.5 Employers Liability with minimum limits of \$1,000,000/1,000,000/1,000,000.
- 2.3 Motor Vehicle Liability Insurance in a comprehensive form with minimum limits of \$1,000,000 CSL
- 2.3.1 Owned Vehicles
- 2.3.2 Hired/Leased Vehicles
- 2.3.3 Non-Owned Vehicles
- 3 SPECIFIC COVERAGE REQUIREMENTS

3.1 PROFESSIONAL LIABILITY (Required for this Bid: Yes _____ No ____X__)

During the life of this contract the Contractor shall procure and maintain Professional Liability Insurance with limits of liability not less than \$1,000,000 per claim/\$1,000,000 annual aggregate. This insurance shall provide coverage for wrongful acts the contractor is responsible for rendering or failing to render professional services. If coverage is on "claims made" basis, Contractor must maintain comparable coverage and limits for a minimum of four (4) years following the expiration date of said contract.

3.2 POLLUTION LIABILITY INSURANCE (Required for this Bid: Yes No <u>X</u>)

During the life of this contract the Contractor shall procure and maintain Pollution Liability Insurance with limits of liability not less than \$1,000,000 or \$5,000,000 per pollution incident / \$3,000,000 or \$10,000,000 annual aggregate. This insurance shall provide coverage pollution incidents that cause bodily injury, including death; loss or damage to property, including loss of use of damaged property or of property that has not been physically injured; cleanup and monitoring costs; and costs and expenses incurred in the investigation, defense, or settlement of claims. If coverage is on "claims made" basis, Contractor must maintain comparable coverage and limits for a minimum of four (4) years following the expiration date of said contract.



Geotechnical Engineering Report Proposed New Jersey State Police Barracks

Prepared For: Mr. O. Andrew Simkins, PE, PP, CME Consulting Engineer Services 645 Berlin Cross Keys Road, Suite 1 Sicklerville, New Jersey 08081

Location:

Block 183, Lot 14 2007 Highland Street Commercial Township, Cumberland County, New Jersey 08349

Prepared By: Digneo Engineering, LLC New Jersey Certificate of Authorization # 24GA28274000 297 Westwood Drive, Suite 101 West Deptford, New Jersey 08096 DE Job Number: 56-110 Date: November 16, 2023

Frank a. DeFeo

Frank DeFeo Senior Project Manager, Geotechnical Services

Robet 2.

Robert L. Jost, PE New Jersey Professional Engineer, License No. 51609 Director of Geotechnical Services



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- A KEY MAP PLAN
- B TEST BORING LOCATION PLAN
- C TEST BORING LOGS
- D LABORATORY TEST RESULTS



1. INTRODUCTION

This report was prepared by Digneo Engineering, LLC (DE), on behalf of Consulting Engineer Services, Inc. (CES), and contains the results of a subsurface geotechnical investigation conducted at the location of a proposed New Jersey State Police Barracks in Commercial Township, Cumberland County, New Jersey. The purpose of this investigation was to assess the suitability of the existing subsurface soil conditions to support the proposed facility. Our scope of work included a subsurface exploration, laboratory testing program, and geotechnical engineering analyses. This report summarizes the work completed and provides foundation and general site improvement recommendations.

2. SITE & PROJECT DESCRIPTION

2.1 EXISTING CONDITIONS

The project site is located at Block 183 and Lot 14, locally known as 2007 Highland Street, in Commercial Township, Cumberland County, New Jersey (see Attachment A – *Key Map Plan*). The area of the proposed facility consists of a wooded lot. The project site is bordered by Highland Street to the north, by Godfrey Lane to the east, by Mauricetown Bypass to the south, and by residential and undeveloped land to the west.

Based on the Site Plan prepared by CES entitled *Site Concept 1 - New Jersey State Police Facility*, dated August 29, 2023, topography across the site is gently rolling. Site elevations generally range from approximately Elevation (EL) 25 feet to EL 34 feet. Vertical elevations are referenced to the North American Vertical Datum of 1988 (NAVD88).

2.2 PROJECT DESCRIPTION

DE understands the proposed development scheme will consist of subdividing the lot into two tracts. Tract 2 will remain wooded and undeveloped, while the proposed New Jersey State Police (NJSP) barracks and site improvements occupy Tract 1. The construction of the new one-story NJSP barracks will encompass approximately 11,500 square feet (SF) in plan area. Additional site improvements include paved drive aisles and parking stalls.

The proposed barracks are expected to be of conventional masonry and steel frame construction and contain a concrete slab-on-grade. At the time of this report, column and wall loads were not available. However, it is expected that column and wall loads will not exceed approximately 150 kips and 5 kips/foot, respectively.

Information provided by the client indicates the Finish Floor Elevation (FFE) of the NJSP barracks will be established at Elevation 33 feet. Therefore, fills ranging between 1 foot to 4 feet are expected to achieve the FFE of the building.

Should the actual loads, site grading, or any other design details differ, DE should be promptly contacted so that we can review and revise our recommendations as necessary.



3. GEOLOGY

Based on the Surficial Geologic Map of New Jersey, the site is underlain by the soils of the Cape May Formation, Unit 2 (Geologic Symbol: Qcm2). According to the description provided by United States Geologic Survey (USGS), the soils of the Cape May Formation, Unit 2 are typically comprised of sand and pebble gravel with varying amounts of silt, clay, peat and cobble gravel. The soils encountered during this investigation are considered representative of this formation.

4. LABORATORY TESTING

Soil samples obtained were reviewed and visually classified. To further define the physical characteristics of the encountered soils, one representative soil sample was subjected to laboratory analysis. The analyses conducted on this sample consisted of the following:

- Natural Moisture Content Testing (ASTM D2216)
- Sieve Analysis (ASTM D6913)

The results of this testing are presented in the following table and the Lab Testing Report is enclosed as Attachment D.

	Laboratory Test Results														
Location	Depth (ft)	Layer ID	% Gravel	% Sand	% Fines	LL	PL	PI	% Natural Moisture Content	USCS Group Symbol	ASTM Group Name				
B-1	2 to 4	Stratum I	10.1	84.0	5.9	NP	NP	NP	2.5	SP-SM	Poorly Graded SAND with Silt				

LL = Liquid Limit, PL = Plastic Limit, PI = Plasticity Index, NP = Non-Plastic

5. SUBSURFACE INVESTIGATION

A subsurface geotechnical investigation was performed on October 11, 2023 to evaluate the subsurface conditions at the project site. A total of 6 test borings, referenced as B-1 through B-6, were performed within the proposed footprint of the building. The test borings were advanced to depths of approximately 20 feet below existing ground surface.

The locations of the test borings are shown on the *Test Boring Location Plan* presented in Attachment B. The test borings were survey located in the field by CES.



The borings were conducted utilizing an All-Terrain Vehicle (ATV) mounted drill rig equipped with hollow stem augers and split spoon samplers. The split spoon samples were conducted in accordance with ASTM D1586, were recovered at appropriate intervals throughout the test borings, and Standard Penetration Test (SPT) values were recorded for each soil sample. SPT values are the number of blows required to drive a 2-inch outer-diameter split barrel sampler 24 inches using a 140-pound weight dropped 30 inches. The number of blows required to advance the sampler over the 12-inch interval from 6 inches to 18 inches is considered the "N" value.

Descriptions of the encountered subsurface conditions are provided in the following sections of this report. Additional details regarding the encountered soils, obtained soil samples, and other subsurface information obtained can be found within the *Test Boring Logs*, presented as Attachment C.

Oversight of the test boring operation was performed by a representative of DE.

5.1 TOPSOIL

Topsoil was encountered at the ground surface at all test boring locations and was measured to be approximately 12 inches in thickness. It should be expected that topsoil depths may differ within the unexplored portions of the site.

5.2 STRATUM I

Stratum I was encountered below the topsoil layer in all test borings and extended to at least the termination depth of approximately 20 feet below existing ground surface. Stratum I consisted primarily of a varicolored fine to coarse SAND with varying amounts of Gravel and Silt. The documented N values indicated this layer was primarily in a very loose to loose state of relative density but improving to medium dense with depth.

Laboratory testing conducted on a representative sample of Stratum I indicated this soil was nonplastic with a natural moisture content of 2.5 percent. This soil was classified using the Unified Soil Classification System (USCS) as a Poorly Graded SAND with Silt (SP-SM).

5.3 **GROUNDWATER**

Groundwater was encountered within all test borings at depths ranging from 12 feet to 13 feet below existing ground surface. These depths corresponded to groundwater elevations ranging from approximately EL. 16 feet to EL. 17 feet. These observations were made at the time of the test boring operation. Groundwater table elevations should be expected to vary with daily, seasonal, and climatological conditions.



6. GEOTECHNICAL CONCLUSIONS & RECOMMENDATIONS

The geotechnical investigation has revealed the general subsurface profile underlying the proposed building is comprised of the naturally occurring soils of Stratum I. Provided the recommendations detailed in this report are followed, the firm and stable naturally occurring soils, or structural fill (placed as described in this report), are suitable for support of the proposed structure.

Details regarding our geotechnical conclusions and recommendations are provided in the following sections.

6.1 FOUNDATIONS

Foundation recommendations for this project are provided below.

- Shallow strip and/or spread foundations are suitable for support of the proposed New Jersey State Police barracks.
 - As previously referenced, portions of the near-surface soils of Stratum I were very loose to loose. Any weak and yielding foundation subgrade soils encountered shall be removed, from within the foundation subgrade areas, to firm and stable naturally occurring soils. The resulting over-excavation shall be backfilled back to the planned foundation subgrade elevations with clean ³/₄ inch stone, cementitious flowable fill, concrete, or structural fill placed in accordance with the recommendations set forth in this report.
- > The foundations shall be supported on the firm and stable soils of Stratum I or structural fill placed in accordance with the recommendations in this report.
- The foundations for the proposed building shall be designed for a maximum allowable bearing pressure of 2,500 pounds per square foot (psf), based on column and wall foundations being a minimum of 3 feet and 2 feet in width, respectively.
- Exterior foundations shall rest on soils no less than 3 feet below final exterior grade to protect against frost heave. Interior foundations located in permanently heated portions of the structure may be established at conventional depths below the floor slab, provided that they are established within the intended bearing stratum.
- Foundation subgrades shall be cleared of loose material or debris immediately prior to the placement of concrete.
- Please note that "stay forms" or similar techniques may be required to maintain vertical excavations within the loose and moist granular soils.
- We recommend that all footings be poured as promptly as possible to reduce the likelihood of excavation subgrade or sidewall degradation.



The foundation subgrades shall be reviewed by a Geotechnical Engineer licensed in the State of New Jersey during construction to confirm the suitability of the subgrade soils.

6.2 SETTLEMENT

For the purposes of our settlement analyses, maximum column loads of 150 kips and wall loads of 5 kips per linear foot were considered. Based on these loads, recommended bearing pressures, thickness of fill necessary to raise the subgrade, and our geotechnical analyses, maximum post-construction settlement is expected to be less than 1.0 inch with differential settlements less than approximately 0.5 inches.

Should the foundation loads exceed those described above, DE shall be contacted so we may review our analyses and revise our conclusions, if required.

6.3 FLOOR SLABS

The floor slab for the proposed building may be constructed as a conventional slab on ground, supported on the firm and stable soils of Stratum I or Structural Fill placed in accordance with the recommendations set forth in this report. Provided the soils supporting the slab are compacted to at least 95 percent of their maximum dry density and within ± 2 percent of the optimum moisture content, both as determined by ASTM D1557, the soils are expected to exhibit a modulus of subgrade reaction of approximately 150 pounds per cubic inch (pci).

The concrete slab on ground shall be supported on a minimum of 4 inches of free-draining clean and washed crushed stone or gravel subbase and compacted to non-movement prior to placement of the slab concrete.

6.4 LATERAL EARTH PRESSURES

The following criteria may be used in establishing lateral earth pressures:

<u>Stratum I</u>

Soil Unit Weight $\gamma = 115$ pcf Cohesion C = 0 psf Angle of Internal Friction Ø= 30 degrees Coefficient of Active Pressure K_a = 0.33 Coefficient of Passive Pressure K_p = 3.00 Coefficient of At-Rest Pressure K_o = 0.50

Should different soil be used, the design data shall be re-evaluated and revised, if necessary, based on the specific material.

6.5 SEISMIC SITE CLASSIFICATION

Based on the subsurface conditions encountered during our investigation at the site, and the guidance provided by "The 2021 International Building Code, New Jersey Edition", the subsurface soils can be classified as Seismic Site Class D.



7. CONSTRUCTION PHASE RECOMMENDATIONS

Based on our geotechnical engineering analyses for this project and our experience with similar projects, the following construction phase recommendations are provided in the following sections.

7.1 SITE PREPARATION

All surficial topsoil, or other surficial materials present, shall be removed from all structural areas at the beginning of the project. Structural areas are defined as areas covered by the proposed structure or any asphalt or concrete paved areas, extending a minimum of five feet beyond the proposed structure or pavement lines. Unstable or deleterious materials shall be removed from within these areas as detailed in this report.

7.2 COMPACTION AND PROOFROLLING

Structural areas shall be compacted using a steel-drum vibratory roller having a minimum static weight of at least 10 tons. This shall be done following the removal of surficial materials, following any excavation needed to reach proposed subgrade elevations, and prior to the placement of any structural fill. A minimum of 3 overlapping passes, in directions perpendicular to each other, of the compaction equipment shall be completed across all structural areas. Compaction of the virgin subgrade soils and proofrolling should be completed under the observation of the Geotechnical Engineer of Record and is considered a critical part of site development.

As previously referenced, portions of the near-surface soils of Stratum I were very loose to loose. As such, the compaction and proofrolling procedures detailed above are vitally important to the performance of this project. In addition, due to these very loose soils, some localized areas of weak and yielding subgrade soils should be expected.

Following the compaction procedures described above, proofrolling of the structural areas shall be performed using a fully loaded tri-axle dump truck. Weak or yielding areas discovered by visual observations during the compaction and proofrolling procedures described above shall be compacted in-place to non-movement or removed to firm and stable subbase soils and replaced with structural fill placed in accordance with this report.

The compaction and proofrolling procedures described above are necessary to verify the stability of the upper zones of the structural areas and for uniform distribution of loads. In areas where removal of soils (cut) is required, proofrolling can be postponed until after the proposed subgrade elevation is achieved.

7.3 EXCAVATION CONSIDERATIONS

Construction excavations for this project are expected to take place within the soils of Stratum I. Based on our investigation, it is anticipated that these soils can be removed using conventional excavation equipment and techniques.



All excavations shall be adequately sloped, benched or otherwise supported to minimize collapse and protect personnel. Additionally, all excavations shall be completed in accordance with all pertinent Occupational Safety and Health Administration (OSHA) guidelines and requirements.

7.4 STRUCTURAL FILL

Recommendations regarding imported Structural Fill and the use of on-site soils as structural fill are provided in the following section.

Imported Fill

Any imported Structural Fill needed to raise site grades or replace weak and yielding soils shall be free of ash, trash, cinders, organic matter, or any other deleterious materials. This Fill shall have a Plasticity Index (PI) less than 10; Liquid Limit (LL) less than 30; and less than 15 percent by weight rock fragments larger than 2 inches with no particle size exceeding 4 inches. Further, the Fill shall be well-graded with less than 15 percent by weight larger than the ³/₄ inches and less than 15 percent smaller than the No. 200 sieve.

The Geotechnical Engineer of Record shall evaluate any proposed imported soils that differ from above prior to their placement as Structural Fill.

On-Site Soils Reuse

Comments regarding the suitability of the on-site soils for reuse as structural fill are provided in the following sections.

Stratum I – These soils consisted primarily of varicolored fine to coarse SAND with varying amounts of Gravel and Silt. These soils are considered suitable for use as Structural Fill, provided they are placed in accordance with the recommendations set forth in this report.

Our analysis of the suitability of the on-site soil for use as Structural Fill was based on data collected from the test boring locations. Soil suitability shall be confirmed in the field by a qualified Geotechnical Engineer during construction.

7.5 **BACKFILLING REQUIREMENTS**

The following structural fill lift thicknesses can be used with the following compaction equipment:

- Loose lifts not exceeding 10 inches:
- Loose lifts not exceeding 6 inches:

Where Heavy Compaction Equipment can be utilized. Where only hand operated tampers or walk-behind roller can be utilized.

Within structural areas, all structural fill shall be compacted to at least 95 percent of the maximum dry density and within $2\pm$ percent of the optimum moisture content, both as determined by ASTM D1557.



Within non-structural areas, structural fill shall be compacted to at least 90 percent of the maximum dry density and within $2\pm$ percent of the optimum moisture content, both as determined by ASTM D1557.

The lift thicknesses, number of passes, and the type of compaction equipment needed to achieve the compaction percentages noted above can be adjusted in the field during backfilling and compaction procedures.

7.6 FOUNDATION CONSTRUCTION

The following shall be adhered to during foundation construction:

- Foundation subgrades shall be compacted using a walk-behind roller, hand-operated tamper or similar compaction equipment to provide a firm and stable subbase within the foundation excavation suitable for proper support of the proposed foundations.
- Should the foundation subgrade soils be disturbed, they shall be compacted in place or removed to firm and stable subbase soils. The resulting over-excavation can be backfilled with concrete, cementitious flowable fill or structural fill placed in accordance with this report.
- ➤ Water shall be prevented from entering the foundation excavations. Any water that does enter the foundation excavation shall be removed within 24 hours and the subgrade soils re-evaluated for stability.
- It is strongly recommended concrete placement take place promptly to reduce degradation of foundation subgrade and excavation sidewalls.
- Attention is directed to Section 6.1 of this report. All items therein shall be strictly adhered to.

The foundation subgrades shall be reviewed by a Geotechnical Engineer licensed in the State of New Jersey during construction to confirm the suitability of the subgrade soils.

7.7 SLAB CONSTRUCTION

Prior to the placement of any granular subbase, and prior to the placement of the concrete slab on ground, proofrolling and compaction of the proposed concrete slab area shall be carried out in accordance with this report.

Dependent upon the weather conditions and construction schedules, the slab subgrade may contain weak, yielding and/or overly saturated soil immediately prior to slab placement. These soils shall be removed and replaced in accordance with this report, or alternate methods, such as aerating and recompacting shall be utilized to stabilize the slab subgrade. The most appropriate method used for stabilization of the slab subgrade shall be determined in the field based on site-specific field and soil conditions, along with the availability and cost effectiveness of various methods. The Geotechnical Engineer shall be consulted should these needs arise.



Any localized areas which contain weak and yielding Stratum I soils shall be removed in their entirety to firm and stable Stratum I soils. The resulting over-excavations shall be proofrolled and backfilled as detailed in this report. The Geotechnical Engineer of Record shall be present to review the slab subgrade area during its preparation and prior to slab subgrade placement.

7.8 **DEWATERING**

Groundwater was encountered within all test borings at depths ranging from 12 feet to 13 feet below existing ground surface. These depths corresponded to groundwater elevations ranging from approximately EL. 16 feet to EL. 17 feet. As such, significant dewatering efforts are not anticipated for this project unless foundation and utility excavations extend beyond EL. 18 feet.

These observations were made at the time of the exploration. Groundwater table elevations should be expected to vary with daily, seasonal, and climatological conditions.

7.9 **PAVEMENT CONSTRUCTION**

Prior to any newly placed bituminous pavement, proposed pavement areas shall be thoroughly compacted and proof-rolled in accordance with this report. These areas shall be compacted to a minimum 95 percent of the subgrade soil's maximum dry density and within ± 2 percent of the optimum moisture content, both as determined by ASTM D1557. This process, and the removal and replacement of any weak and yielding areas of the pavement subgrade, shall be reviewed by the Geotechnical Engineer during construction.

The granular subbase portion of the proposed paving section shall be placed as soon as possible after the subgrade has been reviewed and approved by the Geotechnical Engineer. Exposure to construction traffic prior to paving will likely result in degradation of the subbase materials and instability of the subgrade soils.

The proofrolling and compaction procedures detailed in this report are considered vitally important to the performance of the paving at this project. Any areas of weak and yielding paving subgrade soils encountered within the paved areas shall be removed in their entirety to firm and stable Stratum I soils. The resulting over-excavations shall be proofrolled and backfilled as detailed in this report. The Geotechnical Engineer of Record shall be present to review the paving subgrade areas during their preparation.

Proper drainage is required for the successful performance of any pavement. It is assumed the pavement will be designed for proper grading to provide proper runoff.

Review of all pavement construction activities, including review of the gravel subbase layer and the pavement subgrades, shall be reviewed by a Geotechnical Engineer to ensure adherence to project plans, specifications and recommendation contained in this report.



8. CONSTRUCTION PHASE OBSERVATION & TESTING

As Geotechnical Engineer of Record for this project, DE recommends we be retained to provide construction phase observations and materials testing during construction. This shall be done to verify that the geotechnical recommendations detailed in this report are adhered to during construction.

If an outside firm is retained to provide these services, DE recommends this firm prepare a letter stating they will assume the responsibilities of Geotechnical Engineer of Record for the project. Further, we also recommend this firm provide a letter stating their receipt of this report and acknowledgement of the recommendations provided therein, or detailing revisions to the recommendations within our report.

9. LIMITATIONS

This report was prepared in accordance with generally accepted geotechnical practices for projects such as this one.

The conclusions and recommendations contained in this report were based upon the subsurface data obtained at the site. Soil conditions may vary from location to location and from point to point across the project site. The validity of the conclusions and recommendations contained in this report were limited by the scope of the field investigation and by the number of test borings completed. It is understood the number of test locations were consistent with good engineering practice; however, given the nature of subsurface conditions, there was a possibility actual encountered conditions may differ significantly from those described in this report.

Should encountered conditions differ from those described in this report, DE shall be notified immediately so our conclusions and recommendations can be reviewed and revised, if required. The scope of this investigation was limited to the geotechnical analysis of the load-carrying capabilities and stability of the soils underlying the project area.

Oil, hazardous waste, radioactivity, irritants, pollutants, radon or other dangerous substances and conditions were not the subject of this study. Their presence and/or absence are not implied, inferred or suggested by this report or results of this study.

Attachment A Key Map Plan



PROJECT:

GEOTECHNICAL INVESTIGATION PROPOSED NEW STATE POLICE BUILDING BLOCK 183, LOT 14 2007 HIGHLAND STREET COMMERCIAL TOWNSHIP, NEW JERSEY 08349 DE #56-110 DRAWING TITLE: DRAWING SHEET:

KEY MAP PLAN

ATTACHMENT 'A'



Attachment B Test Boring Location Plan



PROPOSED NEW STATE POLICE BUILDING BLOCK 183, LOT 14 2007 HIGHLAND STREET **COMMERCIAL TOWNSHIP, NEW JERSEY 08349** DE #56-110

ATTACHMENT 'B'

TEST BORING

LOCATION PLAN

 Θ **APPROXIMATE TEST BORING LOCATION**



Attachment C Test Boring Logs



Project:	NJSP Build	ling Geotechnical Inve	stiga	tion				Boring Number: <u>B-1</u>				
Date Drilled:	<u>10/11/23</u>							GS Elevation (ft): <u>30</u>				
Driller / DE Rep:	<u>Sano / Frar</u>	<u>hk D.</u>						GW Elevation (ft): <u>17</u>				
Rig Type:	Acker Rebe	el XL						Drilling Method: <u>3.25" ID HSA</u>				
Project Number:	<u>56-110</u>							Topo Est: Field SurveyX				
Depth (ft)	Sample #	Sample Depth	I	Blov	vs/6	"	Ν	Soil Description	Remarks			
1	S-1	0' - 2'	1	2	2	1	4	Topsoil 12"				
2								Very loose orange brown fine to medium SAND, little Silt, moist				
3	S-2	2' - 4'	1	2	2	3	4	Very loose light brown fine to coarse SAND,				
4												
5	S-3	4' - 6'	3	5	8	9	13	Medium dense light brown fine to coarse SAND, little fine to coarse Gravel, trace Silt,				
6								moist				
7	S-4	6' - 8'	7	9	11	12	20	Medium dense light brown fine to coarse SAND, trace fine to coarse Gravel, trace Silt,				
8								moist				
9	S-5	8' - 10'	9	14	13	17	27	Medium dense light gray fine to medium SAND, trace Silt, wet				
10									Stratum I			
11												
12												
13									H ₂ O Depth : 13'			
14	S-6	13' - 15'	5	7	8	9	15	Medium dense grayish brown fine to medium SAND, trace Silt, wet				
15												
16												
17												
18												
19	S-7	18' - 20'	3	5	9	11	14	Medium dense grayish brown to light brown fine to medium SAND, trace Silt, wet				
20												
21												
22												
23												
24												
25	25											
		END OF BORING AT 20 FEET										



Project:	NJSP Build	ling Geotechnical Inve	stiga	tion			Boring Number: <u>B-2</u>				
Date Drilled:	<u>10/11/23</u>							GS Elevation (ft): 29			
Driller / DE Rep:	<u>Sano / Frar</u>	<u>nk D.</u>						GW Elevation (ft): <u>17</u>			
Rig Type:	Acker Rebe	el XL						Drilling Method: <u>3.25" ID HSA</u>			
Project Number:	<u>56-110</u>							Topo Est: Field SurveyX			
Depth (ft)	Sample #	Sample Depth	I	Blows/6"		Ν	Soil Description	Remarks			
1	S-1	0' - 2'	1	2	2	3	4	Topsoil 12"			
2								Very loose orange brown fine to medium SAND, little Silt, moist			
3	S-2	2' - 4'	2	2	3	3	5	Loose orange brown fine to medium SAND,			
4								ittle ine Gravel, trace Siit, moist			
5	S-3	4' - 6'	3	4	4	4	8	Loose orange brown to brown fine to coarse SAND, trace fine Gravel, trace Silt, moist			
6											
7	S-4	6' - 8'	4	3	4	5	7	Loose light brown to orange brown to gray fine to coarse SAND, trace fine Gravel, trace Silt,			
8								moist			
9	S-5	8' - 10'	5	6	7	7	13	Medium dense light gray fine to medium SAND, trace Silt, wet			
10									Stratum I		
11											
12									H ₂ O Depth : 12'		
13											
14	S-6	13' - 15'	4	7	9	10	16	Medium dense grayish brown fine to medium SAND. trace Silt. wet			
15											
16											
17											
18											
19	S-7	18' - 20'	3	5	7	8	12	Medium dense grayish brown to light brown fine to medium SAND, trace Silt, wet			
20											
21											
22											
23											
24											
25											
				EN	DO	FBC	ORIN	G AT 20 FEET			



Project:	NJSP Build	ling Geotechnical Inve	stiga	<u>ition</u>				Boring Number: <u>B-3</u>					
Date Drilled:	<u>10/11/23</u>							GS Elevation (ft): 28					
Driller / DE Rep:	<u>Sano / Frai</u>	<u>nk D.</u>						GW Elevation (ft): 16					
Rig Type:	Acker Reb	el XL						Drilling Method: <u>3.25" ID HSA</u>					
Project Number:	<u>56-110</u>							Topo Est: Field SurveyX					
Depth (ft)	Sample #	Sample Depth	1	Blov	vs/6		Ν	Soil Description	Remarks				
1	S-1	0' - 2'	1	2	2	2	4	Topsoil 12"					
2								Very loose brown fine to medium SAND, little Silt, trace fine Gravel, moist					
3	S-2	2' - 4'	3	3	5	5	8	Loose orange brown to brown fine to medium					
4								SAND, little line Gravel, trace Slit, moist					
5	S-3	4' - 6'	4	4	4	6	8	Loose light brown to orange brown fine to medium SAND, trace fine to coarse Gravel,					
6								trace Silt, moist					
7	S-4	6' - 8'	5	6	5	6	11	Medium dense light brown to light gray fine to medium SAND, trace Silt, moist					
8													
9	S-5	8' - 10'	5	6	7	8	13	Medium dense light brown to light gray fine to medium SAND, trace Silt, moist					
10									Stratum I				
11													
12									H₂O Depth:12'				
13													
14	S-6	13' - 15'	3	6	7	9	13	Medium dense light brown to light gray fine to medium SAND. trace Silt. wet					
15													
16													
17													
18													
19	S-7	18' - 20'	4	3	5	5	8	Loose grayish brown to orange brown fine to medium SAND. trace Silt. wet					
20													
21													
22													
23													
24													
25	25												
		END OF BORING AT 20 FEET											



Project:	NJSP Build	ling Geotechnical Inve	stiga	tion				Boring Number: <u>B-4</u>					
Date Drilled:	<u>10/11/23</u>							GS Elevation (ft): 29					
Driller / DE Rep:	<u>Sano / Frar</u>	<u>nk D.</u>						GW Elevation (ft): 16					
Rig Type:	Acker Rebe	el XL						Drilling Method: <u>3.25" ID HSA</u>					
Project Number:	<u>56-110</u>							Topo Est: Field SurveyX					
Depth (ft)	Sample #	Sample Depth	I	Blows/6"		Ν	Soil Description	Remarks					
1	S-1	0' - 2'	1	1	2	2	3	Topsoil 12"					
2								Very loose brown fine to medium SAND, little fine Gravel, trace Silt, moist					
3	S-2	2' - 4'	3	3	3	3	6	Loose light brown fine to coarse SAND, trace					
4								line Gravel, trace Siit, moist					
5	S-3	4' - 6'	3	4	4	5	8	Loose light brown to light gray fine to medium SAND, trace fine to coarse Gravel, trace Silt,					
6								moist					
7	S-4	6' - 8'	3	3	4	5	7	Loose light brown to light gray fine to medium SAND, trace Silt, moist					
8													
9	S-5	8' - 10'	4	5	6	6	11	Medium dense light brown to light gray fine to medium SAND, trace Silt, moist					
10									Stratum I				
11													
12													
13									H ₂ O Depth : 13'				
14	S-6	13' - 15'	3	6	6	10	12	Medium dense light brown to light gray fine to medium SAND, trace Silt, wet					
15													
16													
17													
18													
19	S-7	18' - 20'	2	5	6	6	11	Medium dense grayish brown to orange brown fine to medium SAND, trace Silt, wet					
20													
21													
22													
23													
24													
25													
		END OF BORING AT 20 FEET											



Project:	NJSP Build	ling Geotechnical Inve	stiga	ition				Boring Number: <u>B-5</u>											
Date Drilled:	<u>10/11/23</u>							GS Elevation (ft): 29											
Driller / DE Rep:	<u>Sano / Frar</u>	<u>nk D.</u>						GW Elevation (ft): 16											
Rig Type:	Acker Rebe	el XL						Drilling Method: <u>3.25" ID HSA</u>											
Project Number:	<u>56-110</u>							Topo Est: Field Survey	_X										
Depth (ft)	Sample #	Sample Depth	1	Blows/6"		Ν	Soil Description	Remarks											
1	S-1	0' - 2'	1	1	2	2	3	Topsoil 12"											
2								Very loose brown fine to medium SAND, some Silt, trace fine Gravel, moist											
3	S-2	2' - 4'	4	5	5	5	10	Loose light brown fine to coarse SAND, some											
4								ine Graver, trace Sitt, moist											
5	S-3	4' - 6'	3	4	6	7	10	Loose light brown fine to medium SAND, trace Silt, moist											
6																			
7	S-4	6' - 8'	6	7	7	9	14	Medium dense light brown to light gray fine to medium SAND, trace Silt, moist											
8																			
9	S-5	8' - 10'	7	7	9	9	16	Medium dense light gray fine to medium SAND, trace Silt, moist											
10									Stratum I										
11																			
12																			
13									H₂O Depth:13'										
14	S-6	13' - 15'	3	5	6	9	11	Medium dense light brown to light gray to orange brown fine to medium SAND, trace Silt,											
15								wet											
16																			
17																			
18																			
19	S-7	18' - 20'	3	6	6	8	12	Medium dense grayish brown fine to medium SAND, trace Silt, wet											
20																			
21																			
22																			
23																			
24																			
25																			
				EN	DO	FBC	ORIN	END OF BORING AT 20 FEET											



Project:	NJSP Build	ling Geotechnical Inve	stiga	tion				Boring Number: <u>B-6</u>					
Date Drilled:	<u>10/11/23</u>							GS Elevation (ft): 28					
Driller / DE Rep:	<u>Sano / Frar</u>	<u>hk D.</u>						GW Elevation (ft): 16					
Rig Type:	Acker Rebe	el XL						Drilling Method: <u>3.25" ID HSA</u>					
Project Number:	<u>56-110</u>							Topo Est: Field SurveyX					
Depth (ft)	Sample #	Sample Depth	I	Blows/6"		Ν	Soil Description	Remarks					
1	S-1	0' - 2'	1	1	4	4	5	Topsoil 12"					
2								Loose brown fine to medium SAND, little Silt, moist					
3	S-2	2' - 4'	3	4	6	5	10	Loose brown to orange brown fine to medium					
4													
5	S-3	4' - 6'	2	4	4	4	8	SAND, little fine to coarse Gravel, trace Silt, moist					
6													
7	S-4	6' - 8'	3	4	4	5	8	Loose light brown to light gray fine to medium SAND, little fine to coarse Gravel, trace Silt,					
8								moist					
9	S-5	8' - 10'	4	6	5	5	11	Medium dense light brown to light gray fine to medium SAND, little fine to coarse Gravel, trace					
10								Silt, moist	Stratum I				
11													
12									H ₂ O Depth : 12'				
13													
14	S-6	13' - 15'	3	4	8	9	12	Medium dense grayish brown fine to medium SAND, trace Silt, wet					
15													
16													
17													
18													
19	S-7	18' - 20'	4	6	6	5	12	Medium dense light brown to orange brown fine to medium SAND, trace Silt, wet					
20													
21													
22													
23													
24													
25	25												
		END OF BORING AT 20 FEET											

Attachment D Laboratory Test Results







November 3, 2023

Mr. O. Andrew Simkins, PE, PP, CME Project Manager, Land Development Consulting Engineer Services 645 Berlin Cross Keys Road, Suite 1 Sicklerville, New Jersey 08081

Re: Preliminary Stormwater Subsurface Investigation Summary Letter Report Proposed New State Police Building Block 183, Lot 14 2007 Highland Street Commercial Township, Cumberland County, New Jersey 08349 DE Project #: 56-110

Dear Mr. Simkins,

As per your request, Digneo Engineering, LLC (DE) performed a subsurface investigation at the above referenced site in order to investigate the soil and groundwater conditions for the proposed stormwater management facilities. This letter serves to transmit the results of our investigation.

PROJECT DESCRIPTION

Information provided by the stormwater design engineer, Consulting Engineer Services, Inc (CES), indicates that the proposed site development scheme includes three (3) new stormwater management facilities for the proposed state police building planned for the site. The exact size, location, and bottom elevation of the proposed stormwater facilities were not known at the time of this report. However, based on site the plan entitled *Site Concept 1*, prepared by CES, dated August 28, 2023 and last revised on August 29, 2023, the sizes of the basin bottoms of the proposed stormwater facilities are not anticipated to exceed approximately 10,000 square feet (SF).

SITE DESCRIPTION

The project site is located at Block 183, Lot 14, locally known as 2007 Highland Street in Commercial Township, Cumberland County, New Jersey (see Attachment A – *Key Map Plan*). The area of the proposed stormwater facilities consists of an undeveloped wooded lot. The project site is bordered by Highland Street to the north, by Godfrey Lane to the east, by North Avenue to the south, and by residential and undeveloped land to the west.

Based on the *Site Concept 1* plan, topography across the site is generally relatively flat, with a lower area near the eastern side of the site and a gentle slope upward toward the western side of the site. Site elevations generally range from approximately Elevation (EL) 25 feet to EL 34 feet.



USDA SOIL SURVEY

Based on soil mapping data provided by the United States Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS) for Camden County, the areas of the proposed stormwater management facilities are generally underlain by Westphalia fine sandy loam (WeeB), 2 to 5 percent slopes and by Buddtown-Deptford loamy sands (BukA), 0 to 2 percent slopes.

The Galloway loamy sand soils are generally derived from unconsolidated sandy marine deposits and generally range in texture from loamy sand to sand. Depth to restrictive features is noted as being more than 80 inches and depth to the water table is noted as being about 12 inches to 18 inches. This soil is somewhat poorly drained with no frequency of ponding or flooding. This soil generally has a high to very high ability to transmit water at 6 inches per hour (in/hr) to 20 in/hr and is rated as Hydrologic Soil Group A/D.

A plan showing the soil mapping areas in the vicinity of the site has been provided as Attachment B, *Soil Map*.

FIELD INVESTIGATION

DE performed a subsurface investigation at the site in order to investigate the subsurface conditions at the locations of the proposed stormwater management facilities. A total of 6 test pit locations were performed at locations selected and located in the field by CES, referenced as TP-1 through TP-6. The test pits were excavated by a trackhoe excavator under the direction of a DE representative and extended to depths ranging between approximately 11 feet to 12 feet below existing ground surface, where sidewall collapse prevented further advancement of the test pits.

A Test Pit Location Plan showing the locations of the test pits is attached to this letter as Attachment C.

Details regarding the subsurface conditions encountered, including soil descriptions, can be found within the *Test Pit Logs*, attached to this Letter as Attachment D. General descriptions of the subsurface soils encountered are provided in the "Soil Descriptions" section of this letter.

The test pits were backfilled in lifts using the soils excavated during the test pitting operation and compacted intermittently with the trackhoe bucket. Excess soil was mounded at the ground surface.

SOIL DESCRIPTIONS

General descriptions of the subsurface conditions encountered at the site are as follows:

Topsoil

Topsoil was encountered at the ground surface of each test pit location and was found to be approximately 12 inches in thickness. Topsoil thicknesses should be expected to vary within the unexplored portions of the site.

Stratum I

Stratum I was encountered below the Topsoil in all of the test pit locations and extended to the termination depths of the test pits, ranging from approximately 11 feet to 12 feet below existing ground surface. Upon



visual review, the Stratum I soils generally consisted of a yellowish brown to pale brown to light gray Loamy Sand to Sand with varying amounts of Gravel.

More detailed descriptions of Stratum I and Stratum II can be found in the *Stormwater Boring and Test Pit Logs* attached to this letter.

GROUNDWATER

Groundwater was not encountered within any of the test pit locations. The groundwater observations were made at the time of the field operation and should be expected to fluctuate with daily, seasonal, and climatological variations.

SEASONAL HIGH GROUNDWATER TABLE

DE reviewed the soils encountered within the test pits for indicators of the Seasonal High Groundwater Table elevation. Areas within the soil profile that undergo submersion and subsequent drying often exhibit changes in soil colors due to the reduction of iron and manganese. Such conditions are often characterized by "depleted" soils taking on a `grayish color with sandier soils, or bluish, grayish, or greenish colors in finer grained soils. The longer the saturation period, the more pronounced the reduction process, and the grayer the soil becomes. Iron precipitates are often visible within the soil as bright "high chroma" colors which may indicate the fluctuation of the water table within this particular area of the soil stratum. Blotches of gray and reddish-brown soil colors may also be found occurring at the same depth. These patterns of spots or blotches of different color, or shades of color interspersed with the dominant color, are called redoximorphic features, or soil "mottling". These features are often indicative of the seasonal high groundwater table elevation.

Based on our field investigation and review work, indicators of the Seasonal High Groundwater (SHGW) Table were <u>not</u> observed within any test pit locations.

INFILTRATION TESTING

In order to determine the permeability of the soils underlying the site, 6 Single Ring Infiltration (SRI) tests were performed in general accordance with Subsection A5 of Chapter 12 of the New Jersey Stormwater Best Management Practices Manual. The infiltration test depths were determined in the field by a representative of DE based on the subsurface conditions encountered and discussions with the design engineer. The results of all infiltration testing, as well as seasonal high and groundwater table information, are provided below in Table I.

Test Pit / Boring Number (Location)	Surface Elevation (Feet)	Seasonal High Depth/Elevation (Feet)	Groundwater Depth/Elevation (Feet)	Test Depth/ Elevation (Feet)	Soil Texture (at test depth)	Test Method	Hydraulic Conductivity (in/hr)
TP-1	26.0	N/E	N/E	4 / 22.0	Loamy Sand	SRI	17.9
TP-2	29.3	N/E	N/E	4.5 / 23.8	Sand	SRI	Greater than 20 [78.6 in/hr]
TP-3	27.6	N/E	N/E	4.5 / 23.1	Sand	SRI	Greater than 20 [28.2 in/hr]

TABLE I



TP-4	27.7	N/E	N/E	4 / 23.7	Loamy Sand	SRI	Greater than 20 [97.3 in/hr]
TP-5	29.3	N/E	N/E	4 / 25.3	Sand	SRI	Greater than 20 [30.5 in/hr]
TP-6	28.3	N/E	N/E	4 / 24.3	Loamy Sand	SRI	Greater than 20 [56.0 in/hr]

"Greater than 20" indicates a field intake rate of more than 60 in/hr. Therefore, rates of greater than 20 in/hr were reported for the corresponding tests (as per the Manual). An estimate of the hydraulic conductivity rates for the test locations where this occurred have been provided in brackets for informational purposes only based on the line shown in the Single Ring Test Conversion of Observed Field Intake Rate to Hydraulic Conductivity chart provided in Subsection A5 of the Manual. The bracketed rate should not be considered valid for design purposes.

LIMITATIONS

This letter has been prepared in accordance with generally accepted practices for projects such as this one. The conclusions contained in this letter are based upon the subsurface data obtained from the test pits performed at the site. Soil conditions may vary from location to location and from point to point on the project site. The validity of the conclusions contained in this letter are necessarily limited by the scope of the field investigation and by the number of locations that were investigated. It is understood that the number of test locations made are consistent with good engineering practice but, given the nature of subsurface conditions, there is a possibility that actual conditions encountered may differ significantly from those projected in this letter. Should conditions be encountered which differ from those described in this letter, DE shall be notified immediately so that our conclusions can be reviewed and revised, if necessary.

CLOSING

We trust that this is the information you require. Should you have any questions regarding this information or if we may be of further assistance with this matter, please contact us at 856-776-4588.

Respectfully,

and tiding

Alex Redcay Geotechnical Engineer

Anthony J. Digneo, PG, LEED AP President


PROJECT:

PRELIMINARY STORMWATER INVESTIGATION PROPOSED NEW STATE POLICE BUILDING BLOCK 183, LOT 14 2007 HIGHLAND STREET COMMERCIAL TOWNSHIP, NEW JERSEY 08349 DE #56-110 DRAWING TITLE: DRAWING SHEET:

KEY MAP PLAN

ATTACHMENT 'A'





MAP UNIT LEGEND:

UNIT SYMBOL:	UNIT NAME:
GamB	GALLOWAY LOAMY SAND, 0 TO 5 PERCENT SLOPES

PROJECT:	DRAWING TITLE:	DRAWING SHEET:
PRELIMINARY STORMWATER INVESTIGATION PROPOSED NEW STATE POLICE BUILDING BLOCK 183, LOT 14 2007 HIGHLAND STREET COMMERCIAL TOWNSHIP, NEW JERSEY 08349 DE #56-110	SOIL MAP	ATTACHMENT 'B'





	TEST F	PIT LOG	
Project:	NJSP Port Norris Geotech & Prelim Stormwater	Test Pit Number:	TP-1
Client:	Consulting Engineer Services	GS Elevation (ft):	26.0
Date Completed:	10/3/2023	SHGW Elevation (ft):	N/E
Job Number:		GW Elevation (ft):	<u></u> N/E
Location	See Test Pit Location Plan	Topo Est: Field Su	rvey: X
Depth (ft)	Soil De	scription	Remarks
	0' - 1' Dark yellowish brown (10YR 4/4)	Loamy Sand; contains many, fine to coarse roots	
1			Topsoil
	1' - 5.5' Yellowish brown (1	0YR 5/4) Loamy Sand, 5% Gravel	
2	-		
3			
4	Single R	ing Infiltration Test @ 4'	17.9 in/hr
5			
6	5.5' - 11' Very pale brow	n (10YR 8/2) Sand, 5% Gravel	Stratum I
7			
8			
9			
10			
11			
	End of Test I	Pit @ 11' [sidewall collapse]	
12	4		
13			
	1		
14	4		
15			
		Excavator: Sano Drilling, Inc.	
		Excavation Method: John Deere 75G	
RPM Representative: Alex Redcay			
	ENGINEERING Log Completed By: Alex Redcav		
297 We	stwood Drive, Suite 101, West Deptford, NJ 08096	Sheet: 1 of 1	

٦.

	7	TEST PIT LOG		
Projec Clien Date Complete Job Numbe	 :t: <u>NJSP Port Norris Geotech & Prelim Stormwat</u> :t: <u>Consulting Engineer Services</u> :d: <u>10/3/2023</u> : 56-110 	<u>ter</u>	Test Pit Number: GS Elevation (ft): SHGW Elevation (ft): GW Elevation (ft):	<u>TP-2</u> 29.3 N/E N/F
Location	n: <u>See Test Pit Location Plan</u>		Topo Est: Field Su	rvey: X
Depth (ft)		Soil Description	·	Remarks
	0' - 1' Dark yellowish brown	n (10YR 4/4) Loamy Sand; contains many, t	ine to coarse roots	Topsoil
1	1' - 3' Yellov	wish brown (10YR 5/6) Loamy Sand, 5% Gr	avel	
2	_			
3				
4	3' - 11'	Light gray (2.5Y 7/2) Sand, 5% Gravel		
4	-	Single Ring Infiltration Test @ 4.5'		Greater than 20 [78.6 in/hr]
5	-			
6	_			Stratum I
7				
0				
	-			
9	-			
10	_			
11				
12		End of Test Pit @ 11' [sidewall collapse]		
13				
14				
15				
		Excavator: Sa	ano Drilling, Inc.	
		Excavation Method: Jo	hn Deere 75G	
		RPM Representative: Al	ex Redcay	
Č	ENGINEERING	Log Completed By: Al	ex Redcay	
297 W	estwood Drive, Suite 101, West Deptford, NJ 08096	Sheet: 1	of 1	

	TEST F	PIT LOG		
Project:	NJSP Port Norris Geotech & Prelim Stormwater		Test Pit Number:	TP-3
Client:	Consulting Engineer Services		GS Elevation (ft):	27.6
Date Completed:	10/4/2023		SHGW Elevation (ft):	<u>N/E</u>
Job Number:	<u>56-110</u>		GW Elevation (ft):	<u>N/E</u>
Location:	See Test Pit Location Plan		Topo Est: Field Su	rvey: <u>X</u>
Depth (ft)	Soil De	scription		Remarks
1	0' - 1' Dark yellowish brown (10YR 4/4)	Loamy Sand; contains many, fi	ne to coarse roots	Topsoil
· ·	1' - 5' Yellowish brown	n (10YR 5/6) Sand, 10% Grave	l	
2				
2				
2				
3				
4	Single Pi	ng Infiltration Tost @ 4.5'		Greater than 20
5				
	5' - 12' Very pale brow	n (10YR 8/2) Sand, 5% Gravel		
6				
				Stratum I
7				
8				
9				
10				
10				
11				
12				
	End of lest h	ht @ 12" [sidewall collapse]		
13				
14				
15				
		Excavator: Sa	no Drilling, Inc.	
		Excavation Method: Jol	nn Deere 75G	
	RPM Representative: Alex Redcay			
	ENGINEERING	Log Completed By: Ale	ex Redcay	
297 Wes	twood Drive, Suite 101, West Deptford, NJ 08096	Sheet: 1 c	of 1	

	TEST F	PIT LOG		
Project:	NJSP Port Norris Geotech & Prelim Stormwater		Test Pit Number:	TP-4
Client:	Consulting Engineer Services		GS Elevation (ft):	27.7
Date Completed:	<u>10/4/2023</u>		SHGW Elevation (ft):	<u>N/E</u>
Job Number:	<u>56-110</u>		GW Elevation (ft):	<u>N/E</u>
Location:	See Test Pit Location Plan		Topo Est: Field Su	rvey: <u>X</u>
Depth (ft)	Soil De	scription		Remarks
	0' - 1' Dark yellowish brown (10YR 4/4)	Loamy Sand; contains many, f	ine to coarse roots	Topsoil
1	1' - 5' Yellowish brown (1	0YR 5/4) Loamy Sand 5% Gr	avel	
2				
3				
				Greater than 20
4	Single R	ng Infiltration Test @ 4'		[97.3 in/hr]
F				
5	5' - 11' Light gray (INVR 7/2) Sand, 5% Gravel		
6				
				Stratum I
7				
8				
0				
9				
10				
11				
	End of Test F	Pit @ 11' [sidewall collapse]		
12				
13				
10				
14				
15	l			
		Excavator: Sa	ano Drilling, Inc.	
		Excavation Method: Jo	hn Deere 75G	
		RPM Representative: Al	ex Redcay	
	ENGINEERING	Log Completed By: Al	ex Redcay	
297 Wes	stwood Drive, Suite 101, West Deptford, NJ 08096	Sheet: 1	of 1	

	TEST	PIT LOG		
Project:	NJSP Port Norris Geotech & Prelim Stormwater		Test Pit Number:	TP-5
Client:	Consulting Engineer Services		GS Elevation (ft):	29.3
Date Completed:	: <u>10/5/2023</u>		SHGW Elevation (ft):	<u>N/E</u>
Job Number:	: <u>56-110</u>		GW Elevation (ft):	<u>N/E</u>
Location:	: <u>See Test Pit Location Plan</u>		Topo Est: Field Su	rvey: <u>X</u>
Depth (ft)	Soil De	escription		Remarks
	0' - 1' Dark yellowish brown (10YR 4/4)	Loamy Sand; contains many,	fine to coarse roots	Topsoil
1	1 2 Vollowish brown //	INVE EVEN L comy Sond EV	rovol	
		TOTR 5/0) LOanty Sand, 5% Gi	laver	
2	-			
3				
	3' - 11' Brownist	n yellow (10YR 6/8) Sand		Creater than 20
4	Single R	ing Infiltration Test @ 4'		[30.5 in/hr]
5	-			
6	4			
				Stratum I
7				
8				
	1			
9	4			
10	4			
11				
	End of Test	Pit @ 11' [sidewall collapse]		
12				
13				
10	1			
14	-			
15				
		Excavator: S	ano Drilling, Inc.	
	Excavation Method: John Deere 75G			
	RPM Representative: Alex Redcay			
	ENGINEEKING	Log Completed By: A	lex Redcay	
297 Wes	stwood Drive, Suite 101, West Deptford, NJ 08096	Sheet: 1	of 1	

	TEST	PIT LOG	
Project:	NJSP Port Norris Geotech & Prelim Stormwater	Test Pit Number:	TP-6
Client:	Consulting Engineer Services	GS Elevation (ft):	28.3
Date Completed:	10/5/2023	SHGW Elevation (ft):	N/E
Job Number:	<u>56-110</u>	GW Elevation (ft):	N/E
Location:	See Test Pit Location Plan	Topo Est: Field Su	rvey: <u>X</u>
Depth (ft)	Soil De	escription	Remarks
1	0' - 1' Dark yellowish brown (10YR 4/4)	Loamy Sand; contains many, fine to coarse roots	Topsoil
	1' - 3' Yellowish brown (10YR 5/6) Loamy Sand, 5% Gravel	
	,		
2			
3			
	Sincle R	ing Infiltration Tool @ 4	Greater than 20
4			[56.0 in/hr]
5			
6	5.5' - 11' Very pale brow	n (10YR 8/2) Sand, 10% Gravel	
			Otwatum I
7			Stratum I
0			
8			
9			
10			
11			
	End of Test I	Pit @ 11' [sidewall collapse]	
12			
13			
14			
14			
15	l	Executor: Sano Drilling Inc.	
		Excavator: Sano Drining, Inc.	
	I DICNEO	DDM Depresentative: Alex Dedeev	
	ENGINEERING	Log Completed Bit Alex Redeau	
297 Wes	twood Drive, Suite 101, West Deptford. NJ 08096	Log completed by. Alex Redday	
L	, , ,, ,,,,,	Sneet: 1 OF 1	

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DIVISION 2 - SITEWORK

021100 022000 022820 025110 025200 027000 029300	Site Clearing Earthwork Termite Control Hot Mix Asphalt Paving Portland Cement Concrete Paving Sewerage and Drainage Lawns and Grasses
029300	Lawns and Grasses
029400	Landscape Planting

DIVISION 3 – CONCRETE

032000Concrete Reinforcement033000Cast-In-Place Concrete

DIVISION 4 – MASONRY

041000	Mortar and Masonry Grout
043000	Unit Masonry System

DIVISION 5 - METALS

051200	Structural Steel Framing
054600	Cold-Formed Roof Framing System
055000	Metal Fabrication

DIVISION 6 - WOOD AND PLASTIC

061000	Rough Carpentry
061730	Metal Plate Connected Wood Trusses
062000	Finish Carpentry
064100	Custom Casework

DIVISION 7 - THERMAL AND MOISTURE PROTECTION

072100	Thermal Insulation
072700	Firestopping
072726	Fluid-Applied Membrane Air Barriers
075310	Single-Ply Roofing – Fully Adhered - Conventional
076200	Sheet Metal Flashing and Trim
076310	Gutters and Downspouts
079000	Joint Sealers

DIVISION 8 - DOORS AND WINDOWS

081110	Standard Steel Doors
081120	Standard Steel Frames
082110	Wood Doors
083620	Standard Insulated Overhead Doors
084100	Aluminum Entrances and Storefronts
085200	Aluminum Windows
087100	Door Hardware
088000	Glazing

DIVISION 9 - FINISHES

092600	Gypsum Board Systems
093060	Ceramic Tile
095110	Suspended Acoustical Ceilings
096500	Resilient Tile Flooring
096723	Resinous Flooring
096880	Carpet
099000	Painting

DIVISION 10 – SPECIALTIES

101000	Visual Display Boards
102116	Toilet Compartments
103500	Flagpoles
104400	Signage
105220	Fire Extinguishers and Accessories
108000	Toilet Room Accessories

DIVISION 12 - SPECIALTIES

124920 Window Treatments

- DIVISION 22 PLUMBING
- 220500 Common Work Results for Plumbing
- 220519 Meters and Gages for Plumbing Piping
- 220523 General-Duty Valves for Plumbing Piping
- 220529 Hangers and Supports for Plumbing Piping and Equipment
- 220553 Identification for Plumbing Piping and Equipment
- 220700 Plumbing Insulation
- 221116 Domestic Water Piping
- 221119 Domestic Water Piping Specialties
- 221123 Natural Gas Piping
- 221316 Sanitary Waste and Vent Piping
- 221319 Sanitary Waste and Vent Piping Specialties
- 221413 Storm Drainage Piping
- 221423 Storm Drainage Piping Specialties
- 224000 Plumbing Fixtures

DIVISION 23 HEATING, VENTILATING, AND AIR-CONDITIONING (HVAC)

- 230500 Common Work Results for HVAC
- 230529 Hangers and Supports for HVAC Piping and Equipment
- 230553 Identification for HVAC Piping and Equipment
- 230593 Testing, Adjusting, and Balancing for HVAC
- 230700 HVAC Insulation
- 230810 Mechanical Systems Verification Requirements
- 232113 HVAC Piping
- 232300 Refrigerant Piping
- 233113 Metal Ducts
- 233300 Air Duct Accessories
- 233346 Flexible Ducts
- 233416 Centrifugal HVAC Fans
- 233713 Diffusers, Registers, and Grilles
- 237413 Packaged Rooftop Units
- 238239 Cabinet Unit Heaters

DIVISION 26 ELECTRICAL

260500	Common Work Results for Electrical
260519	Low-Voltage Electrical Power Conductors and Cables
260526	Grounding and Bonding for Electrical Systems
260529	Hangers and Supports for Electrical Systems
260533	Raceway and Boxes for Electrical Systems
260536	Cable Trays for Electrical Systems
260543	Underground Ducts and Raceways for Electrical Systems
260553	Identification for Electrical Systems

- 260800 Electrical Systems Verification
- 260923 Lighting Control Devices
- 260943.23 Relay-Based Lighting Controls
- 262416 Panelboards
- 262726 Wiring Devices
- 262813 Fuses
- 262816 Enclosed Switches and Circuit Breakers
- 262913 Enclosed Controllers for Electrical
- 263213 Engine Generators
- 263600 Transfer Switches
- 264313 Surge Protection for Low-Voltage Electrical Power Circuits
- 265119 LED Lighting
- 265219 Exit Lighting

DIVISION 27 - COMMUNICATIONS

- 271100 Communications Equipment Room Fittings
- 271500 Communications Horizontal Cabling

DIVISION 28 - ELECTRONIC SAFETY AND SECURITY

283100 Fire Detection and Alarm

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. Protection of existing trees indicated to remain.
 - 2. Removal of trees and other vegetation.
 - 3. Topsoil stripping.
 - 4. Clearing and grubbing.
 - 5. Removing above-grade improvements.
 - 6. Removing below-grade improvements.

1.3 PROJECT CONDITIONS

- A. Traffic: Conduct site-clearing operations to ensure minimum interference with roads, streets, walks, and other adjacent occupied or used facilities. Do not close or obstruct streets, walks, or other occupied or used facilities without permission from authorities having jurisdiction.
- B. Protection of Existing Improvements: Provide protections necessary to prevent damage to existing improvements indicated to remain in place.
 - 1. Protect improvements on adjoining properties and on Owner's property.
 - 2. Restore damaged improvements to their original condition, as acceptable to property owners.
- C. Protection of Existing Trees and Vegetation: Protect existing trees and other vegetation indicated to remain in place against unnecessary cutting, breaking or skinning of roots, skinning or bruising of bark, smothering of trees by stockpiling construction materials or excavated materials within drip line, excess foot or vehicular traffic, or parking of vehicles within drip line. Provide temporary guards to protect trees and vegetation to be left standing.
 - 1. Water trees and other vegetation to remain within limits of contract work as required to maintain their health during course of construction operations.
 - 2. Provide protection for roots over 1-1/2 inch (38 mm) in diameter that are cut during construction operations. Coat cut faces with an emulsified asphalt or other acceptable coating formulated to use on damaged plant tissues. Temporarily cover exposed roots with wet burlap to prevent roots from drying out; cover with earth as soon as possible.
 - 3. Repair or replace trees and vegetation indicated to remain that are damaged by construction operations in a manner acceptable to Architect. Employ a licensed arborist to repair damage to trees and shrubs.
 - 4. Replace trees that cannot be repaired and restored to full-growth status, as determined by arborist.

1.4 EXISTING SERVICES

- A. General: Indicated locations are approximate; determine exact locations before commencing Work.
- B. Arrange and pay for disconnecting, removing, capping, and plugging utility services. Notify affected utility companies in advance and obtain approval before starting this Work.
- C. Place markers to indicate location of disconnected services. Identify service lines and capping locations on Project Record Documents.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 SITE CLEARING

- A. General: Remove trees, shrubs, grass, and other vegetation, improvements, or obstructions, as required, to permit installation of new construction. Remove similar items elsewhere on site or premises as specifically indicated. Removal includes digging out and off-site disposal of stumps and roots.
 - 1. Cut minor roots and branches of trees indicated to remain in a clean and careful manner where such roots and branches obstruct installation of new construction.
- B. Topsoil: Topsoil is defined as friable clay loam surface soil found in a depth of not less than 4 inches (100 mm). Satisfactory topsoil is reasonably free of subsoil, clay lumps, stones, and other objects over 2 inches (50 mm) in diameter, and without weeds, roots, and other objectionable material.
 - 1. Strip topsoil to whatever depths encountered in a manner to prevent intermingling with underlying subsoil or other objectionable material. Remove heavy growths of grass from areas before stripping.
 - a. Where existing trees are indicated to remain, leave existing topsoil in place within drip lines to prevent damage to root system.
 - 2. Stockpile topsoil in storage piles in areas indicated or directed. Construct storage piles to provide free drainage of surface water. Cover storage piles, if required, to prevent wind erosion.
 - 3. Dispose of unsuitable or excess topsoil as specified for disposal of waste material.
- C. Clearing and Grubbing: Clear site of trees, shrubs, and other vegetation, except for those indicated to be left standing.
 - 1. Completely remove stumps, roots, and other debris protruding through ground surface.
 - 2. Use only hand methods for grubbing inside drip line of trees indicated to remain.
 - 3. Fill depressions caused by clearing and grubbing operations with satisfactory soil material, unless further excavation or earthwork is indicated.
 - a. Place fill material in horizontal layers not exceeding 6 inches (150 mm) loose depth, and thoroughly compact each layer to a density equal to adjacent original ground.

D. Removal of Improvements: Remove existing above-grade and below-grade improvements as indicated and as necessary to facilitate new construction.

3.2 DISPOSAL OF WASTE MATERIALS

- A. Burning on Owner's Property: Burning is not permitted on Owner's property.
- B. Removal from Owner's Property: Remove waste materials from Owner's property.

END OF SECTION

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. Preparing and grading subgrades for slabs-on-grade, walks, pavements, and landscaping.
 - 2. Excavating and backfilling for buildings and structures.
 - 3. Drainage and moisture-control fill course for slabs-on-grade.
 - 4. Subbase course for walks and pavements.
 - 5. Subsurface drainage backfill for walls and trenches.
 - 6. Excavating and backfilling trenches within building lines.
 - 7. Excavating and backfilling for underground mechanical and electrical utilities and appurtenances.
- B. Related Sections: The following Sections contain requirements that relate to this Section.
 - 1. Division 2 Section "Site Clearing" for site stripping, grubbing, topsoil removal, and tree protection.
 - 2. Geotechnical Report The recommendations of this report govern the preparation of the site at the building pad and paved areas.

1.3 DEFINITIONS

- A. Excavation consists of the removal of material encountered to subgrade elevations and the reuse or disposal of materials removed.
- B. Subgrade: The uppermost surface of an excavation or the top surface of a fill or backfill immediately below subbase, drainage fill, or topsoil materials.
- C. Borrow: Soil material obtained off-site when sufficient approved soil material is not available from excavations.
- D. Subbase Course: The layer placed between the subgrade and base course in a paving system or the layer placed between the subgrade and surface of a pavement or walk.
- E. Base Course: The layer placed between the subbase and surface pavement in a paving system.
- F. Drainage Fill: Course of washed granular material supporting slab-on-grade placed to cut off upward capillary flow of pore water.
- G. Unauthorized excavation consists of removing materials beyond indicated subgrade elevations or dimensions without direction by the Architect. Unauthorized excavation, as well as remedial work directed by the Architect, shall be at the Contractor's expense.

- H. Structures: Buildings, footings, foundations, retaining walls, slabs, tanks, curbs, mechanical and electrical appurtenances, or other man-made stationary features constructed above or below ground surface.
- I. Utilities include on-site underground pipes, conduits, ducts, and cables, as well as underground services within building lines.

1.4 SUBMITTALS

- A. General: Submit the following according to the Conditions of the Contract and Division 1 Specification Sections.
- B. Product data for the following: (Not Applicable)
- C. Samples of the following:
 - 1. 20 lb (9 kg) samples, sealed in air-tight containers, of each proposed fill and backfill soil material from on-site or borrow sources.

1.5 QUALITY ASSURANCE

- A. Codes and Standards: Perform earthwork complying with requirements of authorities having jurisdiction.
- B. Testing and Inspection Service: The Contractor will have a qualified independent geotechnical engineering testing agency to classify proposed on-site and borrow soils to verify that soils comply with specified requirements and to perform required field and laboratory testing.

1.6 PROJECT CONDITIONS

- A. Existing Utilities: Do not interrupt existing utilities serving facilities occupied by the Owner or others except when permitted in writing by the Architect and then only after acceptable temporary utility services have been provided.
- B. Demolish and completely remove from site existing underground utilities indicated to be removed. Coordinate with utility companies to shutoff services if lines are active.

PART 2 - PRODUCTS

2.1 SOIL MATERIALS

- A. General: Provide approved borrow soil materials from off-site when sufficient approved soil materials are not available from excavations.
- B. Satisfactory Soil Materials: ASTM D 2487 soil classification groups GW, GP, GM, SW, SP, and SM; free of rock or gravel larger than 2 inches (50 mm) in any dimension, debris, waste, frozen materials, vegetation and other deleterious matter.
- C. Unsatisfactory Soil Materials: ASTM D 2487 soil classification groups GC, SC, ML, MH, CL, CH, OL, OH, and PT.
- D. Backfill and Fill Materials: Satisfactory soil materials.

- E. Subbase and Base Material: Dense graded aggregate base course or soil aggregate base course. Designation I-5 conforming to NJDOT specifications.
- F. Engineered Fill: Subbase or base materials.
- G. Drainage Fill: Washed, evenly graded mixture of crushed stone, or crushed or uncrushed gravel, ASTM D 448, coarse aggregate grading size 57, with 100 percent passing a 1-1/2 inch (38 mm) sieve and not more than 5 percent passing a No. 8 (2.36 mm) sieve.
- H. Filtering Material: Evenly graded mixture of natural or crushed gravel or crushed stone and natural sand, with 100 percent passing a 1-1/2 inch (38 mm) sieve and 0 to 5 percent passing a No. 50 (300 micrometer) sieve.

2.2 ACCESSORIES

- A. Warning Tape: Acid- and alkali-resistant polyethylene film warning tape manufactured for marking and identifying underground utilities, 6 inches (150 mm) wide and 4 mils (0.1 mm) thick, continuously inscribed with a description of the utility.
- B. Detectable Warning Tape: Acid- and alkali-resistant polyethylene film warning tape manufactured for marking and identifying underground utilities, 6 inches (150 mm) wide and 4 mils (0.1 mm) thick minimum, continuously inscribed with a description of the utility, with metallic core encased in a protective jacket for corrosion protection, detectable by metal detector when tape is buried up to 30 inches (750 mm) deep.
 - 1. Tape Colors: Provide tape colors to utilities as follows:
 - a. Red: Electric.
 - b. Yellow: Gas, oil, steam, and dangerous materials.
 - c. Orange: Telephone and other communications.
 - d. Blue: Water systems.
 - e. Green: Sewer systems.
- C. Filter Fabric: Manufacturer's standard nonwoven pervious geotextile fabric of polypropylene, nylon or polyester fibers, or a combination.
 - 1. Provide filter fabrics that meet or exceed the listed minimum physical properties determined according to ASTM D 4759 and the referenced standard test method in parentheses:
 - a. Grab Tensile Strength (ASTM D 4632): 100 lb (45 kg).
 - b. Apparent Opening Size (ASTM D 4751): #100 U.S. Standard (150 micrometer) sieve.
 - c. Permeability (ASTM D 4491): 150 gallons per minute per sq. ft. (102 L/s per sq. m).

PART 3 - EXECUTION

3.1 PREPARATION

A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earthwork operations.

- B. Protect subgrades and foundation soils against freezing temperatures or frost. Provide protective insulating materials as necessary.
- C. Provide erosion control measures to prevent erosion or displacement of soils and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways.
- D. Tree protection is specified in the Division 2 Section "Site Clearing."
- 3.2 DEWATERING
 - A. Prevent surface water and subsurface or ground water from entering excavations, from ponding on prepared subgrades, and from flooding Project site and surrounding area.
 - B. Protect subgrades and foundation soils from softening and damage by rain or water accumulation.
- 3.3 EXCAVATION
 - A. Explosives: Do not use explosives.
 - B. Unclassified Excavation: Excavation is unclassified and includes excavation to required subgrade elevations regardless of the character of materials and obstructions encountered.
- 3.4 STABILITY OF EXCAVATIONS
 - A. Comply with local codes, ordinances, and requirements of authorities having jurisdiction to maintain stable excavations.
- 3.5 EXCAVATION FOR WALKS AND PAVEMENTS
 - A. Excavate surfaces under walks and pavements to indicated cross sections, elevations, and grades.
- 3.6 EXCAVATION FOR UTILITY TRENCHES
 - A. Excavate trenches to indicated slopes, lines, depths, and invert elevations.
 - 1. Beyond building perimeter, excavate trenches to allow installation of top of pipe below frost line.
 - B. Excavate trenches to uniform widths to provide a working clearance on each side of pipe or conduit. Excavate trench walls vertically from trench bottom to 12 inches (300 mm) higher than top of pipe or conduit, unless otherwise indicated.
 - 1. Clearance: 12 inches (300 mm) each side of pipe or conduit.
 - C. Trench Bottoms: Excavate and shape trench bottoms to provide uniform bearing and support of pipes and conduit. Shape subgrade to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits. Remove stones and sharp objects to avoid point loading.
 - 1. For pipes or conduit less than 6 inches (150 mm) in nominal diameter and flat-bottomed, multiple-duct conduit units, hand-excavate trench bottoms and support pipe and conduit on an undisturbed subgrade.

- 2. For pipes and conduit 6 inches (150 mm) or larger in nominal diameter, shape bottom of trench to support bottom 90 degrees of pipe circumference. Fill depressions with tamped sand backfill.
- 3. Where encountering rock or another unyielding bearing surface, carry trench excavation 6 inches (150 mm) below invert elevation to receive bedding course.

3.7 APPROVAL OF SUBGRADE

- A. Notify Architect, Engineer and testing agency when excavations have reached required subgrade.
- B. When testing agency determines that unforeseen unsatisfactory soil is present, continue excavation and replace with compacted backfill or fill material as directed.
 - 1. Unforeseen additional excavation and replacement material will be paid according to the Contract provisions for changes in Work.
- C. Reconstruct subgrades damaged by freezing temperatures, frost, rain, accumulated water, or construction activities, as directed by the Architect.

3.8 UNAUTHORIZED EXCAVATION

- A. Fill unauthorized excavation under foundations or wall footings by extending indicated bottom elevation of concrete foundation or footing to excavation bottom, without altering required top elevation. Lean concrete fill may be used to bring elevations to proper position when acceptable to the Architect.
- B. Where indicated widths of utility trenches are exceeded, provide stronger pipe, or special installation procedures, as required by the Architect.

3.9 STORAGE OF SOIL MATERIALS

A. Stockpile excavated materials acceptable for backfill and fill soil materials, including acceptable borrow materials. Stockpile soil materials without intermixing. Place, grade, and shape stockpiles to drain surface water. Cover to prevent wind-blown dust.

3.10 BACKFILL

- A. Backfill excavations promptly, but not before completing the following:
 - 1. Acceptance of construction below finish grade including, where applicable, dampproofing, waterproofing, and perimeter insulation.
 - 2. Surveying locations of underground utilities for record documents.
 - 3. Testing, inspecting, and approval of underground utilities.
 - 4. Concrete formwork removal.
 - 5. Removal of trash and debris from excavation.
 - 6. Removal of temporary shoring and bracing, and sheeting.
 - 7. Installing permanent or temporary horizontal bracing on horizontally supported walls.

3.11 UTILITY TRENCH BACKFILL

A. Place and compact bedding course on rock and other unyielding bearing surfaces and to fill unauthorized excavations. Shape bedding course to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits.

- B. Place and compact initial backfill of satisfactory soil material or subbase material, free of particles larger than 1 inch (25 mm), to a height of 12 inches (300 mm) over the utility pipe or conduit.
 - 1. Carefully compact material under pipe haunches and bring backfill evenly up on both sides and along the full length of utility piping or conduit to avoid damage or displacement of utility system.
- C. Coordinate backfilling with utilities testing.
- D. Fill voids with approved backfill materials as shoring and bracing, and sheeting is removed.
- E. Place and compact final backfill of satisfactory soil material to final subgrade.
- F. Install warning tape directly above utilities, 12 inches (300 mm) below finished grade, except 6 inches (150 mm) below subgrade under pavements and slabs.
- 3.12 FILL
- A. Fill in accordance with the Geotechnical Report.
- B. Preparation: Remove vegetation, topsoil, debris, wet, and unsatisfactory soil materials, obstructions, and deleterious materials from ground surface prior to placing fills.
 - 1. Plow strip, or break up sloped surfaces steeper than 1 vertical to 4 horizontal so fill material will bond with existing surface.
- C. When subgrade or existing ground surface to receive fill has a density less than that required for fill, break up ground surface to depth required, pulverize, moisture-condition or aerate soil and recompact to required density.
- D. Place fill material in layers to required elevations for each location listed below.
 - 1. Under grass, use satisfactory excavated or borrow soil material.
 - 2. Under walks and pavements, use subbase or base material, or satisfactory excavated or borrow soil material.
 - 3. Under steps and ramps, use subbase material.
 - 4. Under building slabs, in accordance with the Geotechnical Report.
 - 5. Under footings and foundations, in accordance with the Geotechnical Report.

3.13 MOISTURE CONTROL

- A. Uniformly moisten or aerate subgrade and each subsequent fill or backfill layer before compaction to within 2 percent of optimum moisture content.
 - 1. Do not place backfill or fill material on surfaces that are muddy, frozen, or contain frost or ice.
 - 2. Remove and replace, or scarify and air-dry satisfactory soil material that is too wet to compact to specified density.
 - a. Stockpile or spread and dry removed wet satisfactory soil material.

3.14 COMPACTION

A. Place backfill and fill materials in layers in strict accordance with the Geotechnical Report.

3.15 GRADING

- A. General: Uniformly grade areas to a smooth surface, free from irregular surface changes. Comply with compaction requirements and grade to cross sections, lines, and elevations indicated.
 - 1. Provide a smooth transition between existing adjacent grades and new grades.
 - 2. Cut out soft spots, fill low spots, and trim high spots to conform to required surface tolerances.
- B. Site Grading: Slope grades to direct water away from buildings and to prevent ponding. Finish subgrades to required elevations within the following tolerances:
 - 1. Lawn or Unpaved Areas: Plus or minus 1.2 inches (30 mm).
 - 2. Walks: Plus or minus 1.2 inches (30 mm).
 - 3. Pavements: Plus or minus 1/2 inch (13 mm).
- C. Grading Inside Building Lines: Finish subgrade to a tolerance of 1/2 inch (13 mm) when tested with a 10 foot (3 m) straightedge.

3.16 SUBBASE AND BASE COURSES

- A. Under pavements and walks, place subbase course material on prepared subgrades. Place base course material over subbases to pavements.
 - 1. Compact subbase and base courses at optimum moisture content to required grades, lines, cross sections and thickness to not less than 95 percent of ASTM D 4254 relative density.
 - 2. Shape subbase and base to required crown elevations and cross-slope grades.
 - 3. When thickness of compacted subbase or base course is 6 inches (150 mm) or less, place materials in a single layer.
 - 4. When thickness of compacted subbase or base course exceeds 6 inches (150 mm), place materials in equal layers, with no layer more than 6 inches (150 mm) thick or less than 3 inches (75 mm) thick when compacted.
- B. Pavement Shoulders: Place shoulders along edges of subbase and base course to prevent lateral movement. Construct shoulders at least 12 inches (300 mm) wide of acceptable soil materials and compact simultaneously with each subbase and base layer.

3.17 DRAINAGE FILL

- A. Under slabs-on-grade, place drainage fill course on prepared subgrade.
 - 1. Compact drainage fill to required cross sections and thickness.
 - 2. When compacted thickness of drainage fill is 6 inches (150 mm) or less, place materials in a single layer.
 - 3. When compacted thickness of drainage fill exceeds 6 inches (150 mm) thick place materials in equal layers, with no layer more than 6 inches (150 mm) thick nor less than 3 inches (75 mm) thick when compacted.

3.18 FIELD QUALITY CONTROL

A. Testing Agency Services: Contractor will engage a testing agency to inspect Earthwork. Allow testing agency to inspect and test each subgrade and each fill or backfill layer. Do not proceed until test results for previously completed work verify compliance with requirements.

3.19 PROTECTION

- A. Protecting Graded Areas: Protect newly graded areas from traffic, freezing, and erosion. Keep free of trash and debris.
- B. Repair and re-establish grades to specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or lose compaction due to subsequent construction operations or weather conditions.
 - 1. Scarify or remove and replace material to depth directed by the Architect; reshape and recompact at optimum moisture content to the required density.
- C. Settling: Where settling occurs during the Project correction period, remove finished surfacing, backfill with additional approved material, compact, and reconstruct surfacing.
 - 1. Restore appearance, quality, and condition of finished surfacing to match adjacent work, and eliminate evidence of restoration to the greatest extent possible.

3.21 DISPOSAL OF SURPLUS AND WASTE MATERIALS

- A. Disposal: Transport surplus satisfactory soil to designated storage areas at the direction of the Owner. Stockpile or spread soil on site as directed by Architect.
 - 1. Remove waste material, including unsatisfactory soil, trash, and debris, and legally dispose of it off the Owner's property.

END OF SECTION

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 soil treatment for termite control.

1.3 SUBMITTALS

- A. General: Submit the following according to Conditions of Contract and Division 1 Specification Sections.
- B. Product data and application instructions.
- C. Certification that products used comply with U.S. Environmental Protection Agency (EPA) regulations for termiticides.

1.4 QUALITY ASSURANCE

- A. In addition to requirements of these specifications, comply with manufacturer's instructions and recommendations for preparing substrate and application.
- B. Engage a professional pest control operator who is licensed according to regulations of governing authorities to apply soil treatment solution.
- C. Use only termiticides that bear a federal registration number of the EPA and are approved by local authorities having jurisdiction.

1.5 JOB CONDITIONS

- A. Restrictions: Do not apply soil treatment solution until excavating, filling, and grading operations are completed, except as otherwise required in construction operations.
- B. To ensure penetration, do not apply soil treatment to frozen or excessively wet soils or during inclement weather. Comply with handling and application instructions of the soil toxicant manufacturer.

1.6 WARRANTY

- A. Warranty: Furnish written warranty, executed by Applicator and Contractor, certifying that applied soil termiticide treatment will prevent infestation of subterranean termites. If subterranean termite activity is discovered during warranty period, Contractor will re-treat soil and repair or replace damage caused by termite infestation.
- B. Warranty Period: 5 years from date of Substantial Completion.

C. The warranty shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and will be in addition to and run concurrent with other warranties made by the Contractor under requirements of the Contract Documents.

PART 2 - PRODUCTS

2.1 SOIL TREATMENT SOLUTION

- A. General: Use an emulsible, concentrated termiticide that dilutes with water, specially formulated to prevent termites infestation. Fuel oil will not be permitted as a diluent. Provide a solution consisting of one of following chemical elements.
- B. Available Products: Subject to compliance with requirements, products that may be incorporated in the Work include, but are not limited to, the following:
- C. Products: Subject to compliance with requirements, provide one of the following:
 - 1. Chloropyrifos:
 - a. Dursban TC, Dow Chemical Co.
 - b. or approved equal.
- D. Dilute with water to concentration level recommended by manufacturer.
- E. Other solutions may be used as recommended by Applicator if approved for intended application by local authorities having jurisdiction. Use only soil treatment solutions that are not harmful to plants.

PART 3 - EXECUTION

- 3.1 APPLICATION
 - A. Surface Preparation: Remove foreign matter 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 foundations. Toxicants may be applied before placing compacted fill under slabs if recommended by toxicant manufacturer.
 - B. Application Rates: Apply soil treatment solution per manufacturer's recommendations for site and application.
 - 1. At hollow masonry foundations or grade beams, treat voids at rate of 2 gallons per 10 linear feet (2.6 L per meter), poured directly into the hollow spaces.
 - 2. At expansion joints, control joints, and areas where slabs will be penetrated, apply at rate of 4 gallons per 10 linear feet (5.1 L per linear m) of penetration.
 - C. Post signs in areas of application to warn workers that soil termiticide treatment has been applied. Remove signs after areas are covered by other construction.
 - D. Reapply soil treatment solution to areas disturbed by subsequent excavation, landscape grading, or other construction activities following application.

END OF SECTION

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. Hot-mix asphalt paving.
 - 2. Hot-mix asphalt patching.
 - 3. Hot-mix asphalt overlays.
 - 4. Pavement-marking paint.
- B. Related Sections include the following:
 - 1. Section 02200 Earthwork: Aggregate subbase and base courses and aggregate pavement shoulders.
 - 2. Section 07900 Joint Sealers: Joint sealants and fillers at paving terminations.

1.3 SYSTEM DESCRIPTION

- A. Provide hot-mix asphalt pavement according to the materials, workmanship, and other applicable requirements of the standard specifications of the New Jersey Department of Transportation.
 - 1. Standard Specification: As indicated.
 - 2. Measurement and payment provisions and safety program submittals included in standard specifications do not apply to this Section.

1.4 SUBMITTALS

- A. Product Data: For each product specified. Include technical data and tested physical and performance properties.
- B. Job-Mix Designs: Certification, by authorities having jurisdiction, of approval of each job mix proposed for the Work.
- C. Job-Mix Designs: For each job mix proposed for the Work.
- D. Shop Drawings: Indicate pavement markings, lane separations, and defined parking spaces. Indicate dedicated handicapped spaces with international graphics symbol.
- E. Qualification Data: For firms and persons specified in the "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.
- F. Material Test Reports: Indicate and interpret test results for compliance of materials with requirements indicated.

G. Material Certificates: Certificates signed by manufacturers certifying that each material complies with requirements.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Engage an experienced installer who has completed hot-mix asphalt paving similar in material, design, and extent to that indicated for this Project and with a record of successful in-service performance.
- B. Manufacturer Qualifications: Engage a firm experienced in manufacturing hot-mix asphalt similar to that indicated for this Project and with a record of successful in-service performance.
 - 1. Firm shall be a registered and approved paving mix manufacturer with authorities having jurisdiction or with the DOT of the state in which Project is located.
- C. Regulatory Requirements: Conform to applicable standards of authorities having jurisdiction for asphalt paving work on public property.
- D. Asphalt-Paving Publication: Comply with AI's "The Asphalt Handbook," except where more stringent requirements are indicated.
- E. Preinstallation Conference: Conduct conference at Project site to comply with requirements of Division 1 – General Requirements: Project Meetings, review methods and procedures related to asphalt paving including, but not limited to, the following:
 - 1. Review proposed sources of paving materials, including capabilities and location of plant that will manufacture hot-mix asphalt.
 - 2. Review condition of substrate and preparatory work performed by other trades.
 - 3. Review requirements for protecting paving work, including restriction of traffic during installation period and for remainder of construction period.
 - 4. Review and finalize construction schedule for paving and related work. Verify availability of materials, paving Installer's personnel, and equipment required to execute the Work without delays.
 - 5. Review inspection and testing requirements, governing regulations, and proposed installation procedures.
 - 6. Review forecasted weather conditions and procedures for coping with unfavorable conditions.
- F. Testing Agency Qualifications: Demonstrate to Architect's satisfaction, based on Architect's evaluation of criteria conforming to ASTM D 3666, that the independent testing agency has the experience and capability to satisfactorily conduct the testing indicated without delaying the Work.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver pavement-marking materials to Project site in original packages with seals unbroken and bearing manufacturer's labels containing brand name and type of material, date of manufacture, and directions for storage.
- B. Store pavement-marking materials in a clean, dry, protected location and within temperature range required by manufacturer. Protect stored materials from direct sunlight.

1.7 PROJECT CONDITIONS

A. Environmental Limitations: Do not apply asphalt materials if substrate is wet or excessively damp or if the following conditions are not met:

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- 1. Prime and Tack Coats: Minimum surface temperature of 60 deg F (15.5 deg C).
- 2. Slurry Coat: Comply with weather limitations of ASTM D 3910.
- 3. Asphalt Base Course: Minimum surface temperature of 40 deg F (4 deg C) and rising at time of placement.
- 4. Asphalt Surface Course: Minimum surface temperature of 60 deg F (15.5 deg C) at time of placement.
- B. Pavement-Marking Paint: Proceed with pavement marking only on clean, dry surfaces and at a minimum ambient or surface temperature of 40 deg F (4 deg C) for oil-based materials, 50 deg F (10 deg C) for water-based materials, and not exceeding 95 deg F (35 deg C).

PART 2 PRODUCTS

2.1 AGGREGATES

- A. General: Use materials and gradations that have performed satisfactorily in previous installations.
- B. Coarse Aggregate: Sound; angular crushed stone; crushed gravel; or properly cured, crushed blast-furnace slag; complying with ASTM D 692.
- C. Fine Aggregate: Sharp-edged natural sand or sand prepared from stone; gravel, properly cured blast-furnace slag, or combinations thereof; complying with ASTM D 1073.
 - 1. For hot-mix asphalt, limit natural sand to a maximum of 20 percent by weight of the total aggregate mass.
- D. Mineral Filler: Rock or slag dust, hydraulic cement, or other inert material complying with ASTM D 242.

2.2 ASPHALT MATERIALS

- A. Asphalt Cement: ASTM D 3381 for viscosity-graded material; ASTM D 946 for penetrationgraded material.
- B. Asphalt Cement: ASTM D 3381 for viscosity-graded material.
- C. Undersealing Asphalt: ASTM D 3141, pumping consistency.
- D. Prime Coat: ASTM D 2027; medium-curing cutback asphalt; MC-30, MC-70, or MC-250.
- E. Prime Coat: Asphalt emulsion prime conforming to state DOT requirements.
- F. Prime Coat: ASTM D 977, emulsified asphalt or ASTM D 2397, cationic emulsified asphalt, slow setting, factory diluted in water, of suitable grade and consistency for application.
- G. Tack Coat: ASTM D 977, emulsified asphalt or ASTM D 2397, cationic emulsified asphalt, slow setting, factory diluted in water, of suitable grade and consistency for application.
- H. Fog Seal: ASTM D 977, emulsified asphalt or ASTM D 2397, cationic emulsified asphalt, slow setting, factory diluted in water, of suitable grade and consistency for application.
- I. Water: Potable.

- 2.3 AUXILIARY MATERIALS
 - A. Sand: ASTM D 1073, Grade Nos. 2 or 3.
 - B. Pavement-Marking Paint: Alkyd-resin type, ready-mixed, complying with FS TT-P-115, Type I, or AASHTO M-248, Type N.
 - C. Pavement-Marking Paint: Latex, water-base emulsion, ready-mixed, complying with FS TT-P-1952.
 - 1. Color: As indicated.

2.4 MIXES

- A. Hot-Mix Asphalt: Provide dense, hot-laid, hot-mix asphalt plant mixes approved by authorities having jurisdiction; designed according to procedures in Al's "Mix Design Methods for Asphalt Concrete and Other Hot-Mix Types"; and complying with the following requirements:
 - 1. Provide mixes with a history of satisfactory performance in geographical area where Project is located.
 - 2. Base Course: As indicated.
 - 3. Surface Course: As indicated.
- B. Hot-Mix Asphalt: Provide dense, hot-laid, hot-mix asphalt plant mixes approved by authorities having jurisdiction and designed according to procedures in AI's "Mix Design Methods for Asphalt Concrete and Other Hot-Mix Types."
 - 1. Provide mixes with a history of satisfactory performance in geographical area where Project is located.
 - 2. Provide mixes complying with the composition, grading, and tolerance requirements of ASTM D 3515 for the following nominal, maximum aggregate sizes:
 - a. Base Course: 1 inch (25 mm).
 - b. Surface Course: 1/2 inch (13 mm).

PART 3 EXECUTION

- 3.1 EXAMINATION
 - A. Verify that subgrade is dry and in suitable condition to support paving and imposed loads.
 - B. Proof-roll subbase using heavy, pneumatic-tired rollers to locate areas that are unstable or that require further compaction.
 - C. Notify Architect in writing of any unsatisfactory conditions. Do not begin paving installation until these conditions have been satisfactorily corrected.

3.2 COLD MILLING

- A. Clean existing paving surface of loose and deleterious material immediately before cold milling. Remove existing asphalt pavement, inlcuding hot-mix asphaly and, as necessary, unboundaggregate base course, by cold milling to grades and cross sections indicated.
 - 1. Repair or replace curbs, manholes, and other construction damaged during cold milling.

3.3 PATCHING AND REPAIRS

- A. Patching: Saw cut perimeter of patch and excavate existing pavement section to sound base. Recompact new subgrade. Excavate rectangular or trapezoidal patches, extending 12 inches (300 mm) into adjacent sound pavement, unless otherwise indicated. Cut excavation faces vertically.
 - 1. Tack coat faces of excavation and allow to cure before paving.
 - 2. Fill excavation with dense-graded, hot-mix asphalt base mix and, while still hot, compact flush with adjacent surface.
 - 3. Partially fill excavation with dense-graded, hot-mix asphalt base mix and compact while still hot. Cover asphalt base course with compacted, hot-mix surface layer finished flush with adjacent surfaces.
- B. Tack Coat: Apply uniformly to existing surfaces of previously constructed asphalt or portland cement concrete paving and to surfaces abutting or projecting into new, hot-mix asphalt pavement. Apply at a uniform rate of 0.05 to 0.15 gal./sq. yd. (0.2 to 0.7 L/sq. m) of surface.
 - 1. Allow tack coat to cure undisturbed before paving.
 - 2. Avoid smearing or staining adjoining surfaces, appurtenances, and surroundings. Remove spillages and clean affected surfaces.

3.4 SURFACE PREPARATION

- A. General: Immediately before placing asphalt materials, remove loose and deleterious material from substrate surfaces. Ensure that prepared subgrade is ready to receive paving.
 - 1. Sweep loose granular particles from surface of unbound-aggregate base course. Do not dislodge or disturb aggregate embedded in compacted surface of base course.

3.5 HOT-MIX ASPHALT PLACING

- A. Machine place hot-mix asphalt mix on prepared surface, spread uniformly, and strike off. Place asphalt mix by hand to areas inaccessible to equipment in a manner that prevents segregation of mix. Place each course to required grade, cross section, and thickness, when compacted.
 - 1. Place hot-mix asphalt base course in number of lifts and thicknesses indicated.
 - 2. Place hot-mix asphalt surface course in single lift.
 - 3. Spread mix at minimum temperature of 250 deg F (121 deg C).
 - 4. Begin applying mix along centerline of crown for crowned sections and on high side of one-way slopes, unless otherwise indicated.
 - 5. Regulate paver machine speed to obtain smooth, continuous surface free of pulls and tears in asphalt-paving mat.
- B. Place paving in consecutive strips not less than 10 feet (3 m) wide, except where infill edge strips of a lesser width are required.
 - 1. After first strip has been placed and rolled, place succeeding strips and extend rolling to overlap previous strips. Complete asphalt base course for a section before placing asphalt surface course.
- C. Promptly correct surface irregularities in paving course behind paver. Use suitable hand tools to remove excess material forming high spots. Fill depressions with hot-mix asphalt to prevent segregation of mix; use suitable hand tools to smooth surface.

- A. Construct joints to ensure continuous bond between adjoining paving sections. Construct joints free of depressions with same texture and smoothness as other sections of hot-mix asphalt course.
 - 1. Clean contact surfaces and apply tack coat.
 - 2. Offset longitudinal joints in successive courses a minimum of 6 inches (150 mm).
 - 3. Offset transverse joints in successive courses a minimum of 24 inches (600 mm).
 - 4. Construct transverse joints by bulkhead method or sawed vertical face method as described in Al's "The Asphalt Handbook."
 - 5. Compact joints as soon as hot-mix asphalt will bear roller weight without excessive displacement.
 - 6. Compact asphalt at joints to a density within 2 percent of specified course density.

3.7 COMPACTION

- A. General: Begin compaction as soon as placed hot-mix paving will bear roller weight without excessive displacement. Compact hot-mix paving with hot, hand tampers or vibratory-plate compactors in areas inaccessible to rollers.
 - 1. Complete compaction before mix temperature cools to 185 deg F (85 deg C).
- B. Breakdown Rolling: Accomplish breakdown or initial rolling immediately after rolling joints and outside edge. Examine surface immediately after breakdown rolling for indicated crown, grade, and smoothness. Repair surfaces by loosening displaced material, filling with hot-mix asphalt, and rerolling to required elevations.
- C. Intermediate Rolling: Begin intermediate rolling immediately after breakdown rolling, while hotmix asphalt is still hot enough to achieve specified density. Continue rolling until hot-mix asphalt course has been uniformly compacted to the following density:
 - 1. Average Density: 96 percent of reference laboratory density according to ASTM D 1559, but not less than 94 percent nor greater than 100 percent.
 - 2. Average Density: 92 percent of reference maximum theoretical density according to ASTM D 2041, but not less than 90 percent nor greater than 96 percent.
- D. Finish Rolling: Finish roll paved surfaces to remove roller marks while hot-mix asphalt is still warm.
- E. Edge Shaping: While surface is being compacted and finished, trim edges of pavement to proper alignment. Bevel edges while still hot, with back of rake or smooth iron. Compact thoroughly using tamper or other satisfactory method.
- F. Repairs: Remove paved areas that are defective or contaminated with foreign materials. Remove paving course over area affected and replace with fresh, hot-mix asphalt. Compact by rolling to specified density and surface smoothness.
- G. Protection: After final rolling, do not permit vehicular traffic on pavement until it has cooled and hardened.
- H. Erect barricades to protect paving from traffic until mixture has cooled enough not to become marked.
- 3.8 INSTALLATION TOLERANCES

- A. Thickness: Compact each course to produce the thickness indicated within the following tolerances:
 - 1. Base Course: Plus or minus 1/2 inch (13 mm).
 - 2. Surface Course: Plus 1/4 inch (6 mm), no minus.
- B. Surface Smoothness: Compact each course to produce a surface smoothness within the following tolerances as determined by using a 10-foot (3-m) straightedge applied transversely or longitudinally to paved areas:
 - 1. Base Course: 1/4 inch (6 mm).
 - 2. Surface Course: 1/8 inch (3 mm).
 - 3. Crowned Surfaces: Test with crowned template centered and at right angle to crown. Maximum allowable variance from template is 1/4 inch (6 mm).

3.9 PAVEMENT MARKING

- A. Do not apply pavement-marking paint until layout, colors, and placement have been verified with Architect.
- B. Allow paving to cure for 30 days before starting pavement marking.
- C. Sweep and clean surface to eliminate loose material and dust.
- D. Apply paint with mechanical equipment to produce pavement markings of dimensions indicated with uniform, straight edges. Apply at manufacturer's recommended rates to provide a minimum wet film thickness of 15 mils (0.4 mm).
 - 1. Broadcast glass spheres uniformly into wet pavement markings at a rate of 6 lb/gal. (0.72 kg/L).

3.10 FIELD QUALITY CONTROL

- A. Testing Agency: Contractor will engage a qualified independent testing agency to perform field inspections and tests and to prepare test reports.
 - 1. Testing agency will conduct and interpret tests and state in each report whether tested Work complies with or deviates from specified requirements.
- B. Additional testing, at Contractor's expense, will be performed to determine compliance of corrected Work with specified requirements.
- C. Thickness: In-place compacted thickness of hot-mix asphalt courses will be determined according to ASTM D 3549.
- D. Surface Smoothness: Finished surface of each hot-mix asphalt course will be tested for compliance with smoothness tolerances.
- E. In-Place Density: Samples of uncompacted paving mixtures and compacted pavement will be secured by testing agency according to ASTM D 979.
 - 1. Reference laboratory density will be determined by averaging results from 4 samples of hot-mix asphalt-paving mixture delivered daily to site, prepared according to ASTM D 1559, and compacted according to job-mix specifications.

- 2. Reference maximum theoretical density will be determined by averaging results from 4 samples of hot-mix asphalt-paving mixture delivered daily to site, prepared according to ASTM D 2041, and compacted according to job-mix specifications.
- 3. In-place density of compacted pavement will be determined by testing core samples according to ASTM D 1188 or ASTM D 2726.
 - a. One core sample will be taken for every 1000 sq. yd. (836 sq. m) or less of installed pavement, but in no case will fewer than 3 cores be taken.
 - Field density of in-place compacted pavement may also be determined by nuclear method according to ASTM D 2950 and correlated with ASTM D 1188 or ASTM D 2726.
- F. Remove and replace or install additional hot-mix asphalt where test results or measurements indicate that it does not comply with specified requirements.

END OF SECTION

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 exterior portland cement concrete paving for the following:
 - 1. Miscellaneous pads and items.
 - 2. Curbs and gutters.
 - 3. Walkways.
 - 4. Driveway aprons.
- B. Related Sections: The following Sections contain requirements that relate to this Section:
 - 1. Division 2 Section "Earthwork" for subgrade preparation, grading and subbase course.
 - 2. Division 2 Section "Pavement Joint Sealants" for joint fillers and sealants within concrete paving and at joints with adjacent construction

1.3 SUBMITTALS

- A. General: Submit the following according to the Conditions of the Contract and Division 1 Specification Sections.
- B. Product data for proprietary materials and items, including reinforcement and forming accessories, admixtures, joint systems, curing compounds, dry-shake finish materials, and others if requested by Architect.
- C. Design mixes for each class of concrete. Include revised mix proportions when characteristics of materials, project conditions, weather, test results, or other circumstances warrant adjustments.
- D. Laboratory test reports for evaluation of concrete materials and mix design tests.
- E. Material certificates in lieu of material laboratory test reports when permitted by Architect. Material certificates shall be signed by manufacturer and Contractor certifying that each material item complies with or exceeds requirements. Provide certification from admixture manufacturers that chloride content complies with requirements.

1.4 QUALITY ASSURANCE

- A. Concrete Standards: Comply with provisions of the following standards, except where more stringent requirements are indicated.
 - 1. American Concrete Institute (ACI) 301, "Specifications for Structural Concrete for Buildings."
 - 2. ACI 318, "Building Code Requirements for Reinforced Concrete."
 - 3. Concrete Reinforcing Steel Institute (CRSI) "Manual of Standard Practice."
- B. Concrete Manufacturer Qualifications: Manufacturer of ready-mixed concrete products complying with ASTM C 94 requirements for production facilities and equipment.

C. Concrete Testing Service: Engage a qualified independent testing agency to perform materials evaluation tests and to design concrete mixes.

PART 2 - PRODUCTS

2.1 FORMS

- A. Form Materials: Plywood, metal, metal-framed plywood, or other acceptable panel-type materials to provide full-depth, continuous, straight, smooth exposed surfaces. Use flexible or curved forms for curves of a 100-foot or less radius.
- B. Form Release Agent: Provide commercial formulation form-release agent with a maximum of 350 g/L volatile organic compounds (VOCs) that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces.
- 2.2 REINFORCING MATERIALS
 - A. Reinforcing Bars and Tie Bars: ASTM A 615, Grade 60, deformed.
 - B. Epoxy-Coated Reinforcing Bars: ASTM A 775 with ASTM A 615, Grade 60 deformed steel bars.
 - C. Plain, Cold-Drawn Steel Wire: ASTM A 82.
 - D. Welded Steel Wire Fabric: ASTM A 185. Furnish in flat sheets, not rolls, unless otherwise acceptable to Engineer.
 - E. Deformed-Steel Welded Wire Fabric: ASTM A 497.
 - F. Fabricated Bar Mats: Welded or clip-assembled steel bar mats, ASTM A 184. Use ASTM A 615, Grade 60 steel bars, unless otherwise indicated.
 - G. Joint Dowel Bars: Plain steel bars, ASTM A 615, Grade 60. Cut bars true to length with ends square and free of burrs.
 - H. Epoxy-Coated Joint Dowel Bars: ASTM A 775 with ASTM A 615, Grade 60 plain steel bars.
 - I. Supports for Reinforcement: Chairs, spacers, dowel bar supports and other devices for spacing, supporting, and fastening reinforcing bars, welded wire fabric, and dowels in place. Use wire bar-type supports complying with CRSI specifications.
 - 1. Use supports with sand plates or horizontal runners where base material will not support chair legs.

2.3 CONCRETE MATERIALS

- A. Portland Cement: ASTM C 150, Type I.
 - 1. Use one brand of cement throughout Project unless otherwise acceptable to Architect.
- B. Fly Ash: ASTM C 618, Type F.

- C. Normal-Weight Aggregates: ASTM C 33, Class 4, and as follows. Provide aggregates from a single source.
 - 1. Maximum Aggregate Size: 1-1/2 inches.
 - 2. Do not use fine or coarse aggregates that contain substances that cause spalling.
 - 3. Local aggregates not complying with ASTM C 33 that have been shown to produce concrete of adequate strength and durability by special tests or actual service may be used when acceptable to Architect.
- D. Water: Potable.
- E. Fiber Reinforcement: Synthetic fibers engineered and designed for secondary reinforcement of concrete slabs, complying with ASTM C 1116, Type III.

2.4 ADMIXTURES

- A. Provide concrete admixtures that contain not more than 0.1 percent chloride ions.
- B. Air-Entraining Admixture: ASTM C 260, certified by manufacturer to be compatible with other required admixtures.
- C. Water-Reducing Admixture: ASTM C 494, Type A.
- D. High-Range Water-Reducing Admixture: ASTM C 494, Type F or Type G.
- E. Water-Reducing and Accelerating Admixture: ASTM C 494, Type E.
- F. Water-Reducing and Retarding Admixture: ASTM C 494, Type D.
- G. Available Products: Subject to compliance with requirements, products that may be incorporated in the Work include, but are not limited to, the following:
- H. Products: Subject to compliance with requirements, provide one of the following:
 - 1. Air-Entraining Admixture:
 - a. Air-Tite or Amex 210; Cormix Construction Chemicals.
 - b. Sealtight AEA; W.R. Meadows, Inc.
 - c. Sika AER; Sika Corp.
 - d. or approved equal.
 - 2. Water-Reducing Admixture:
 - a. Chemtard; ChemMasters Corp.
 - b. Type A Series; Cormix Construction Chemicals.
 - c. Eucon WR-75; Euclid Chemical Co.
 - d. or approved equal.
 - 3. High-Range Water-Reducing Admixture:
 - a. Super P; Anti-Hydro Co., Inc.
 - b. Cormix 2000, PSI Super, or Melmet; Cormix Construction Chemicals.
 - c. Eucon 37; Euclid Chemical Co.
 - d. or approved equal.

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- 4. Water-Reducing and Accelerating Admixture:
 - a. Q-Set; Conspec Marketing & Manufacturing Co.
 - b. Gilco Accelerator or Lub NCA; Cormix Construction Chemicals.
 - c. Accelguard 80; Euclid Chemical Co.
 - d. or approved equal.
- 5. Water-Reducing and Retarding Admixture:
 - a. Type D Series; Cormix Construction Chemicals.
 - b. Eucon Retarder 75; Euclid Chemical Co.
 - c. Daratard-17; W.R. Grace & Co.
 - d. or approved equal.

2.5 CURING MATERIALS

- A. Absorptive Cover: Burlap cloth made from jute or kenaf, weighing approximately 9 oz. per sq. yd., complying with AASHTO M 182, Class 2.
- B. Moisture-Retaining Cover: One of the following, complying with ASTM C 171.
 - 1. Waterproof paper.
 - 2. Polyethylene film.
 - 3. White burlap-polyethylene sheet.
- C. Clear Waterborne Membrane-Forming Curing Compound: ASTM C 309, Type I, Class B.
 - 1. Provide material that has a maximum volatile organic compound (VOC) rating of 350 g/L.
 - 2. Clear Waterborne Membrane-Forming Curing Compound:
 - a. Clear Cure Water Base; Anti-Hydro Co., Inc.
 - b. Spartan Cote WB; The Burke Co.
 - c. W.B. Resin Cure; Conspec Marketing and Mfg. Co.
 - d. or approved equal.

2.6 RELATED MATERIALS

- A. Boiled Linseed Oil Mixture: Combination of boiled linseed oil and mineral spirits, complying with AASHTO M-233.
- B. Traffic Paint: Alkyd-resin ready-mixed, complying with AASHTO M 248, Type S.
 - 1. Color: White.
- C. Nonslip Aggregate Finish: Fused aluminum oxide granules or crushed emery as the abrasive aggregate for a nonslip finish, with emery aggregate containing not less than 50 percent aluminum oxide and not less than 25 percent ferric oxide. Use material that is factory-graded, packaged, rustproof, nonglazing, and unaffected by freezing, moisture, and cleaning materials.
- D. Dry-Shake Color Hardener: Packaged dry combination of materials consisting of portland cement, graded quartz aggregate, coloring pigments, and plasticizing admixture. Use coloring pigments that are finely ground nonfading mineral oxides interground with cement. Color as selected by Architect from manufacturers' standards, unless indicated otherwise.

- E. Bonding Agent: Acrylic or styrene butadiene.
- F. Epoxy Adhesive: ASTM C 881, two-component material suitable for dry or damp surfaces. Provide material type, grade, and class to suit requirements.

2.7 CONCRETE MIX

- A. Prepare design mixes for each type and strength of normal-weight concrete by either laboratory trial batch or field experience methods as specified in ACI 301.
- B. Proportion mixes according to ACI 211.1 and ACI 301 to provide normal-weight concrete with the following properties:
 - 1. Compressive Strength (28-Day): 4000 psi.
 - 2. Maximum Water-Cement Ratio at Point of Placement: 0.45.
 - 3. Slump Limit at Point of Placement: 3 inches.
 - a. Slump limit for concrete containing high-range water-reducing admixture (superplasticizer): Not more than 8 inches after adding admixture to site-verified 2-to-3-inch slump concrete.
- C. Add air-entraining admixture at manufacturer's prescribed rate to result in concrete at point of placement having an air content as follows with a tolerance of plus or minus 1-1/2 percent:
 - 1. Air Content: 5.5 percent for 1-1/2-inch maximum aggregate.
 - 2. Air Content: 6.0 percent for 1-inch maximum aggregate.
 - 3. Air Content: 6.0 percent for 3/4-inch maximum aggregate.
 - 4. Air Content: 7.0 percent for 1/2-inch maximum aggregate.
 - 5. Air Content: 2.5 to 4.5 percent.
- D. Fiber Reinforcement: Add to mix at rate of 1.5 lb per cu. yd., unless manufacturer recommends otherwise.
- E. Adjustment to Concrete Mixes: Mix design adjustments may be requested by Contractor when characteristics of materials, project conditions, weather, test results, or other circumstances warrant.

2.8 CONCRETE MIXING

- A. Ready-Mixed Concrete: Comply with requirements and with ASTM C 94.
 - When air temperature is between 85 deg F (30 deg C) and 90 deg F (32 deg C), reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F (32 deg C), reduce mixing and delivery time to 60 minutes.

PART 3 - EXECUTION

- 3.1 SURFACE PREPARATION
 - A. Proof-roll prepared subbase surface to check for unstable areas and verify need for additional compaction. Do not begin paving work until such conditions have been corrected and are ready to receive paving.
 - B. Remove loose material from compacted subbase surface immediately before placing concrete.

3.2 EDGE FORMS AND SCREED CONSTRUCTION

- A. Set, brace, and secure edge forms, bulkheads, and intermediate screed guides for paving to required lines, grades, and elevations. Install forms to allow continuous progress of work and so that forms can remain in place at least 24 hours after concrete placement.
- B. Check completed formwork and screeds for grade and alignment to following tolerances:
 - 1. Top of Forms: Not more than 1/8 inch in 10 feet.
 - 2. Vertical Face on Longitudinal Axis: Not more than 1/4 inch in 10 feet.
- C. Clean forms after each use and coat with form release agent as required to ensure separation from concrete without damage.

3.3 PLACING REINFORCEMENT

- A. General: Comply with Concrete Reinforcing Steel Institute's recommended practice for "Placing Reinforcing Bars" for placing and supporting reinforcement.
- B. Clean reinforcement of loose rust and mill scale, earth, ice, or other bond-reducing materials.
- C. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position during concrete placement. Maintain minimum cover to reinforcement.
- D. Install welded wire fabric in lengths as long as practicable. Lap adjoining pieces at least one full mesh and lace splices with wire. Offset laps of adjoining widths to prevent continuous laps in either direction.
- E. Install fabricated bar mats in lengths as long as practicable. Handle units to keep them flat and free of distortions. Straighten bends, kinks, and other irregularities or replace units as required before placement. Set mats for a minimum 2-inch overlap to adjacent mats.

3.4 JOINTS

- A. General: Construct contraction, construction, and isolation joints true to line with faces perpendicular to surface plane of concrete. Construct transverse joints at right angles to the centerline, unless indicated otherwise.
 - 1. When joining existing paving, place transverse joints to align with previously placed joints, unless indicated otherwise.
- B. Contraction Joints: Provide weakened-plane contraction joints, sectioning concrete into areas as shown on Drawings. Construct contraction joints for a depth equal to at least 1/4 of the concrete thickness, as follows:
 - 1. Tooled Joints: Form contraction joints in fresh concrete by grooving and finishing each edge of joint with a radiused jointer tool.
 - 2. Inserts: Form contraction joints by inserting premolded plastic, hardboard, or fiberboard strips into fresh concrete until top surface of strip is flush with paving surface. Radius each joint edge with a jointer tool. Carefully remove strips or caps of two-piece assemblies after concrete has hardened. Clean groove of loose debris.

- C. Construction Joints: Set construction joints at side and end terminations of paving and at locations where paving operations are stopped for more than 1/2 hour, unless paving terminates at isolation joints.
 - 1. Provide preformed galvanized steel or plastic keyway-section forms or bulkhead forms with keys, unless indicated otherwise. Embed keys at least 1-1/2 inches into concrete.
 - 2. Continue reinforcement across construction joints unless indicated otherwise. Do not continue reinforcement through sides of strip paving unless indicated.
 - 3. Provide tie bars at sides of paving strips where indicated.
 - 4. Use bonding agent on existing concrete surfaces that will be joined with fresh concrete.
- D. Isolation Joints: Form isolation joints of preformed joint filler strips abutting concrete curbs, catch basins, manholes, inlets, structures, walks, other fixed objects, and where indicated.
 - 1. Locate expansion joints at intervals of 50 feet, unless indicated otherwise.
 - 2. Extend joint fillers full width and depth of joint, not less than 1/2 inch or more than 1 inch below finished surface where joint sealant is indicated. Place top of joint filler flush with finished concrete surface when no joint sealant is required.
 - 3. Furnish joint fillers in one-piece lengths for full width being placed wherever possible. Where more than one length is required, lace or clip joint filler sections together.
 - 4. Protect top edge of joint filler during concrete placement with a metal, plastic, or other temporary preformed cap. Remove protective cap after concrete has been placed on both sides of joint.

3.5 CONCRETE PLACEMENT

- A. Inspection: Before placing concrete, inspect and complete formwork installation, reinforcing steel, and items to be embedded or cast in. Notify other trades to permit installation of their work.
- B. Remove snow, ice, or frost from subbase surface and reinforcing before placing concrete. Do not place concrete on surfaces that are frozen.
- C. Moisten subbase to provide a uniform dampened condition at the time concrete is placed. Do not place concrete around manholes or other structures until they are at the required finish elevation and alignment.
- D. Comply with requirements and with ACI 304R for measuring, mixing, transporting, and placing concrete.
- E. Deposit and spread concrete in a continuous operation between transverse joints. Do not push or drag concrete into place or use vibrators to move concrete into place.
 - 1. When concrete placing is interrupted for more than 1/2 hour, place a construction joint.
- F. Use a bonding agent at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
- G. Consolidate concrete by mechanical vibrating equipment supplemented by hand-spading, rodding, or tamping. Use equipment and procedures to consolidate concrete complying with ACI 309R.
 - 1. Consolidate concrete along face of forms and adjacent to transverse joints with an internal vibrator. Keep vibrator away from joint assemblies, reinforcement, or side forms.

Use only square-faced shovels for hand-spreading and consolidation. Consolidate with care to prevent dislocating reinforcing, dowels, and joint devices.

- H. Screed paved surfaces with a straightedge and strike off. Use bull floats or darbies to form a smooth surface plane before excess moisture or bleed water appears on the surface. Do not further disturb concrete surfaces prior to beginning finishing operations.
- I. Place concrete in two operations; strike off initial pour for entire width of placement and to the required depth below finish surface. Lay welded wire fabric or fabricated bar mats immediately in final position. Place top layer of concrete, strike off, and screed.
 - 1. Remove and replace portions of bottom layer of concrete that have been placed more than 15 minutes without being covered by top layer or use bonding agent if acceptable to Architect.
- J. Curbs and Gutters: When automatic machine placement is used for curb and gutter placement, submit revised mix design and laboratory test results that meet or exceed requirements. Produce curbs and gutters to required cross section, lines, grades, finish, and jointing as specified for formed concrete. If results are not acceptable, remove and replace with formed concrete.
- K. When adjoining pavement lanes are placed in separate pours, do not operate equipment on concrete until pavement has attained 85 percent of its 28-day compressive strength.
- L. Cold-Weather Placement: Comply with provisions of ACI 306R and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.
 - 1. When air temperature has fallen to or is expected to fall below 40 deg F (4 deg C), uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 50 deg F (10 deg C) and not more than 80 deg F (27 deg C) at point of placement.
 - 2. Do not use frozen materials or materials containing ice or snow.
 - 3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise accepted in mix designs.
- M. Hot-Weather Placement: Place concrete complying with ACI 305R and as specified when hot weather conditions exist.
 - Cool ingredients before mixing to maintain concrete temperature at time of placement to below 90 deg F (32 deg C). Mixing water may be chilled or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
 - 2. Cover reinforcing steel with water-soaked burlap if it becomes too hot, so that steel temperature will not exceed the ambient air temperature immediately before embedding in concrete.
 - 3. Fog spray forms, reinforcing steel, and subgrade just before placing concrete. Keep subgrade moisture uniform without standing water, soft spots, or dry areas.

3.6 CONCRETE FINISHING

A. Float Finish: Begin floating when bleed water sheen has disappeared and the concrete surface has stiffened sufficiently to permit operations. Float surface with power-driven floats, or by

hand-floating if area is small or inaccessible to power units. Finish surfaces to true planes within a tolerance of 1/4 inch in 10 feet as determined by a 10-foot-long straightedge placed anywhere on the surface in any direction. Cut down high spots and fill low spots. Refloat surface immediately to a uniform granular texture.

- 1. Medium-to-Fine-Textured Broom Finish: Draw a soft bristle broom across concrete surface perpendicular to line of traffic to provide a uniform fine line texture finish.
- 2. Medium-to-Coarse-Textured Broom Finish: Provide a coarse finish by striating surface 1/16 inch to 1/8 inch deep with a stiff-bristled broom, perpendicular to line of traffic.
- 3. Final Tooling: Tool edges of paving, gutters, curbs, and joints formed in fresh concrete with a jointing tool to the following radius. Repeat tooling of edges and joints after applying surface finishes. Eliminate tool marks on concrete surfaces.
- 4. Radius: 1/4 inch.

3.7 CONCRETE PROTECTION AND CURING

- A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with the recommendations of ACI 306R for cold weather protection and ACI 305R for hot weather protection during curing.
- B. Evaporation Control: In hot, dry, and windy weather, protect concrete from rapid moisture loss before and during finishing operations with an evaporation-control material. Apply according to manufacturer's instructions after screeding and bull floating, but before floating.
- C. Begin curing after finishing concrete but not before free water has disappeared from concrete surface.
- D. Curing Methods: Cure concrete by moisture curing, moisture-retaining-cover curing, curing compound, or a combination of these as follows:
 - 1. Moisture Curing: Keep surfaces continuously moist for not less than 7 days with the following materials:
 - a. Water.
 - b. Continuous water-fog spray.
 - c. Absorptive cover, water saturated, and kept continuously wet. Cover concrete surfaces and edges with a 12-inch lap over adjacent absorptive covers.
 - 2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches, and sealed by waterproof tape or adhesive. Immediately repair any holes or tears during curing period using cover material and waterproof tape.
 - 3. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's directions. Recoat areas subjected to heavy rainfall within 3 hours after initial application. Maintain continuity of coating and repair damage during curing period.

3.8 FIELD QUALITY CONTROL TESTING

- A. The Contractor will employ a qualified testing and inspection agency to sample materials, perform tests, and submit test reports during concrete placement. Sampling and testing for quality control may include the following:
 - 1. Sampling Fresh Concrete: ASTM C 172, except modified for slump to comply with ASTM C 94.

- a. Slump:
- b. Air Content:
- c. Concrete Temperature:
- d. Compression Test Specimens:
- e. Compressive-Strength Tests:
- B. Additional Tests: The testing agency will make additional tests of the concrete when test results indicate slump, air entrainment, concrete strengths, or other requirements have not been met, as directed by Architect. Testing agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42, or by other methods as directed.
- 3.9 REPAIRS AND PROTECTION
 - A. Remove and replace concrete paving that is broken, damaged, or defective, or does not meet the requirements of this Section.
 - B. Drill test cores where directed by Architect when necessary to determine magnitude of cracks or defective areas. Fill drilled core holes in satisfactory pavement areas with portland cement concrete bonded to paving with epoxy adhesive.
 - C. Protect concrete from damage. Exclude traffic from paving for at least 14 days after placement. When construction traffic is permitted, maintain paving as clean as possible by removing surface stains and spillage of materials as they occur.
 - D. Maintain concrete paving free of stains, discoloration, dirt, and other foreign material. Sweep concrete paving not more than 2 days prior to date scheduled for Substantial Completion inspections.

END OF SECTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including the General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes sewerage and drainage systems outside the building. Systems include the following:
 - 1. Storm drainage.
 - 2. Sanitary sewer.

1.3 DEFINITIONS

- A. Sewerage Piping: System of sewer pipes, fittings, and appurtenances for gravity flow of sanitary sewage.
- B. Drainage Piping: System of sewer pipe, fittings, and appurtenances for gravity flow of storm drainage.
- 1.4 PERFORMANCE REQUIREMENTS
 - A. Gravity-Flow, Nonpressure-Piping Pressure Ratings: At least equal to system test pressure.

1.5 SUBMITTALS

- A. General: Submit each item in this Article according to the Conditions of the Contract and Division 1 Specification Sections.
- B. Product data for the following:
 - 1. Storm drainage piping.
 - 2. Sanitary sewer piping.
- C. Shop drawings for precast concrete manholes and other structures. Include frames, covers, and grates.
- D. Shop drawings for cast-in-place concrete or field-erected masonry manholes and other structures. Include frames, covers, and grates.
- E. Reports and calculations for design mixes for each class of cast-in-place concrete.
- F. Coordination drawings showing manholes and other structures, pipe sizes, locations, and elevations. Include details of underground structures and connections. Show other piping in same trench and clearances from sewerage system piping. Indicate interface and spatial relationship between piping and proximate structures.
- G. Inspection and test reports specified in the "Field Quality Control" Article.

1.6 QUALITY ASSURANCE

- A. Environmental Agency Compliance: Comply with regulations pertaining to sanitary sewerage and storm drainage systems.
- B. Utility Compliance: Comply with regulations pertaining to sanitary sewerage and storm drainage systems. Include standards of water and other utilities where appropriate.
- C. Product Options: Drawings indicate sizes, profiles, connections, and dimensional requirements of system components and are based on specific manufacturer types indicated. Other manufacturers' products with equal performance characteristics may be considered. Refer to Division 1 Section "Product Substitutions."
- 1.7 DELIVERY, STORAGE, AND HANDLING
 - A. Do not store plastic structures in direct sunlight.
 - B. Do not store plastic pipe or fittings in direct sunlight.
 - C. Protect pipe, pipe fittings, and seals from dirt and damage.
 - D. Handle precast concrete manholes and other structures according to manufacturer's rigging instructions.
- 1.8 PROJECT CONDITIONS
 - A. Site Information: Perform site survey, research public utility records, and verify existing utility locations.
 - B. Locate existing structures and piping to be closed and abandoned.
 - C. Existing Utilities: Do not interrupt existing utilities serving facilities occupied by the Owner or others except when permitted under the following conditions and then only after arranging to provide acceptable temporary utility services.
 - 1. Notify Architect not less than 48 hours in advance of proposed utility interruptions.
 - 2. Do not proceed with utility interruptions without receiving Architect's written permission.
- 1.9 SEQUENCING AND SCHEDULING
 - A. Coordinate with interior building drainage systems.
 - B. Coordinate with other utility work.

PART 2 - PRODUCTS

- 2.1 PIPES AND FITTINGS
 - A. Polyvinyl Chloride (PVC) Sewer Pipe and Fittings: ASTM D 3034, SDR 35, for solventcemented or gasketed joints.
 - 1. Primer: ASTM F 656.
 - 2. Solvent Cement: ASTM D 2564.
 - 3. Gaskets: ASTM F 477, elastomeric seal.

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- B. Reinforced-Concrete Sewer Pipe and Fittings: ASTM C 76 (ASTM C 76M), Class III, Wall B, for gasketed joints.
 - 1. Gaskets: ASTM C 443 (ASTM C 443M), rubber.
- C. High Density Polyethylene (HDPE) Pipe and Fittings: ASTM D2321 and ASTM F2306
- 2.2 CATCH BASINS
 - A. Precast Concrete Catch Basins: ASTM C 478 (ASTM C 478M), precast, reinforced concrete, of depth indicated, with provision for rubber gasket joints.
 - 1. Base Section: 6-inch (150-mm) minimum thickness for floor slab and 4-inch (100-mm) minimum thickness for walls and base riser section, and having a separate base slab or base section with integral floor.
 - 2. Riser Sections: 4-inch (100-mm) minimum thickness; 48-inch (1220-mm) diameter, and lengths to provide depth indicated.
 - 3. Top Section: Eccentric cone type, unless concentric cone or flat-slab-top type is indicated. Top of cone of size that matches grade rings.
 - 4. Grade Rings: Include 2 or 3 reinforced-concrete rings, of 6- to 9-inch (152- to 229-mm) total thickness, that match a 30-inch- (760-mm-) diameter frame and grate.
 - 5. Steps: Fiber glass, individual steps or ladder. Include a width that allows a worker to place both feet on one step and is designed to prevent lateral slippage off the step. Cast steps or anchor ladder into base, riser, and top section sidewalls at 12- to 16-inch (300- to 400-mm) intervals. Omit steps for catch basins less than 60 inches (1500 mm) deep.
 - 6. Steps: ASTM C 478 (ASTM C 478M) individual steps or ladder. Omit steps for catch basins less than 60 inches (1500 mm) deep.
 - 7. Pipe Connectors: ASTM C 923 (ASTM C 923M), resilient, of size required, for each pipe connecting to base section.
 - B. Brick Catch Basins: Brick and mortar, of depth, shape, and dimensions indicated.
 - 1. Base, Channel, and Bench: Concrete.
 - 2. Wall: ASTM C 32, Grade MS, manhole brick; 8-inch (200-mm) minimum thickness with tapered top for a 24-inch (610-mm) frame and cover.
 - a. Option: ASTM C 139, concrete masonry units may be used instead of brick.
 - 3. Mortar: ASTM C 270, Type S, using ASTM C 150, Type II, portland cement.
 - 4. Steps: Fiber glass, individual steps or ladder. Include a width that allows a worker to place both feet on one step and is designed to prevent lateral slippage off the step. Cast steps or anchor ladder into sidewalls at 12- to 16-inch (300- to 400-mm) intervals. Omit steps for catch basins less than 60 inches (1500 mm) deep.
 - C. Frames and Grates: ASTM A 536, Grade 60-40-18, heavy-duty ductile iron, 30-inch (760-mm) inside diameter by 7- to 9-inch (178- to 229-mm) riser with 4-inch (100-mm) minimum width flange, and 31 3/4-inch- (660-mm-) diameter flat grate having small square or short-slotted drainage openings.
- 2.3 CONCRETE
 - A. General: Cast-in-place concrete according to ACI 318, ACI 350R, and the following:
 - 1. Cement: ASTM C 150, Type II.

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- 2. Fine Aggregate: ASTM C 33, sand.
- 3. Coarse Aggregate: ASTM C 33, crushed gravel.
- 4. Water: Potable.
- B. Structures: Portland-cement design mix, 4000 psi (27.6 MPa) minimum, with 0.45 maximum water-cement ratio.
 - 1. Reinforcement Fabric: ASTM A 185, steel, welded wire fabric, plain.
 - 2. Reinforcement Bars: ASTM A 615, Grade 60 (ASTM A 615M, Grade 400), deformed steel.
- C. Structure Channels and Benches: Factory or field formed from concrete. Portland-cement design mix, 4000 psi (27.6 MPa) minimum, with 0.45 maximum water-cement ratio.
 - 1. Include channels and benches in manholes.
 - 2. Include channels and benches in sanitary sewerage manholes.
 - a. Manhole Channels: Concrete invert, formed to same width as connected piping, with height of the vertical sides to 3/4 of the pipe diameter. Form curved channels with smooth, uniform radius and slope.
 - 1) Invert Slope: 1.2 inches (30 mm) through manhole.
 - b. Manhole Benches: Concrete, sloped to drain into channel.
 - 1) Slope: 1 inch per foot (1:12).
- D. Ballast and Pipe Supports: Portland-cement design mix, 3000 psi (20.7 MPa) minimum, with 0.58 maximum water-cement ratio.
 - 1. Reinforcement Fabric: ASTM A 185, steel, welded wire fabric, plain.
 - 2. Reinforcement Bars: ASTM A 615, Grade 60 (ASTM A 615M, Grade 400), deformed steel.

2.4 PROTECTIVE COATINGS

- A. General: Include factory- or field-applied protective coatings to structures and appurtenances according to the following:
- B. Coating: 1- or 2-coat, coal-tar epoxy, 15-mil (0.381-mm) minimum thickness, except where otherwise indicated.
 - 1. Catch Basins: On exterior surface.
 - 2. Catch Basin Frames and Grates: On entire surfaces.

PART 3 - EXECUTION

- 3.1 EARTHWORK
 - A. Excavating, trenching, and backfilling are specified in Division 2 Section "Earthwork."

3.2 IDENTIFICATION

- A. Materials and their installation are specified in Division 2 Section "Earthwork." Arrange for installation of green warning tapes directly over piping and at outside edges of underground structures.
 - 1. Use warning tapes or detectable warning tape over ferrous piping.
 - 2. Use detectable warning tape over nonferrous piping and over edges of underground structures.

3.3 SEWERAGE PIPING APPLICATIONS

- A. General: Include watertight joints.
- B. Refer to Part 2 of this Section for detailed specifications for pipe and fitting products listed below. Use pipe, fittings, and joining methods according to the following applications.
- C. Pipe Sizes 8 and 10 Inches (200 and 250 mm): ASTM D 3034, polyvinyl chloride (PVC) sewer pipe and fittings; solvent-cemented joints; or with gaskets and gasketed joints.

3.4 DRAINAGE PIPING APPLICATIONS

- A. General: Include watertight, silttight, or soiltight joints, except where watertight or silttight joints are indicated.
- B. Refer to Part 2 of this Section for detailed specifications for pipe and fitting products listed below. Use pipe, fittings, and joining methods according to the following applications.
- C. Pipe Sizes 18 to 36 Inches (450 to 900 mm): Reinforced-concrete sewer pipe and fittings; rubber gaskets; and gasketed joints.
- D. Pipe Sizes 42 to 144 Inches (1050 to 3600 mm): Reinforced-concrete sewer pipe and fittings; rubber gaskets; and gasketed joints.

3.5 INSTALLATION, GENERAL

- A. General Locations and Arrangements: Drawings (plans and details) indicate the general location and arrangement of underground sewerage and drainage systems piping. Location and arrangement of piping layout take into account many design considerations. Install piping as indicated, to extent practical.
- B. Install piping beginning at low point of systems, true to grades and alignment indicated with unbroken continuity of invert. Place bell ends of piping facing upstream. Install gaskets, seals, sleeves, and couplings according to manufacturer's recommendations for use of lubricants, cements, and other installation requirements. Maintain swab or drag in line and pull past each joint as it is completed.
- C. Use manholes for changes in direction, except where fittings are indicated. Use fittings for branch connections, except where direct tap into existing sewer is indicated.
- D. Use proper size increasers, reducers, and couplings, where different sizes or materials of pipes and fittings are connected. Reduction of the size of piping in the direction of flow is prohibited.

- E. Install gravity-flow-systems piping at constant slope between points and elevations indicated. Install straight piping runs at constant slope, not less than that specified, where slope is not indicated.
- F. Extend sewerage piping and connect to building's sanitary drains, of sizes and in locations indicated. Terminate piping as indicated.
- G. Extend drainage piping and connect to building's storm drains, of sizes and in locations indicated. Terminate piping as indicated.

3.6 PIPE JOINT CONSTRUCTION AND INSTALLATION

- A. General: Join and install pipe and fittings according to the following.
- B. Polyvinyl Chloride (PVC) Plastic Pipe and Fittings: As follows:
 - 1. Join solvent-cement-joint pipe and fittings with solvent cement according to ASTM D 2855 and ASTM F 402.
 - 2. Join pipe and gasketed fittings with elastomeric seals according to ASTM D 2321.
 - 3. Join profile sewer pipe and ribbed drain pipe and gasketed fittings with elastomeric seals according to ASTM D 2321 and manufacturer's written instruction.
 - 4. Install according to ASTM D 2321.
- C. Concrete Pipe and Fittings: Install according to ACPA "Concrete Pipe Handbook." Use the following seals:
 - 1. Round Pipe and Fittings: ASTM C 443 (ASTM C 443M), rubber gaskets.
 - 2. Elliptical Pipe: ASTM C 877 (ASTM C 877M), Type I, sealing bands.
 - 3. Arch Pipe: ASTM C 877 (ASTM C 877M), Type I, sealing bands.
- D. High Density Polyethylene (HDPE) Pipe and Fittings
 - 1. Join pipe and gasketed fittings according to ASTM D2321.
 - 2. Fittings and joints shall conform to ASTM F2306.
- 3.7 CATCH BASIN INSTALLATION
 - A. Construct catch basins to sizes and shapes indicated.
 - B. Set frames and grates to elevations indicated.

3.8 CONCRETE PLACEMENT

- A. Place cast-in-place concrete according to ACI 318, ACI 350R, and as indicated.
- 3.9 FIELD QUALITY CONTROL
 - A. Clear interior of piping and structures of dirt and superfluous material as the work progresses. Maintain swab or drag in piping and pull past each joint as it is completed.
 - 1. In large, accessible piping, brushes and brooms may be used for cleaning.
 - 2. Place plug in end of incomplete piping at end of day and whenever work stops.
 - 3. Flush piping between manholes and other structures, if required by authorities having jurisdiction, to remove collected debris.

- B. Inspect interior of piping to determine whether line displacement or other damage has occurred. Inspect after approximately 24 inches (600 mm) of backfill is in place, and again at completion of the Project.
 - 1. Submit separate reports for each system inspection.
 - 2. Defects requiring correction include the following:
 - a. Alignment: Less than full diameter of inside of pipe is visual between structures.
 - b. Deflection: Flexible piping with deflection that prevents passage of a ball or cylinder of a size not less than 92.5 percent of piping diameter.
 - c. Crushed, broken, cracked, or otherwise damaged piping.
 - d. Infiltration: Water leakage into piping.
 - e. Exfiltration: Water leakage from or around piping.
 - 3. Replace defective piping using new materials and repeat inspections until defects are within allowances specified.
 - 4. Reinspect and repeat procedure until results are satisfactory.
- C. Test new piping systems and parts of existing systems that have been altered, extended, or repaired for leaks and defects.
 - 1. Do not enclose, cover, or put into service before inspection and approval.
 - 2. Test completed piping systems according to authorities having jurisdiction.
 - 3. Schedule tests, and their inspections by authorities having jurisdiction, with at least 24 hours' advance notice.
 - 4. Submit separate reports for each test.
 - 5. Where authorities having jurisdiction do not have published procedures, perform tests as follows:
 - a. Sanitary Sewerage: Perform air test according to UNI-B-6.
 - 1) Option: Test concrete piping according to ASTM C 924 (ASTM C 924M).
 - 6. Manholes: Perform hydraulic test according to ASTM C 969 (ASTM C 969M).
 - 7. Leaks and loss in test pressure constitute defects that must be repaired.
 - 8. Replace leaking piping using new materials and repeat testing until leakage is within allowances specified.

END OF SECTION

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. Fine grading and preparing lawn areas.
 - 2. Furnishing and applying new topsoil.
 - 3. Furnishing and applying soil amendments.
 - 4. Furnishing and applying fertilizers.
 - 5. Seeding new lawns.
 - 6. Replanting unsatisfactory or damaged lawns.
- B. Related Sections: The following Sections contain requirements that relate to this Section:
 - 1. Division 2 Section "Site Clearing" for protection of existing trees and planting, topsoil stripping and stockpiling, and site clearing.
 - 2. Division 2 Section "Earthwork" for excavation, filling, rough grading, and subsurface aggregate drainage and drainage backfill.

1.3 SUBMITTALS

- A. General: Submit each item in this Article according to the Conditions of the Contract and Division 1 Specification Sections.
- B. Product data for the following:
 - 1. Seed Mix.
 - 2. Fertilizers.
- C. Maintenance instructions recommending procedures to be established by Owner for maintenance of landscaping during an entire year. Submit before expiration of required maintenance periods.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: Engage an experienced Installer who has completed landscaping work similar in material, design, and extent to that indicated for this Project and with a record of successful grass establishment. Require Installer to maintain an experienced full-time supervisor on the Project site during times that grass planting is in progress.
- B. Topsoil Analysis: Furnish a soil analysis made by a qualified independent soil-testing agency stating percentages of organic matter, inorganic matter (silt, clay, and sand), deleterious material, pH, and mineral and plant-nutrient content of topsoil.
 - 1. Report suitability of topsoil for lawn growth. 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.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Seed: Deliver seed in original sealed, labeled, and undamaged containers.

1.6 COORDINATION AND SCHEDULING

- A. Planting Season: Sow lawn seed and install sod during normal planting seasons for type of lawn work required. Correlate planting with specified maintenance periods to provide required maintenance from date of Substantial Completion.
- B. Weather Limitations: Proceed with planting only when existing and forecast weather conditions are suitable for work.

1.7 MAINTENANCE

- A. Begin maintenance of lawns immediately after each area is planted and continue until acceptable lawn is established, but for not less than the following periods:
 - 1. Seeded Lawns: 60 days after date of Substantial Completion.
 - a. When full maintenance period has not elapsed before end of planting season, or if lawn is not fully established at that time, continue maintenance during next planting season.
- B. Maintain and establish lawns by watering, fertilizing, weeding, mowing, trimming, replanting, and other operations. Roll, regrade, and replant bare or eroded areas and remulch to produce a uniformly smooth lawn.
 - 1. Replant bare areas with same materials specified for lawns.
 - 2. Add new mulch in areas where mulch has been disturbed by wind or maintenance operations sufficiently to nullify its purpose. Anchor as required to prevent displacement.
- C. Watering: Provide and maintain temporary piping, hoses, and lawn-watering equipment to convey water from sources and to keep lawns uniformly moist to a depth of 4 inches (100 mm).
 - 1. Lay out temporary lawn-watering system and arrange watering schedule to prevent wilting, puddling, erosion, and displacement of seed or mulch. Lay out temporary watering system to avoid walking over muddy or newly seeded, plugged, or sprigged areas.
 - 2. Water lawn at the minimum rate of 1 inch (25 mm) per week.
- D. Mow lawns as soon as there is enough top growth to cut with mower set at specified height for principal species planted. Repeat mowing as required to maintain specified height without cutting more than 40 percent of the grass height. Remove no more than 40 percent of grass-leaf growth in initial or subsequent mowings. Do not delay mowing until grass blades bend over and become matted. Do not mow when grass is wet. Schedule initial and subsequent mowings to maintain following grass height:
 - 1. Mow grass from 2 to 3 inches (50 to 75 mm) high.
- E. Postfertilization: Apply fertilizer to lawn after first mowing and when grass is dry.
 - 1. Use fertilizer that will provide actual nitrogen of at least 1 lb per 1000 sq. ft. (0.5 kg per 100 sq. m) of lawn area.

PART 2 - PRODUCTS

2.1 SEED

- A. Grass Seed: Fresh, clean, dry, new-crop seed complying with the Association of Official Seed Analysts' "Rules for Testing Seeds" for purity and germination tolerances.
 - 1. Seed Mixture: Provide seed of grass species and varieties, proportions by weight, and minimum percentages of purity, germination, and maximum percentage of weed seed as indicated on Schedules at the end of this Section.

2.2 TOPSOIL

- A. Topsoil: ASTM D 5268, pH range of 5.5 to 7, 4 percent organic material minimum, free of stones 1 inch (25 mm) or larger in any dimension, and other extraneous materials harmful to plant growth.
 - 1. Topsoil Source: Reuse surface soil stockpiled on the site. Verify suitability of surface soil to produce topsoil meeting requirements and amend when necessary. Supplement with imported topsoil when quantities are insufficient. Clean topsoil of roots, plants, sods, stones, clay lumps, and other extraneous materials harmful to plant growth.
 - 2. Topsoil Source: Import topsoil from off-site sources. Obtain topsoil from naturally welldrained sites where topsoil occurs at least 4 inches (100 mm) deep; do not obtain from bogs or marshes.

2.3 SOIL AMENDMENTS

- A. Lime: ASTM C 602, Class T, agricultural limestone containing a minimum 80 percent calcium carbonate equivalent, with a minimum 99 percent passing a No. 8 (2.36 mm) sieve and a minimum 75 percent passing a No. 60 (250 micrometer) sieve.
- B. Aluminum Sulfate: Commercial grade, unadulterated.
- C. Sand: Clean, washed, natural or manufactured sand, free of toxic materials.
- D. Perlite: Horticultural perlite, soil amendment grade.
 - 1. When site treated, mix with at least 0.15 lb (2.4 kg) of ammonium nitrate or 0.25 lb (4 kg) of ammonium sulfate per cu. ft. (cu. m) of loose sawdust or ground bark.
- G. Manure: Well-rotted, unleached stable or cattle manure containing not more than 25 percent by volume of straw, sawdust, or other bedding materials; free of toxic substances, stones, sticks, soil, weed seed, and material harmful to plant growth.
- H. Herbicides: EPA registered and approved, of type recommended by manufacturer.
- I. Water: Potable.

2.4 FERTILIZER

- A. Commercial Fertilizer: Commercial-grade complete fertilizer of neutral character, consisting of fast- and slow-release nitrogen, 50 percent derived from natural organic sources of urea-form, phosphorous, and potassium.
- B. Slow-Release Fertilizer: Granular fertilizer consisting of 50 percent water-insoluble nitrogen, phosphorus, and potassium.

2.5 MULCHES

- A. Straw Mulch: Provide air-dry, clean, mildew- and seed-free, salt hay or threshed straw of wheat, rye, oats, or barley.
- B. Fiber Mulch: Biodegradable dyed-wood cellulose-fiber mulch, nontoxic, free of plant growth- or germination-inhibitors, with maximum moisture content of 15 percent and a pH range of 4.5 to 6.5.

2.6 EROSION-CONTROL MATERIALS

- A. Blankets: Biodegradable wood excelsior, straw, or coconut-fiber mat enclosed in a photodegradable plastic mesh. Include manufacturer's recommended steel wire staples, 6 inches (150 mm) long.
- B. Fiber Mesh: Biodegradable twisted jute or spun-coir mesh, 0.92 lb per sq. yd. (0.5 kg per sq. m) minimum, with 50 to 65 percent open area. Include manufacturer's recommended steel wire staples, 6 inches (150 mm) long.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas to receive lawns and grass for compliance with requirements and for conditions affecting performance of work of this Section. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Protect structures, utilities, sidewalks, pavements, and other facilities, trees, shrubs, and plantings from damage caused by planting operations.
 - 1. Protect adjacent and adjoining areas from hydroseed overspraying.
- B. Provide erosion-control measures to prevent erosion or displacement of soils and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways.

3.3 PLANTING SOIL PREPARATION

- A. Limit subgrade preparation to areas that will be planted in the immediate future.
- B. Loosen subgrade to a minimum depth of 4 inches (100 mm). Remove stones larger than 1-1/2 inches (38 mm) in any dimension and sticks, roots, rubbish, and other extraneous matter.
- C. Mix soil amendments and fertilizers with topsoil at rates indicated. Delay mixing fertilizer if planting does not follow placing of planting soil within a few days. Either mix soil before spreading or apply soil amendments on surface of spread topsoil and mix thoroughly into top 4 inches (100 mm) of topsoil before planting.
 - 1. A "Planting Soil Amendments Schedule" is included at the end of this Section.
 - 2. Mix lime with dry soil prior to mixing fertilizer.
 - 3. Apply superphosphate fertilizer directly to subgrade before tilling, at the rate indicated.

- D. Spread planting soil mixture to depth required to meet thickness, grades, and elevations shown, after light rolling and natural settlement. Do not spread if planting soil or subgrade is frozen.
 - 1. Place approximately 1/2 the thickness of planting soil mixture required. Work into top of loosened subgrade to create a transition layer and then place remainder of planting soil mixture.
 - 2. Allow for sod thickness in areas to be sodded.
- E. Preparation of Unchanged Grades: Where lawns are to be planted in areas unaltered or undisturbed by excavating, grading, or surface soil stripping operations, prepare soil as follows:
 - 1. Remove and dispose of existing grass, vegetation, and turf. Do not turn over into soil being prepared for lawns.
 - 2. Till surface soil to a depth of at least 6 inches (150 mm). Apply required soil amendments and initial fertilizers and mix thoroughly into top 4 inches (100 mm) of soil. Trim high areas and fill in depressions. Till soil to a homogenous mixture of fine texture.
 - 3. Clean surface soil of roots, plants, sod, stones, clay lumps, and other extraneous materials harmful to plant growth.
 - 4. Remove waste material, including grass, vegetation, and turf, and legally dispose of it off the Owner's property.
- F. Grade lawn and grass areas to a smooth, even surface with loose, uniformly fine texture. Roll and rake, remove ridges, and fill depressions to meet finish grades. Limit fine grading to areas that can be planted in the immediate future. Remove trash, debris, stones larger than 1-1/2 inches (38 mm) in any dimension, and other objects that may interfere with planting or maintenance operations.
- G. Moisten prepared lawn areas before planting when soil is dry. Water thoroughly and allow surface to dry before planting. Do not create muddy soil.
- H. Restore prepared areas if eroded or otherwise disturbed after fine grading and before planting.

3.4 SEEDING NEW LAWNS

- A. Sow seed with a spreader or a seeding machine. Do not broadcast or drop seed when wind velocity exceeds 5 mph (8 km/h). Evenly distribute seed by sowing equal quantities in 2 directions at right angles to each other.
 - 1. Do not use wet seed or seed that is moldy or otherwise damaged in transit or storage.
- B. Sow seed at the following rates:
 - 1. Seeding Rate: 3 to 4 lb per 1000 sq. ft. (1.5 to 2 kg per 100 sq. m).
- C. Rake seed lightly into top 1/8 inch (3 mm) of topsoil, roll lightly, and water with fine spray.
- D. Protect seeded slopes exceeding 1:4 against erosion with erosion-control blankets installed and stapled according to manufacturer's recommendations.
- E. Protect seeded slopes exceeding 1:6 against erosion with jute or coir-fiber erosion-control mesh installed and stapled according to manufacturer's recommendations.
- F. Protect seeded areas with slopes less than 1:6 against erosion by spreading straw mulch after completion of seeding operations. Spread uniformly at a minimum rate of 2 tons per acre (45 kg

per 100 sq. m) to form a continuous blanket 1-1/2 inches (38 mm) loose depth over seeded areas. Spread by hand, blower, or other suitable equipment.

- 1. Anchor straw mulch by crimping into topsoil by suitable mechanical equipment.
- 2. Anchor straw mulch by spraying with asphalt-emulsion tackifier at the rate of 10 to 13 gal. per 1000 sq. ft. (41 to 53 L per 100 sq. m). Take precautions to prevent damage or staining of structures or other plantings adjacent to mulched areas. Immediately clean damaged or stained areas.
- G. Protect seeded areas against hot, dry weather or drying winds by applying peat mulch within 24 hours after completion of seeding operations. Soak and scatter uniformly to a depth of 3/16 inch (4.8 mm) thick and roll to a smooth surface.

3.5 HYDROSEEDING NEW LAWNS

- A. Hydroseeding: Mix specified seed, fertilizer, and fiber mulch in water, using equipment specifically designed for hydroseed application. Continue mixing until uniformly blended into homogenous slurry suitable for hydraulic application.
 - 1. Mix slurry with nonasphaltic tackifier.
 - 2. Apply slurry uniformly to all areas to be seeded in a 1-step process. Apply mulch at the minimum rate of 1500 lb per acre (16.5 kg per 100 sq. m) dry weight but not less than the rate required to obtain specified seed-sowing rate.

3.6 SATISFACTORY LAWN

- A. Seeded lawns will be satisfactory provided requirements, including maintenance, have been met and a healthy, uniform, close stand of grass is established, free of weeds, bare spots exceeding 5 by 5 inches (125 by 125 mm), and surface irregularities.
- B. Replant lawns that do not meet requirements and continue maintenance until lawns are satisfactory.

3.7 CLEANUP AND PROTECTION

- A. Promptly remove soil and debris created by lawn work from paved areas. Clean wheels of vehicles before leaving site to avoid tracking soil onto surface of roads, walks, or other paved areas.
- B. Erect barricades and warning signs as required to protect newly planted areas from traffic. Maintain barricades throughout maintenance period until lawn is established.

3.8 PLANTING SOIL AMENDMENTS SCHEDULE

- A. Lawns: Provide soil amendments in not less than the following quantities:
 - 1. Weight of lime per 1000 sq. ft. (100 sq. m): 90lbs
 - 2. Weight of commercial fertilizer per 1000 sq. ft. (100 sq. m): 11lbs

3.9 SEED MIXTURES SCHEDULE

A. Full-Sun Mixture: Provide certified grass-seed blends or mixes, proportioned by weight, as follows:

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Proportion	Name	Min. Pct. Germ.	Min. Pct. Pure Sd.	Max. Pct. Weed Sd.
100 pct.	Bermudagrass (Cynodon dactylon)	80	85	0.50

B. Sun and Partial Shade: Provide certified grass-seed blends or mixes, proportioned by weight, as follows:

Proportion	Name	Min. Pct. Germ.	Min. Pct. Pure Sd.	Max. Pct. Weed Sd.
50 pot	Kaptuolov bluggroop	90	95	0.50
50 pci.	(Poa pratensis)	00	00	0.50
30 pct.	Chewings red fescue	85	98	0.50
40 4	(Festuca rubra variety)	~~		0.50
10 pct.	Perennial rye grass	90	98	0.50
40 4	(Lolium perenne)	05	~~	4.00
10 pct.	Redtop (Agrostis alba)	85	92	1.00

C. Heavy Shade: Provide certified grass-seed blends or mixes, proportioned by weight, as follows:

Proportion	Name	Min. Pct. Germ.	Min. Pct. Pure Sd.	Max. Pct. Weed Sd.
	.			
50 pct.	Chewings red tescue	85	98	0.50
35 pct.	Rough bluegrass (Poa trivialis)	80	85	1.00
15 pct.	Redtop (Agrostis alba)	85	92	1.00

END OF SECTION

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. Excavating tree pits and planting beds.
 - 2. Preparation of subsoil and topsoil.
 - Topsoil bedding.
 Mulch.

 - 5. Fertilizer.
 - 6. Pruning.
 - 7. Maintenance.
- B. Related Sections: The following Sections contain requirements that relate to this Section:
 - 1. Section 02200 Earthwork: Excavation, filling, rough grading, and subsurface aggregate drainage and drainage backfill.
 - Section 02930 Lawns and Grasses: Topsoil, finish grading and seeding. 2.

1.3 REFERENCES

- A. American National Standards Institute:
 - 1. ANSI A300 Tree Care Operations Tree, Shrub and Other Woody Plant Maintenance Standard Practices.
 - 2. ANSI Z60.1 Nursery Stock.

1.4 SUBMITTALS

- A. General: Submit each item in this Article according to the Conditions of the Contract and Division 1 Specification Section.
- B. Product data and samples (as note) for the following:
 - 1. Fertilizers and lime.
 - 2. Soil amendments (sample).
 - 3. Topsoil (sample).
 - 4. Mulches(sample).
 - 5. List of plant material sources.
- C. Product certification, including:
 - 1. NJ Dept. of Agriculture Certificate of Plant Inspection.
 - 2. NJ Dept. of Agriculture Dealer's Agreement.
- D. 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, landscape architects and owners, and other information specified.
- E. Material test reports from qualified independent testing agency indicating and interpreting test results relative to compliance of the materials with requirements indicated.
 - 1. Analysis of existing topsoil (stock piled and undisturbed).
 - 2. Analysis of imported topsoil.
 - 3. Analysis of organic compost.

- F. Planting schedule indicating anticipated dates and locations for each type of planting.
- G. Maintenance instructions recommending procedures to be established by Owner for maintenance of landscaping during an entire year. Submit before expiration of required maintenance periods.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications. Engage an experienced Installer who has completed landscaping work similar in material, design, and extent to that indicated for this Project and with a record of successful plant establishment.
- B. Testing Agency Qualifications: To qualify for acceptance, an independent testing agency must demonstrate to Landscape Architect's satisfaction, based on evaluation of agency submitted criteria conforming to ASTM E 699, that it has the experience and capability to satisfactorily conduct the testing indicated without delaying the Work.
- C. Topsoil analysis: Furnish a soil analysis made by a qualified independent soil-testing agency stating percentages of organic matter, inorganic matter (silt, clay, and sand), deleterious material, pH, and mineral and plant-nutrient content of topsoil.
 - 1. Report suitability of topsoil for plant growth. State recommended type and quantities of soil amendments to be added to produce a satisfactory topsoil.
- D. Organic Compost analysis: Furnish a compost analysis made by a qualified independent testing laboratory stating organic matter content, pH, percent of moisture content, conductivity, and existing levels of basic nutrients
 - 1. Report raw materials used to make compost.
- E. Perform Work in accordance with State, County, and City laws and standards.
- F. Maintain one copy of Project plans and specifications on site.
- G. Pre-installation Conference: Conduct conference at Project site to comply with requirements of Division 1 Section "Project Meetings".
- 1.6 DELIVERY, STORAGE, AND HANDLING
 - A Deliver products in original sealed, labeled, and undamaged containers.
 - B. Deliver plants labeled according to genus, specie, and variety and supplier bill of lading.
 - C. Transport plants with protective covering and trunk protection.
 - D. Store plants with root balls set on moist straw and covered with same. Protect tops and trunks from drying by sun and wind. Water daily.

1.7 COORDINATION AND SCHEDULING

- A. General: Coordinate all work according to the Conditions of the Contract and Division 1 Specification Sections.
- B. Coordinate installation of plant life with installation of underground utilities and grading and seeding.
- C. Planting Season: Install plants during normal planting season for plant type and method of transplanting. Correlate planting with specified maintenance periods to provide required maintenance from date of Substantial Completion.

D. Weather Limitations: Proceed with planting only when existing and forecast weather conditions are suitable for work.

1.8 WARRANTY

- A. Furnish one year warranty for trees, shrubs, and ground cover, begin at Date of Substantial Completion, including:
 - 1. Replacement upon death or exhibiting poor health, including: disease, loss of foliage, dieback of twigs and branches greater than 10 percent initial plant size, and splitting bark.
 - 2. Replacement without cost to the Owner, except in cases of violent weather, vandalism or abuse.

1.9 MAINTENANCE SERVICE

- A. Maintain plant life for twelve months after Date of Substantial Completion.
- B. Maintain plant life immediately after placement until plants are well established and exhibit vigorous growing condition. Continue maintenance until termination of warranty period.
- C. Maintenance includes:
 - 1. Cultivation and weeding plant beds and tree pits.
 - 2. Applying herbicides and insecticides. Remedy damage resulting from use.
 - 3. Irrigating sufficient to sustain vigorous, healthy growth.
 - 4. Pruning, including removal of dead or broken branches.
 - 5. Fertilizing to sustain vigorous, healthy growth.
 - 6. Resetting plants to proper grade and vertical position.
 - 7. Plant replacement.
 - 8. Replacement of mulch.

PART 2 – PRODUCTS

2.1 TREES, SHRUBS, AND GROUND COVER

A. Plant Stock:

- 1. Species: In accordance with Standardized Plant Names, official code of American Joint Committee on Horticulture Nomenclature.
- 2. Identification: Label each plant or group of the same plant type.
- Plants: No. 1 Grade conforming to "American Standard for Nursery Stock" of American Nursery & Landscape Association (formerly AAN); well-branched, vigorous and balanced root and top growth; free from disease, injurious insects, mechanical wounds, broken branches, decay and other defects.
- 4. Trees: Furnish with reasonably straight trunks, well balanced tops, single leader, and trunks centered in root ball.
- 5. Method of transplanting: Balled and burlapped or container as specified in plant schedule.
- B. Trees, shrubs, and ground cover: Genus, species, and size identifiable in plant schedule, grown in climatic conditions similar to those in locality of the Work.

2.2 SOIL MATERIALS

A. Topsoil: Sandy loam topsoil, pH range of 6.0 to 7.0 with 4 percent organic material minimum; free of stones 1 inch (25 mm) or larger in any dimension, subsoil, clay, plants, weeds, roots, impurities, and other extraneous materials harmful to plant growth.

- 1. Topsoil Source: Reuse surface soil stockpiled and spread on the site. Verify suitability of surface soil to produce topsoil meeting requirements and amend when necessary. Supplement with imported topsoil when quantities are insufficient. Clean topsoil of roots, plants, sods, stones, clay lumps, and other extraneous materials harmful to plant growth.
- 2. Topsoil Source: Import topsoil from off-site sources. Manufactured or fertile agricultural soil, typical for locality, capable of sustaining vigorous plant growth, taken from well drained site.

2.3 SOIL AMENDMENT MATERIALS

- A. Compost: Commercially manufactured, stable organic compost derived primarily from composted yard trimmings; pH range of 6.0 to 8.0, and organic matter content 30 to 50 percent.
- B. Peat-bark Mix: Medium-weight, peat-bark growing medium, components: processed pine bark (45-55% by volume), sphagnum peat moss (37-47% by volume), horticultural coarse grade perlite, calcitic limestone, dolomitic limestone, macro & micro nutrients, and wetting agent; pH range 5.2 - 6.2.
- C. Lime: Dolomitic limestone, 50% total oxides, 30% calcium oxide, 20% magnesium oxide, with minimum 75% passing a 100 mesh sieve and a minimum passing a 20 mesh sieve.
- D. Fertilizer: Commercial-grade complete fertilizer of neutral character, consisting of fast- and slowrelease nitrogen, 50 percent (min.) derived from natural organic sources in the following composition:
 - 1. Composition: 5 percent nitrogen, 3 percent phosphorus, and 3 percent potassium by weight.

2.4 MULCH MATERIALS

- A. Mulching Material: Double shredded hardwood bark, dark brown in color, free of soil and extraneous matter.
- B. Mulching material: Wheat straw, free from weeds, foreign matter detrimental to plant life, and dry.

2.5 ACCESSORIES

- A. Drip Irrigation Bladder: 10 mil., UV polyester reinforced polyethylene, 20 gal. capacity.
- B. Monitoring Tubes: PVC, perforated field drain pipe w/ filter fabric cover; 4" dia. x 36" length; threaded adaptor & thread end cap.

2.6 PLANT SOIL MIX

A. Plant Soil Mix: Uniform mixture of 2 parts peat-bark mix and 3 parts sandy loam topsoil by volume.

2.7 HERBICIDE

- A. Herbicide for weed control, including:
 - 1. Non-Selective Herbicide: Water soluble, spray application, for total weed control.
 - 2. Selective Pre-Emergent Herbicide: Granular, dry application, for pre-emergent control of broadleaf weeds and grasses.

2.8 GRASS SEED

A. Lawn grass and Low-maintenance grass seed mixes and varieties according to Division 2 Section "Lawns and Grasses".

2.9 WATER

A. Water: Clean, fresh, and free of substances or matter capable of inhibiting vigorous growth of plants.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas to receive plants for compliance with requirements and for conditions affecting performance of work of this Section. Do not proceed with installation until unsatisfactory conditions have been corrected.
- B. Locate all underground utilities before digging.

3.2 EXCAVATION

- A. Remove soil from planting pits to width and depth shown on the Planting Details.
- B. Retain satisfactory soil for reuse. Remove unsatisfactory soil, foreign materials and debris. Properly dispose off site.
- C. Scarify subsoil to depth of 4 inches (100 mm) the entire surface at bottom of planting pit.
- D. Dig pits and beds 6 feet wide or twice the width of the root ball, whichever is greater, or as shown on the planting details.

3.3 PLANTING

- A. Add plant soil mix to bottom of planting pit to the depth shown on the Planting Details; evenly blend with Subsoil. Tamp firm and stable under each root ball.
- B. Place plants for best appearance. Review and final orientation by the Landscape Architect.
- C. Set plants vertical.
- D. Set top, outer edge of root ball flush with finish grade.
- E. Remove containers. Cut and remove (or fold away) burlap and binding from top of root ball. Cut top bands of wire baskets and fold away from top of root ball.
- F. Container Grown Plants: Use fingers or small hand tools to pull roots out of outer layer of potting soil; cut or pull apart any roots circling the perimeter of the container.
- G. Prune broken and frayed roots.
- H. Trees: Install monitoring tubes:
 - 1. Place in corner of tree planting pit. End cap flush with finish grade.
 - 2. Gently slope bottom of pit toward monitoring tube.
 - 3. Maintain vertical position during backfilling and tamping.
 - 4. Keep tube free of soil and debris during and after installation.
- I. Backfill planting soil mix in 6 inch (150 mm) layers. Tamp each layer firmly around root ball. Maintain each plant in vertical position. Fill to slightly below finish grade elevation.

- J. Saturate soil with water when planting pit is half full of soil mix and again when full.
- K. Apply 3 inches (75 mm) to 4 inches (100 mm) of organic compost to surface of filled planting area. Till and blend evenly into top 6 inches (150 mm).
- L. Drip Irrigation Bladder: Install at each tree, including:
 - 1. Shade trees.
 - 2. Small single- and multi-trunk ornamental trees.

3.4 HERBICIDE

- A. Selective Pre-emergent Herbicide:
 - 1. Apply to planting bed and tree pit surfaces prior to mulching.
 - 2. Remove weeds before applying.
 - 3. Application required for spring and summer planting.
 - 4. Apply according to manufacturer recommendations.

3.5 MULCHING

A. Mulch planting surfaces with 3 inch (75 mm) depth, hardwood bark mulch. Apply within 24 hours of planting.

3.6 PRUNING

A. When pruning trees is required, lightly prune trees in accordance with ANSI A300 Maintenance Pruning Type: Crown Pruning. Prune to preserve tree natural shape.

3.7 SEEDING

- A. Reseed grass areas disturbed by planting work.
- B. Loosen compacted soil, add topsoil (as necessary), rake, grade smooth and even to proper finish grade.
- C. Seed mixes and varieties, application rates, and method of application and mulching according to Division 2 Section "Lawns and Grasses".

3.8 FIELD QUALITY CONTROL

- A. Plants will be rejected when:
 - 1. Size, genus, species, variety, and/or quality do not meet or exceed requirements specified herein.
 - 2. Improperly or not labeled.
 - 3. Not properly covered and protected during transport and delivery.
 - 4. Failure to provide current NJ Dept. of Agriculture Certificate Inspection.
 - 5. Tree trunks improperly protected.
 - 6. Tree trunks damaged, bent, curved, or configuration not typical of species.
 - 7. Root ball disturbed or damaged prior to or during planting.
- 3.9 SCHEDULE SEE DRAWINGS

END OF SECTION

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Reinforcing steel bars, wire fabric and accessories for cast-in-place concrete.
- 1.2 RELATED SECTIONS
 - A. Section 033000 Cast-in-Place Concrete.

1.3 REFERENCES

- A. ACI 301 Structural Concrete for Buildings.
- B. ACI 318 Building Code Requirements For Reinforced Concrete.
- C. ACI SP-66 American Concrete Institute Detailing Manual.
- D. ANSI/ASTM A185 Welded Steel Wire Fabric for Concrete Reinforcement.
- E. ANSI/AWS D1.4 Structural Welding Code for Reinforcing Steel.
- F. AWS D12.1 Welding Reinforcement Steel, Metal Inserts and Connections in Reinforced Concrete Construction.
- G. CRSI Concrete Reinforcing Steel Institute Manual of Practice.
- H. CRSI 63 Placing Reinforcing Bars.

1.4 SUBMITTALS

- A. Submit under provisions of Division 1 General Requirements.
- B. Shop Drawings: Indicate bar sizes, spacings, locations, and quantities of reinforcing steel and wire fabric, bending and cutting schedules, and supporting and spacing devices.
- C. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

1.5 QUALITY ASSURANCE

A. Perform Work in accordance with CRSI - Manual of Standard Practice, ACI 301 and ACI 318.

1.6 COORDINATION

- A. Coordinate work under provisions of Division 1 General Requirements.
- B. Coordinate with placement of formwork, formed openings and other Work.

PART 2 PRODUCTS

2.1 REINFORCEMENT

- A. Reinforcing Steel: ASTM A615, 60 ksi; deformed billet steel bars, unfinished.
- B. Welded Steel Wire Fabric: ASTM A185, in flat sheets or coiled rolls, unfinished.
- C. Stirrup Steel: ANSI/ASTM A82, unfinished.

2.2 ACCESSORY MATERIALS

A. Tie Wire: Minimum 16 gage annealed type.

B. Chairs, Bolsters, Bar Supports, Spacers: Sized and shaped for strength and support of reinforcement during concrete placement conditions including load bearing pad on bottom to prevent vapor barrier puncture.

2.3 FABRICATION

- A. Fabricate concrete reinforcing in accordance with CRSI Manual of Practice.
- B. Locate reinforcing splices not indicated on drawings, at point of minimum stress. Review location of splices with Architect.

PART 3 EXECUTION

3.1 PLACEMENT

- A. Place, support and secure reinforcement against displacement. Do not deviate from required position.
- B. Do not displace or damage vapor barrier.
- C. Accommodate placement of formed openings.
- D. Maintain minimum recommended concrete cover around reinforcing as required.

3.2 FIELD QUALITY CONTROL

A. Field inspection will be performed under provisions of Division 1 - General Requirements.

END OF SECTION

PART 1 GENERAL

1.1 SECTION INCLUDES

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 specifies cast-in place concrete, including formwork, reinforcement, concrete materials, mixture design, placement procedures, and finishes, for the following:
 - 1. Footings.
 - 2. Slabs-on-grade.
- B. RELATED SECTIONS:
 - 1. Section 022000 Earthwork.
 - 2. Section 025200 Portland Cement Concrete Paving.
 - 3. Section 027000 Sewerage and Drainage.

1.3 DEFINITIONS

- A. Cementitious Materials: Portland cement alone or in combination with one or more of the following: blended hydraulic cement, fly ash and other pozzolans, ground granulated blast-furnace slag, and silica fume; subject to compliance with requirements.
- 1.4 ACTION SUBMITTALS
 - A. Product Data: For each type of product indicated.
 - B. Design Mixtures: For each concrete mixture. Submit alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.
 - 1. Indicate amounts of mixing water to be withheld for later addition at Project site.
 - C. Steel Reinforcement Shop Drawings: Placing drawings that detail fabrication, bending, and placement. Include bar sizes, lengths, material, grade, bar schedules, stirrup spacing, bent bar diagrams, bar arrangement, splices and laps, mechanical connections, tie spacing, hoop spacing, and supports for concrete reinforcement.
 - 1. The contractor shall deliver to the engineer, at the completion of the job, one (1) electronic version of the final field copies of all steel reinforcing shop drawings.
 - D. Formwork Shop Drawings: Prepared by or under the supervision of a qualified professional engineer detailing fabrication, assembly, and support of formwork.
 - 1. Shoring and Reshoring: Indicate proposed schedule and sequence of stripping formwork, shoring removal, and reshoring installation and removal.
 - E. Construction Joint Layout: Indicate proposed construction joints required to construct the structure.

- 1. Location of construction joints is subject to approval of the Architect.
- F. Samples: For waterstops and vapor retarder.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer, manufacturer, and testing agency.
- B. Welding certificates.
- C. Material Certificates: For each of the following, signed by manufacturers:1. Cementitious materials.
 - 2. Admixtures.
 - 3. Form materials and form-release agents.
 - 4. Steel reinforcement and accessories.
 - 5. Fiber reinforcement.
 - 6. Waterstops.
 - 7. Curing compounds.
 - 8. Floor and slab treatments.
 - 9. Bonding agents.
 - 10. Adhesives.
 - 11. Vapor retarders.
 - 12. Semirigid joint filler.
 - 13. Joint-filler strips.
 - 14. Repair materials.
 - 15. Mechanical Splices.
- D. Material Test Reports: For the following, from a qualified testing agency, indicating compliance with requirements:
 - 1. Aggregates. Include service record data indicating absence of deleterious expansion of concrete due to alkali aggregate reactivity.
- E. Floor surface flatness and levelness measurements indicating compliance with specified tolerances.
- F. Field quality-control test and inspection reports.
- G. Minutes of preinstallation conference.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: A qualified installer who employs on Project personnel qualified as ACI-certified Flatwork Technician and Finisher and a supervisor who is an ACI-certified Concrete Flatwork Technician.
- B. Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94/C 94M requirements for production facilities and equipment.
 - 1. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities."
- C. Testing Agency Qualifications: An independent agency, acceptable to authorities having jurisdiction, qualified according to ASTM C 1077 and ASTM E 329 for testing indicated.
 - 1. Personnel conducting field tests shall be qualified as ACI Concrete Field Testing Technician, Grade 1, according to ACI CP-1 or an equivalent certification program.
 - 2. Personnel performing laboratory tests shall be ACI-certified Concrete Strength Testing Technician and Concrete Laboratory Testing Technician Grade I. Testing Agency laboratory supervisor shall be an ACI-certified Concrete Laboratory Testing Technician Grade II.
- D. Source Limitations: Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant, obtain aggregate from single source, and obtain admixtures through single source from single manufacturer.
- E. Welding Qualifications: Qualify procedures and personnel according to AWS D1.4/D1.4M, "Structural Welding Code-Reinforcing Steel."
- F. ACI Publications: Comply with the following unless modified by requirements in the Contract Documents:
 - 1. ACI 301, "Specification for Structural Concrete."
 - 2. ACI 117, "Specifications for Tolerances for Concrete Construction and Materials."
 - 3. ACI 216, "Guide for Determining Fire Endurance of Concrete Elements".
- G. Concrete Testing Service: Engage a qualified independent testing agency to perform material evaluation tests and to design concrete mixtures.
- H. Mockups: Cast concrete slab-on-grade and formed-surface panels as required by the Architect/owner to demonstrate typical joints, surface finish, texture, tolerances, and standard of workmanship.
 - 1. Build panel approximately 200 sq. ft. (18.6 sq. m) for slab-on-grade and 100 sq. ft. (9.3 sq. m) for formed surface in the location indicated or, if not indicated, as directed by Architect.
 - 2. Approved panels may become part of the completed Work if undisturbed at time of Substantial Completion.

- I. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination."
 - 1. Before submitting design mixtures, review concrete design mixture and examine procedures for ensuring quality of concrete materials. Require representatives of each entity directly concerned with cast-in-place concrete to attend, including the following:
 - a. Contractor's superintendent.
 - b. Independent testing agency responsible for concrete design mixtures.
 - c. Ready-mix concrete manufacturer.
 - d. Concrete subcontractor.
 - e. Special concrete finish subcontractor.
 - 2. Review special inspection and testing and inspecting agency procedures for field quality control, concrete finishes and finishing, cold- and hot-weather concreting procedures, curing procedures, construction contraction and isolation joints, and joint-filler strips, semirigid joint fillers, forms and form removal limitations, shoring and reshoring procedures, vapor-retarder installation, anchor rod and anchorage device installation tolerances, steel reinforcement installation, floor and slab flatness and levelness measurement, concrete repair procedures, and concrete protection.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Steel Reinforcement: Deliver, store, and handle steel reinforcement to prevent bending and damage. Avoid damaging coatings on steel reinforcement.
- B. Waterstops: Store waterstops under cover to protect from moisture, sunlight, dirt, oil, and other contaminants.

PART 2 PRODUCTS

- 2.1 FORM-FACING MATERIALS
 - A. Smooth-Formed Finished Concrete: Form-facing panels that will provide continuous, true, and smooth concrete surfaces. Furnish in largest practicable sizes to minimize number of joints.
 - 1. Plywood, metal, or other approved panel materials. Utilize steel, glass-fiber-reinforced plastic, or other approved non-absorptive panel material that will provide continuous, true and smooth surfaces in all architectural concrete.
 - 2. Exterior-grade plywood panels, suitable for concrete forms, complying with DOC PS 1, and as follows:
 - a. High-density overlay, Class 1 or better.
 - b. B-B (Concrete Form), Class 1 or better; mill oiled and edge sealed.
 - B. Rough-Formed Finished Concrete: Plywood, lumber, metal, or another approved material. Provide lumber dressed on at least two edges and one side for tight fit.
 - C. Chamfer Strips: Wood, metal, PVC, or rubber strips, 3/4 by 3/4 inch (19 by 19 mm), minimum.

- D. Rustication Strips: Wood, metal, PVC, or rubber strips, kerfed for ease of form removal.
- E. Form-Release Agent: Commercially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces.
 - 1. Formulate form-release agent with rust inhibitor for steel form-facing materials.
- F. Form Ties: Factory-fabricated, removable or snap-off metal or glass-fiber-reinforced plastic form ties designed to resist lateral pressure of fresh concrete on forms and to prevent spalling of concrete on removal.
 - 1. Furnish units that will leave no corrodible metal closer than 1 inch (25 mm) to the plane of exposed concrete surface.
 - 2. Furnish ties that, when removed, will leave holes no larger than 1 inch (25 mm) in diameter in concrete surface.
 - 3. Furnish ties with integral water-barrier plates to walls indicated to receive dampproofing or waterproofing.

2.2 STEEL REINFORCEMENT

- A. Reinforcing Bars: ASTM A 615/A 615M, Grade 60 (Grade 420), deformed.
- B. Low-Alloy-Steel Reinforcing Bars: ASTM A 706/A 706M, deformed.
- C. Steel Bar Mats: ASTM A 184/A 184M, fabricated from ASTM A 615/A 615M, Grade 60 (Grade 420) ASTM A 706/A 706M, deformed bars, assembled with clips.
- D. Plain-Steel Wire: ASTM A 82 /A 82M.
- E. Deformed-Steel Wire: ASTM A 496/A 496M.
- F. Plain-Steel Welded Wire Reinforcement: ASTM A 185/A 185M, plain, fabricated from as-drawn steel wire into flat sheets.
- G. Deformed-Steel Welded Wire Reinforcement: ASTM A 497/ A 497M, flat sheet.

2.3 REINFORCEMENT ACCESSORIES

- A. Joint Dowel Bars: ASTM A 615/A 615M, Grade 60 (Grade 420), plain-steel bars, cut bars true to length with ends square and free of burrs.
- B. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire reinforcement in place. Manufacture bar supports from steel wire, plastic, or precast concrete according to CRSI's "Manual of Standard Practice," of greater compressive strength than concrete and as follows:
 - 1. For concrete surfaces exposed to view where legs of wire bar supports contact forms, use CRSI Class 1 plastic-protected steel wire or CRSI Class 2 stainless-steel bar supports.
- C. Mechanical Splices: For splicing reinforcing bars, splice material must conform with testing set forth in ASTM 1034/1034M, and shall develop in tension or compression, as required, at least 125% of the specified yield strength of the bar.

2.4 CONCRETE MATERIALS

- A. Cementitious Material: Use the following cementitious materials, of the same type, brand, and source, throughout Project:
 - 1. Portland Cement: ASTM C 150, Type I, color as indicated on Architectural Contract documents. Supplement with the following:
 - a. Fly Ash: ASTM C 618, Class C or F.
 - b. Ground Granulated Blast-Furnace Slag: ASTM C 989, Grade 100 or 120.
 - 2. Blended Hydraulic Cement: ASTM C 595, Type IS, portland blast-furnace slag.
- B. Normal-Weight Aggregates: ASTM C 33, Class **3S** coarse aggregate or better, graded. Provide aggregates from a single source.
 - 1. Maximum Coarse-Aggregate Size: 3/4 inch (19 mm) nominal.
 - 2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.
- C. Water: ASTM C 94/C 94M and potable.

2.5 ADMIXTURES

- A. Air-Entraining Admixture: ASTM C 260.
- B. Chemical Admixtures: Provide admixtures certified by manufacturer to be compatible with other admixtures and that will not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride.
 - 1. Water-Reducing Admixture: ASTM C 494/C 494M, Type A.
 - 2. Retarding Admixture: ASTM C 494/C 494M, Type B.
 - 3. Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type D.
 - 4. High-Range, Water-Reducing Admixture: ASTM C 494/C 494M, Type F.
 - 5. High-Range, Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type G.
 - 6. Plasticizing and Retarding Admixture: ASTM C 1017/C 1017M, Type II.

2.6 WATERSTOPS

- A. Self-Expanding Butyl Strip Waterstops: Manufactured rectangular or trapezoidal strip, butyl rubber with sodium bentonite or other hydrophilic polymers, for adhesive bonding to concrete, 3/4 by 1 inch (19 by 25 mm).
 - 1. Products: Subject to compliance with requirements, provide the following:
 - a. CETCO; Volclay Waterstop-RX.

2.7 VAPOR RETARDERS

A. Sheet Vapor Retarder under slab-on-grade: ASTM E 1745, Class A, not less than 10 mils thick. Include manufacturer's recommended adhesive or pressure-sensitive tape.

- 1. Products: Subject to compliance with requirements, provide one of the following or approved equal:
 - a. Stego Industries, LLC; Stego Wrap 10 mil vapor barrier Class A for use under slabs-ongrade.
 - b. Substititions: Under provisions of Division 1 General Requirements.

2.8 LIQUID FLOOR TREATMENTS

- A. VOC Content: Liquid floor treatments shall have a VOC content of 200 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- B. Penetrating Liquid Floor Treatment: Clear, chemically reactive, waterborne solution of inorganic silicate or siliconate materials and proprietary components; odorless; that penetrates, hardens, and densifies concrete surfaces.
 - 1. incorporated into the Work include, but are not limited to, the following:
 - a. ChemMasters; Chemisil Plus.
 - b. ChemTec Int'l; ChemTec One.
 - c. Conspec by Dayton Superior; Intraseal.
 - d. Curecrete Distribution Inc.; Ashford Formula.
 - e. Dayton Superior Corporation; Day-Chem Sure Hard (J-17).
 - f. Edoco by Dayton Superior; Titan Hard.
 - g. Euclid Chemical Company (The), an RPM company; Euco Diamond Hard.
 - h. Kaufman Products, Inc.; SureHard.
 - i. L&M Construction Chemicals, Inc.; Seal Hard.
 - j. Meadows, W. R., Inc.; LIQUI-HARD.
 - k. Metalcrete Industries; Floorsaver.
 - I. Nox-Crete Products Group; Duro-Nox.
 - m. Symons by Dayton Superior; Buff Hard.
 - n. US SPEC, Division of US Mix Products Company; US SPEC Industraseal.
 - o. Vexcon Chemicals, Inc.; Vexcon StarSeal PS Clear.

2.9 CURING MATERIALS

A. Evaporation Retarder: Waterborne, monomolecular film forming, manufactured for application to fresh concrete.
- 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Axim Italcementi Group, Inc.; CATEXOL CimFilm.
 - b. BASF Construction Chemicals Building Systems; Confilm.
 - c. ChemMasters; SprayFilm.
 - d. Conspec by Dayton Superior; Aquafilm.
 - e. Dayton Superior Corporation; Sure Film (J-74).
 - f. Edoco by Dayton Superior; BurkeFilm.
 - g. Euclid Chemical Company (The), an RPM company; Eucobar.
 - h. Kaufman Products, Inc.; Vapor-Aid.
 - i. Lambert Corporation; LAMBCO Skin.
 - j. L&M Construction Chemicals, Inc.; E-CON.
 - k. Meadows, W. R., Inc.; EVAPRE.
 - I. Metalcrete Industries; Waterhold.
 - m. Nox-Crete Products Group; MONOFILM.
 - n. Sika Corporation; SikaFilm.
 - o. SpecChem, LLC; Spec Film.
 - p. Symons by Dayton Superior; Finishing Aid.
 - q. TK Products, Division of Sierra Corporation; TK-2120 TRI-FILM.
 - r. Unitex; PRO-FILM.
 - s. Vexcon Chemicals, Inc.; Certi-Vex Envio Set.
- B. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. (305 g/sq. m) when dry.
- C. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.
- D. Water: Potable.
- E. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B, nondissipating, certified by curing compound manufacturer to not interfere with bonding of floor covering.
 - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Anti-Hydro International, Inc.; AH Clear Cure WB.

- b. BASF Construction Chemicals Building Systems; Kure-N-Seal WB.
- c. ChemMasters; Safe-Cure & Seal 20.
- d. Conspec by Dayton Superior; Cure and Seal WB.
- e. Cresset Chemical Company; Crete-Trete 309-VOC Cure & Seal.
- f. Dayton Superior Corporation; Safe Cure and Seal (J-18).
- g. Edoco by Dayton Superior; Spartan Cote WB II.
- h. Euclid Chemical Company (The), an RPM company; Aqua Cure VOX; Clearseal WB 150.
- i. Kaufman Products, Inc.; Cure & Seal 309 Emulsion.
- j. Lambert Corporation; Glazecote Sealer-20.
- k. L&M Construction Chemicals, Inc.; Dress & Seal WB.
- I. Meadows, W. R., Inc.; Vocomp-20.
- m. Metalcrete Industries; Metcure.
- n. Nox-Crete Products Group; Cure & Seal 150E.
- o. Symons by Dayton Superior; Cure & Seal 18 Percent E.
- p. TK Products, Division of Sierra Corporation; TK-2519 WB.
- q. Vexcon Chemicals, Inc.; Starseal 309.

2.10 RELATED MATERIALS

- A. Expansion- and Isolation-Joint-Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber or ASTM D 1752, cork or self-expanding cork.
- B. Semirigid Joint Filler: Two-component, semirigid, 100 percent solids, epoxy resin with a Type A shore durometer hardness of 80 per ASTM D 2240.
- C. Bonding Agent: ASTM C 1059/C1059M, Type II, non-redispersible, acrylic emulsion or styrene butadiene.
- D. Epoxy Bonding Adhesive: ASTM C 881, two-component epoxy resin, capable of humid curing and bonding to damp surfaces, of class suitable for application temperature and of grade to suit requirements, and as follows:
 - 1. Types IV and V, load bearing, for bonding hardened or freshly mixed concrete to hardened concrete.
- E. Reglets: Fabricate reglets of not less than 0.022-inch- (0.55-mm-) thick, galvanized steel sheet. Temporarily fill or cover face opening of reglet to prevent intrusion of concrete or debris.

F. Dovetail Anchor Slots: Hot-dip galvanized steel sheet, not less than 0.034 inch (0.85 mm) thick, with bent tab anchors. Temporarily fill or cover face opening of slots to prevent intrusion of concrete or debris.

2.11 REPAIR MATERIALS

- A. Repair Underlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/8 inch (3.2 mm) and that can be feathered at edges to match adjacent floor elevations.
 - 1. Cement Binder: ASTM C 150, portland cement or hydraulic or blended hydraulic cement as defined in ASTM C 219.
 - 2. Primer: Product of underlayment manufacturer recommended for substrate, conditions, and application.
 - 3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch (3.2 to 6 mm) or coarse sand as recommended by underlayment manufacturer.
 - 4. Compressive Strength: Not less than 4100 psi (29 MPa) at 28 days when tested according to ASTM C 109/C 109M.
- B. Repair Overlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/4 inch (6.4 mm) and that can be filled in over a scarified surface to match adjacent floor elevations.
 - 1. Cement Binder: ASTM C 150, portland cement or hydraulic or blended hydraulic cement as defined in ASTM C 219.
 - 2. Primer: Product of topping manufacturer recommended for substrate, conditions, and application.
 - 3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch (3.2 to 6 mm) or coarse sand as recommended by topping manufacturer.
 - 4. Compressive Strength: Not less than 5000 psi (34.5 MPa) at 28 days when tested according to ASTM C 109/C 109M.

2.12 CONCRETE MIXTURES, GENERAL

- A. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both, according to ACI 301.
 - 1. Use a qualified independent testing agency for preparing and reporting proposed mixture designs based on laboratory trial mixtures.
- B. Cementitious Materials: Fly ash, pozzolan, ground granulated blast-furnace slag, and silica fume may be used to reduce the total amount of portland cement. Limit percentage, by weight, of cementitious materials other than portland cement in concrete as follows:
 - 1. Fly Ash: 25 percent.
 - 2. Combined Fly Ash and Pozzolan: 25 percent.
 - 3. Ground Granulated Blast-Furnace Slag: 40 percent.

- 4. Combined Fly Ash or Pozzolan and Ground Granulated Blast-Furnace Slag: 50 percent portland cement minimum, with fly ash or pozzolan not exceeding 25 percent.
- C. Limit water-soluble, chloride-ion content in hardened concrete to 0.15 percent by weight of cement.
- D. Admixtures: Use admixtures according to manufacturer's written instructions.
 - 1. Use water-reducing, high-range water-reducing or plasticizing admixture in concrete, as required, for placement and workability.
 - 2. Use water-reducing and retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.
 - 3. Use water-reducing admixture in pumped concrete, concrete for heavy-use industrial slabs and parking structure slabs, concrete required to be watertight, and concrete with a water-cementitious materials ratio below 0.50.

2.13 CONCRETE MIXTURES FOR BUILDING ELEMENTS

- A. Footings: Proportion normal-weight concrete mixture as follows:
 - 1. Minimum Compressive Strength: As indicated on contract documents.
 - 2. Maximum Water-Cementitious Materials Ratio: 0.45.
 - Slump Limit: 8 inches (200 mm) for concrete with verified slump of 2 to 4 inches (50 to 100 mm) before adding high-range water-reducing admixture or plasticizing admixture , plus or minus 1 inch (25 mm).
 - 4. Air Content: 6 percent, plus or minus 1.5 percent at point of delivery for 3/4-inch (19-mm) nominal maximum aggregate size.
- B. Basement, Retaining, and Foundation Walls: Proportion normal-weight concrete mixture as follows:
 - 1. Minimum Compressive Strength: As indicated on contract documents.
 - 2. Maximum Water-Cementitious Materials Ratio: 0.45.
 - Slump Limit: 8 inches (200 mm) for concrete with verified slump of 2 to 4 inches (50 to 100 mm) before adding high-range water-reducing admixture or plasticizing admixture, plus or minus 1 inch (25 mm).
 - 4. Air Content: 6 percent, plus or minus 1.5 percent at point of delivery for 3/4-inch (19-mm) nominal maximum aggregate size.
- C. Slabs-on-Grade: Proportion normal-weight concrete mixture as follows:
 - 1. Minimum Compressive Strength: As indicated on contract documents.
 - 2. Minimum Cementitious Materials Content: 500 lb/cu. yd. (297 kg/cu. m).
 - 3. Slump Limit: 4 inches (100 mm), plus or minus 1 inch (25 mm).

- 4. Air Content: 6 percent, plus or minus 1.5 percent at point of delivery for 3/4-inch (19-mm) nominal maximum aggregate size for slabs exposed to freeze and thaw only.
- 5. Air Content: Do not allow air content of troweled finished floors to exceed 3 percent.
- D. Suspended Slabs: Proportion normal-weight concrete mixture as follows:
 - 1. Minimum Compressive Strength: As indicated on contract documents.
 - 2. Minimum Cementitious Materials Content: 500 lb/cu. yd. (297 kg/cu. m).
 - 3. Slump Limit: 4 inches (100 mm) plus or minus 1 inch (25 mm).
 - 4. Air Content: 6 percent, plus or minus 1.5 percent at point of delivery for 3/4-inch (19-mm) nominal maximum aggregate size for slabs exposed to freeze and thaw only.
 - 5. Air Content: Do not allow air content of troweled finished floors to exceed 3 percent.
- E. Concrete Toppings: Proportion normal-weight concrete mixture as follows:
 - 1. Minimum Compressive Strength: As indicated on contract documents.
 - 2. Minimum Cementitious Materials Content: 500 lb/cu. yd. (297 kg/cu. m).
 - 3. Slump Limit: 4 inches (100 mm) plus or minus 1 inch (25 mm).
 - 4. Air Content: 6 percent, plus or minus 1.5 percent at point of delivery for 3/4-inch (19-mm) nominal maximum aggregate size for slabs exposed to freeze and thaw only.
 - 5. Air Content: Do not allow air content of troweled finished toppings to exceed 3 percent.
- F. Building Frame Members: Proportion normal-weight concrete mixture as follows:
 - 1. Minimum Compressive Strength: As indicated on contract documents.
 - 2. Maximum Water-Cementitious Materials Ratio: 0.45.
 - Slump Limit: 8 inches (200 mm) for concrete with verified slump of 2 to 4 inches (50 to 100 mm) before adding high-range water-reducing admixture or plasticizing admixture plus or minus 1 inch (25 mm).
 - 4. Air Content: 6 percent, plus or minus 1.5 percent at point of delivery for 3/4-inch (19-mm) nominal maximum aggregate size for elements exposed to freeze and thaw only.

2.14 FABRICATING REINFORCEMENT

- A. Fabricate steel reinforcement according to CRSI's "Manual of Standard Practice."
- 2.15 CONCRETE MIXING
 - A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94/C 94M and ASTM C 1116/C116M, and furnish batch ticket information.

- 1. When air temperature is between 85 and 90 deg F (30 and 32 deg C), reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F (32 deg C), reduce mixing and delivery time to 60 minutes.
- B. Project-Site Mixing: Measure, batch, and mix concrete materials and concrete according to ASTM C 94/C 94M. Mix concrete materials in appropriate drum-type batch machine mixer.
 - 1. For mixer capacity of 1 cu. yd. (0.76 cu. m) or smaller, continue mixing at least 1-1/2 minutes, but not more than 5 minutes after ingredients are in mixer, before any part of batch is released.
 - 2. For mixer capacity larger than 1 cu. yd. (0.76 cu. m), increase mixing time by 15 seconds for each additional 1 cu. yd. (0.76 cu. m).
 - 3. Provide batch ticket for each batch discharged and used in the Work, indicating Project identification name and number, date, mixture type, mixture time, quantity, and amount of water added. Record approximate location of final deposit in structure.

PART 3 EXECUTION

3.1 FORMWORK

- A. Design, erect, shore, brace, and maintain formwork, according to ACI 301, to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until structure can support such loads.
- B. Construct formwork so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117.
- C. Limit concrete surface irregularities per Architectural documents and designated by ACI 347 as abrupt or gradual, as follows:
 - 1. Class A, 1/8 inch (3.2 mm) for smooth-formed finished surfaces.
 - 2. Class B, 1/4 inch (6 mm) Class C, 1/2 inch (13 mm) for rough-formed finished surfaces.
- D. Construct forms tight enough to prevent loss of concrete mortar.
- E. Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush or wrecking plates where stripping may damage cast concrete surfaces. Provide top forms for inclined surfaces steeper than 1.5 horizontal to 1 vertical.
 - 1. Install keyways, reglets, recesses, and the like, for easy removal.
 - 2. Do not use rust-stained steel form-facing material.
- F. Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and slopes in finished concrete surfaces. Provide and secure units to support screed strips; use strike-off templates or compacting-type screeds.
- G. Provide temporary openings for cleanouts and inspection ports where interior area of formwork is inaccessible. Close openings with panels tightly fitted to forms and securely braced to prevent loss of concrete mortar. Locate temporary openings in forms at inconspicuous locations.

- H. Chamfer exterior corners and edges of permanently exposed concrete.
- I. Form openings, chases, offsets, sinkages, keyways, reglets, blocking, screeds, and bulkheads required in the Work. Determine sizes and locations from trades providing such items.
- J. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.
- K. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.
- L. Coat contact surfaces of forms with form-release agent, according to manufacturer's written instructions, before placing reinforcement.

3.2 EMBEDDED ITEMS

- A. Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by cast-in-place concrete. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - 1. Install anchor rods, accurately located, to elevations required and complying with tolerances in Section 7.5 of AISC's "Code of Standard Practice for Steel Buildings and Bridges."
 - 2. Install reglets to receive waterproofing and to receive through-wall flashings in outer face of concrete frame at exterior walls, where flashing is shown at lintels, shelf angles, and other conditions.
 - 3. Install dovetail anchor slots in concrete structures as indicated.

3.3 REMOVING AND REUSING FORMS

A. General: Formwork for sides of beams, walls, columns, and similar parts of the Work that does not support weight of concrete may be removed after cumulatively curing at not less than 50 deg F (10 deg C) for 24 hours after placing concrete. Concrete has to be hard enough to not be damaged by formremoval operations and curing and protection operations need to be maintained.

Retain option in first subparagraph below if adopting recommendation of ACI 347. ACI 301 requires concrete to reach its specified compressive strength.

- 1. Leave formwork for beam soffits, joists, slabs, and other structural elements that supports 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. Split, frayed, delaminated, or otherwise damaged form-facing material will not be acceptable for exposed surfaces. Apply new form-release agent.

C. When forms are reused, clean surfaces, remove fins and laitance, and tighten to close joints. Align and secure joints to avoid offsets. Do not use patched forms for exposed concrete surfaces unless approved by Architect.

3.4 SHORES AND RESHORES

- A. Comply with ACI 318 (ACI 318M), ACI 347 and ACI 301 for design, installation, and removal of shoring and reshoring.
 - 1. Do not remove shoring or reshoring until measurement of slab tolerances is complete.
- B. In multistory construction, extend shoring or reshoring over a sufficient number of stories to distribute loads in such a manner that no floor or member will be excessively loaded or will induce tensile stress in concrete members without sufficient steel reinforcement.
- C. Plan sequence of removal of shores and reshore to avoid damage to concrete. Locate and provide adequate reshoring to support construction without excessive stress or deflection.

3.5 VAPOR RETARDERS

- A. Sheet Vapor Retarders: Place, protect, and repair sheet vapor retarders according to ASTM E 1643 and manufacturer's written instructions.
 - 1. Lap joints 6 inches (150 mm) and seal with manufacturers recommended tape.

3.6 STEEL REINFORCEMENT

- A. General: Comply with CRSI's "Manual of Standard Practice" for placing reinforcement.
 - 1. Do not cut or puncture vapor retarder. Repair damage and reseal vapor retarder before placing concrete.
- B. Clean reinforcement of loose rust and mill scale, earth, ice, and other foreign materials that would reduce bond to concrete.
- C. Accurately position, support, and secure reinforcement against displacement. Locate and support reinforcement with bar supports to maintain minimum concrete cover. Do not tack weld crossing reinforcing bars.
 - 1. Weld reinforcing bars according to AWS D1.4/D1.4M, where indicated.
- D. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.
- E. Install welded wire reinforcement in longest practicable lengths on bar supports spaced to minimize sagging. Lap edges and ends of adjoining sheets at least one mesh spacing. Offset laps of adjoining sheet widths to prevent continuous laps in either direction. Lace overlaps with wire.

3.7 JOINTS

- A. General: Construct joints true to line with faces perpendicular to surface plane of concrete.
- B. Construction Joints: Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Architect.

- 1. Place joints perpendicular to main reinforcement. Continue reinforcement across construction joints, unless otherwise indicated. Do not continue reinforcement through sides of strip placements of floors and slabs.
- 2. Form keyed joints as indicated. Embed keys at least 1-1/2 inches (38 mm) into concrete.
- 3. Locate joints for beams, slabs, joists, and girders in the middle third of spans. Offset joints in girders a minimum distance of twice the beam width from a beam-girder intersection.
- 4. Locate horizontal joints in walls and columns at underside of floors, slabs, beams, and girders and at the top of footings or floor slabs.
- 5. Space vertical joints in walls as indicated. Locate joints beside piers integral with walls, near corners, and in concealed locations where possible.
- 6. Use a bonding agent at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
- 7. Use epoxy-bonding adhesive at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
- C. Contraction Joints in Slabs-on-Grade: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of concrete thickness as follows:
 - 1. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch- (3.2-mm-) wide joints into concrete when cutting action will not tear, abrade, or otherwise damage surface and before concrete develops random contraction cracks.
- D. Isolation Joints in Slabs-on-Grade: After removing formwork, install joint-filler strips at slab junctions with vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.
 - 1. Extend joint-filler strips full width and depth of joint, terminating flush with finished concrete surface, unless otherwise indicated.
 - Terminate full-width joint-filler strips not less than 1/2 inch (13 mm) or more than 1 inch (25 mm) below finished concrete surface where joint sealants, specified in Division 07 Section "Joint Sealants," are indicated.
 - 3. Install joint-filler strips in lengths as long as practicable. Where more than one length is required, lace or clip sections together.
- E. Doweled Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate or asphalt coat one-half of dowel length to prevent concrete bonding to one side of joint.

3.8 WATERSTOPS

A. Self-Expanding Strip Waterstops: Install in construction joints and at other locations indicated, according to manufacturer's written instructions, adhesive bonding, mechanically fastening, and firmly pressing into place. Install in longest lengths practicable.

3.9 CONCRETE PLACEMENT

- A. Before placing concrete, verify that installation of formwork, reinforcement, and embedded items is complete and that required inspections have been performed.
- B. Do not add water to concrete during delivery, at Project site, or during placement unless approved by Architect.
- C. Before test sampling and placing concrete, water may be added at Project site, subject to limitations of ACI 301.
 - 1. Do not add water to concrete after adding high-range water-reducing admixtures to mixture.
- D. Deposit concrete continuously in one layer or in horizontal layers of such thickness that no new concrete will be placed on concrete that has hardened enough to cause seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as indicated. Deposit concrete to avoid segregation.
 - 1. Deposit concrete in horizontal layers of depth to not exceed formwork design pressures and in a manner to avoid inclined construction joints.
 - 2. Consolidate placed concrete with mechanical vibrating equipment according to ACI 301.
 - 3. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations to rapidly penetrate placed layer and at least 6 inches (150 mm) into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity. At each insertion, limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing mixture constituents to segregate.
- E. Deposit and consolidate concrete for floors and slabs in a continuous operation, within limits of construction joints, until placement of a panel or section is complete.
 - 1. Consolidate concrete during placement operations so concrete is thoroughly worked around reinforcement and other embedded items and into corners.
 - 2. Maintain reinforcement in position on chairs during concrete placement.
 - 3. Screed slab surfaces with a straightedge and strike off to correct elevations.
 - 4. Slope surfaces uniformly to drains where required.
 - 5. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane, before excess bleedwater appears on the surface. Do not further disturb slab surfaces before starting finishing operations.
- F. Cold-Weather Placement: Comply with ACI 306.1 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.
 - 1. When average high and low temperature is expected to fall below 40 deg F (4.4 deg C) for three successive days, maintain delivered concrete mixture temperature within the temperature range required by ACI 301.

- 2. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
- 3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in mixture designs.
- G. Hot-Weather Placement: Comply with ACI 301 and as follows:
 - 1. Maintain concrete temperature below 90 deg F (32 deg C) at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
 - 2. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade uniformly moist without standing water, soft spots, or dry areas.

3.10 FINISHING FORMED SURFACES

- A. Rough-Formed Finish: As-cast concrete texture imparted by form-facing material with tie holes and defects repaired and patched. Remove fins and other projections that exceed specified limits on formed-surface irregularities.
 - 1. Apply to concrete surfaces not exposed to public view as indicated on Architectural documents.
- B. Smooth-Formed Finish: As-cast concrete texture imparted by form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Repair and patch tie holes and defects. Remove fins and other projections that exceed specified limits on formed-surface irregularities.
 - 1. Apply to concrete surfaces exposed to public view, to receive a rubbed finish, to be covered with a coating or covering material applied directly to concrete as indicated on Architectural documents.
- C. Rubbed Finish: Apply the following to smooth-formed finished as-cast concrete where indicated:
 - 1. Smooth-Rubbed Finish: Not later than one day after form removal, moisten concrete surfaces and rub with carborundum brick or another abrasive until producing a uniform color and texture. Do not apply cement grout other than that created by the rubbing process.
 - 2. Grout-Cleaned Finish: Wet concrete surfaces and apply grout of a consistency of thick paint to coat surfaces and fill small holes. Mix one part portland cement to one and one-half parts fine sand with a 1:1 mixture of bonding admixture and water. Add white portland cement in amounts determined by trial patches so color of dry grout will match adjacent surfaces. Scrub grout into voids and remove excess grout. When grout whitens, rub surface with clean burlap and keep surface damp by fog spray for at least 36 hours.
 - 3. Cork-Floated Finish: Wet concrete surfaces and apply a stiff grout. Mix one part portland cement and one part fine sand with a 1:1 mixture of bonding agent and water. Add white portland cement in amounts determined by trial patches so color of dry grout will match adjacent surfaces. Compress grout into voids by grinding surface. In a swirling motion, finish surface with a cork float.

D. Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with a texture matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces, unless otherwise indicated.

3.11 FINISHING FLOORS AND SLABS

- A. General: Comply with ACI 302.1R recommendations for screeding, restraightening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.
- B. Scratch Finish: While still plastic, texture concrete surface that has been screeded and bull-floated or darbied. Use stiff brushes, brooms, or rakes to produce a profile amplitude of 1/4 inch (6 mm) in one direction.
 - 1. Apply scratch finish to surfaces indicated and to receive concrete floor toppings and to receive mortar setting beds for bonded cementitious floor finishes and as indicated on Architectural documents.
- C. Float Finish: Consolidate surface with power-driven floats or by hand floating if area is small or inaccessible to power driven floats. Restraighten, cut down high spots, and fill low spots. Repeat float passes and restraightening until surface is left with a uniform, smooth, granular texture.
 - 1. Apply float finish to surfaces indicated and to receive trowel finish and to be covered with fluidapplied or sheet waterproofing, built-up or membrane roofing, or sand-bed terrazzo and as indicated on Architectural documents.
- D. Trowel Finish: After applying float finish, apply first troweling and consolidate concrete by hand or powerdriven trowel. Continue troweling passes and restraighten until surface is free of trowel marks and uniform in texture and appearance. Grind smooth any surface defects that would telegraph through applied coatings or floor coverings.
 - 1. Apply a trowel finish to surfaces indicated and exposed to view or to be covered with resilient flooring, carpet, ceramic or quarry tile set over a cleavage membrane, paint, or another thin-film-finish coating system and as indicated on Architectural documents.
 - 2. Finish on-grade and supported surfaces to the applicable minimum following tolerances, according to ASTM E 1155 (ASTM E 1155M), for a randomly trafficked floor surface. The contractor shall supply floor leveling material and other corrective measures in areas where floor finish provisions exceed the flatness and levelness requirements. Per ACI 302.1R, F(L) requirements should only be applied to slabs-on-ground that are level and suspended slabs that are both level and shored.
 - a. For carpeted slabs, specified overall values of flatness, F(F) 25; and of levelness, F(L) 20; with minimum local values of flatness, F(F) 17; and of levelness, F(L) 15.
 - For thin floor coverings, specified overall values of flatness, F(F) 35; and of levelness, F(L) 25; with minimum local values of flatness, F(F) 24; and of levelness, F(L) 17; for slabs-on-grade.
 - For thin floor coverings, specified overall values of flatness, F(F) 30; and of levelness, F(L) 20; with minimum local values of flatness, F(F) 24; and of levelness, F(L) 15; for suspended slabs.

- E. Trowel and Fine-Broom Finish: Apply a first trowel finish to surfaces indicated and where ceramic or quarry tile is to be installed by either thickset or thin-set method and as indicated on Architectural documents. While concrete is still plastic, slightly scarify surface with a fine broom.
 - 1. Comply with flatness and levelness tolerances for trowel finished floor surfaces.
- F. Broom Finish: Apply a broom finish to exterior concrete platforms, steps, and ramps, and elsewhere as indicated.
 - 1. Immediately after float finishing, slightly roughen trafficked surface by brooming with fiber-bristle broom perpendicular to main traffic route. Coordinate required final finish with Architect before application.
- G. Slip-Resistive Finish: Before final floating, apply slip-resistive aggregate or aluminum granule finish where indicated and to concrete stair treads, platforms, and ramps. Apply according to manufacturer's written instructions and as follows:
 - 1. Uniformly spread dampened slip-resistive aggregate or aluminum granules over surface in one or two applications. Tamp aggregate flush with surface, but do not force below surface.
 - 2. After broadcasting and tamping, apply float finish.
 - 3. After curing, lightly work surface with a steel wire brush or an abrasive stone and water to expose slip-resistive aggregate or aluminum granules.

3.12 MISCELLANEOUS CONCRETE ITEMS

- A. Filling In: Fill in holes and openings left in concrete structures, unless otherwise indicated, after work of other trades is in place. Mix, place, and cure concrete, as specified, to blend with in-place construction. Provide other miscellaneous concrete filling indicated or required to complete the Work.
- B. Curbs: Provide monolithic finish to interior curbs by stripping forms while concrete is still green and by steel-troweling surfaces to a hard, dense finish with corners, intersections, and terminations slightly rounded.
- C. Equipment Bases and Foundations: Provide machine and equipment bases and foundations as shown on Drawings. Set anchor bolts for machines and equipment at correct elevations, complying with diagrams or templates from manufacturer furnishing machines and equipment.
- D. Steel Pan Stairs: Provide concrete fill for steel pan stair treads, landings, and associated items. Cast-in inserts and accessories as shown on Drawings. Screed, tamp, and trowel-finish concrete surfaces.

3.13 CONCRETE PROTECTING AND CURING

- A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and ACI 301 for hot-weather protection during curing.
- B. Evaporation Retarder: Apply evaporation retarder to unformed concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h (1 kg/sq. m x h) before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.

- C. Formed Surfaces: Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces. If forms remain during curing period, moist cure after loosening forms. If removing forms before end of curing period, continue curing for the remainder of the curing period.
- D. Unformed Surfaces: Begin curing immediately after finishing concrete. Cure unformed surfaces, including floors and slabs, concrete floor toppings, and other surfaces.
- E. Cure concrete according to ACI 308.1, by one or a combination of the following methods:
 - 1. Moisture Curing: Keep surfaces continuously moist for not less than seven days with the following materials:
 - a. Water.
 - b. Continuous water-fog spray.
 - c. Absorptive cover, water saturated, and kept continuously wet. Cover concrete surfaces and edges with 12-inch (300-mm) lap over adjacent absorptive covers.
 - Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches (300 mm), and sealed by waterproof tape or adhesive. Cure for not less than seven days. Immediately repair any holes or tears during curing period using cover material and waterproof tape.
 - a. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive floor coverings.
 - b. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive penetrating liquid floor treatments.
 - c. Cure concrete surfaces to receive floor coverings with either a moisture-retaining cover or a curing compound that the manufacturer certifies will not interfere with bonding of floor covering used on Project.
 - 3. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating and repair damage during curing period.
 - a. Removal: After curing period has elapsed, remove curing compound without damaging concrete surfaces by method recommended by curing compound manufacturer unless manufacturer certifies curing compound will not interfere with bonding of floor covering used on Project.
 - 4. Curing and Sealing Compound: Apply uniformly to floors and slabs indicated in a continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Repeat process 24 hours later and apply a second coat. Maintain continuity of coating and repair damage during curing period.

3.14 LIQUID FLOOR TREATMENTS

- A. Penetrating Liquid Floor Treatment: Prepare, apply, and finish penetrating liquid floor treatment according to manufacturer's written instructions.
 - 1. Remove curing compounds, sealers, oil, dirt, laitance, and other contaminants and complete surface repairs.
 - 2. Apply liquid until surface is saturated, scrubbing into surface until a gel forms; rewet; and repeat brooming or scrubbing. Rinse with water; remove excess material until surface is dry. Apply a second coat in a similar manner if surface is rough or porous.

3.15 JOINT FILLING

- A. Prepare, clean, and install joint filler according to manufacturer's written instructions.
 - 1. Defer joint filling until concrete has aged at least six months. 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 joint clean and dry.
- C. Install semirigid joint filler full depth in saw-cut joints and at least 2 inches (50 mm) deep in formed joints. Overfill joint and trim joint filler flush with top of joint after hardening.

3.16 CONCRETE SURFACE REPAIRS

- A. Defective Concrete: Repair and patch defective areas when approved by Architect. Remove and replace concrete that cannot be repaired and patched to Architect's approval.
- B. Patching Mortar: Mix dry-pack patching mortar, consisting of one part portland cement to two and onehalf parts fine aggregate passing a No. 16 (1.18-mm) 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.
 - Immediately after form removal, cut out honeycombs, rock pockets, and voids more than 1/2 inch (13 mm) in any dimension to solid concrete, Limit cut depth to 3/4 inch (19 mm). Make edges of cuts perpendicular to concrete surface. Clean, dampen with water, and brush-coat holes and voids with bonding agent. Fill and compact with patching mortar before bonding agent has dried. Fill form-tie voids with patching mortar or cone plugs secured in place with bonding agent.
 - 2. Repair defects on surfaces exposed to view by blending white portland cement and standard portland cement so that, when dry, patching mortar will match surrounding color. Patch a test area at inconspicuous locations to verify mixture and color match before proceeding with patching. Compact mortar in place and strike off slightly higher than surrounding surface.
 - 3. Repair defects on concealed formed surfaces that affect concrete's durability and structural performance as determined by Architect.

- D. Repairing Unformed Surfaces: Test unformed surfaces, such as floors and slabs, for finish and verify surface tolerances specified for each surface. Correct low and high areas. Test surfaces sloped to drain for trueness of slope and smoothness; use a sloped template.
 - 1. Repair finished surfaces containing defects. Surface defects include spalls, pop-outs, honeycombs, rock pockets, crazing and cracks in excess of 0.01 inch (0.25 mm) wide or that penetrate to reinforcement or completely through unreinforced sections regardless of width, and other objectionable conditions.
 - 2. After concrete has cured at least 14 days, correct high areas by grinding.
 - 3. Correct localized low areas during or immediately after completing surface finishing operations by cutting out low areas and replacing with patching mortar. Finish repaired areas to blend into adjacent concrete.
 - 4. Correct other low areas scheduled to receive floor coverings with a repair underlayment. Prepare, mix, and apply repair underlayment and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface. Feather edges to match adjacent floor elevations.
 - 5. Correct other low areas scheduled to remain exposed with a repair topping. Cut out low areas to ensure a minimum repair topping depth of 1/4 inch (6 mm) to match adjacent floor elevations. Prepare, mix, and apply repair topping and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface.
 - 6. Repair defective areas, except random cracks and single holes 1 inch (25 mm) or less in diameter, by cutting out and replacing with fresh concrete. Remove defective areas with clean, square cuts and expose steel reinforcement with at least a 3/4-inch (19-mm) clearance all around. Dampen concrete surfaces in contact with patching concrete and apply bonding agent. Mix patching concrete of same materials and mixture as original concrete except without coarse aggregate. Place, compact, and finish to blend with adjacent finished concrete. Cure in same manner as adjacent concrete.
 - 7. Repair random cracks and single holes 1 inch (25 mm) or less in diameter with patching mortar. Groove top of cracks and cut out holes to sound concrete and clean off dust, dirt, and loose particles. Dampen cleaned concrete surfaces and apply bonding agent. Place patching mortar before bonding agent has dried. Compact patching mortar and finish to match adjacent concrete. Keep patched area continuously moist for at least 72 hours.
- E. Perform structural repairs of concrete, subject to Architect's approval, using epoxy adhesive and patching mortar.
- F. Repair materials and installation not specified above may be used, subject to Architect's approval.

3.17 FIELD QUALITY CONTROL

- A. Except as otherwise indicated on drawings or specified herein, all work under this Section shall conform to applicable requirements of the local Building Code and regulations of all government authorities having jurisdiction, applicable State Code, and ACI 318.
- B. Testing and Inspecting: Engage a special inspector and qualified testing and inspecting agency to perform field tests and inspections and to prepare and submit reports.

- C. Inspections:
 - 1. Steel reinforcement placement.
 - 2. Steel reinforcement welding.
 - 3. Headed bolts and studs.
 - 4. Verification of use of required design mixture.
 - 5. Concrete placement, including conveying and depositing.
 - 6. Curing procedures and maintenance of curing temperature.
 - 7. Verification of concrete strength before removal of shores and forms from beams and slabs.
- D. Concrete Tests: Testing of composite samples of fresh concrete obtained according to ASTM C 172 shall be performed according to the following requirements:
 - 1. Testing Frequency: Obtain one composite sample for each day's pour of each concrete mixture exceeding 5 cu. yd. (4 cu. m), but less than 25 cu. yd. (19 cu. m), plus one set for each additional 50 cu. yd. (38 cu. m) or fraction thereof.
 - a. When frequency of testing will provide fewer than five compressive-strength tests for each concrete mixture, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.
 - 2. Slump: ASTM C 143/C 143M; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture. Perform additional tests when concrete consistency appears to change.
 - 3. Air Content: ASTM C 231, pressure method, for normal-weight concrete; ASTM C 173/C 173M, volumetric method, for structural lightweight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
 - 4. Concrete Temperature: ASTM C 1064/C 1064M; one test hourly when air temperature is 40 deg F (4.4 deg C) and below and when 80 deg F (27 deg C) and above, and one test for each composite sample.
 - 5. Compression Test Specimens: ASTM C 31/C 31M, and either ASTM C617 (Bonded Caps) or ASTM C1231 (Unbonded Caps).
 - a. Cast and laboratory cure two sets of two standard cylinder specimens for each composite sample.
 - b. Cast and field cure two sets of two standard cylinder specimens for each composite sample.
 - c. Cast and field cure additional sets of two standard cylinder specimens for construction sequencing purposes for each composite sample.
 - 6. Compressive-Strength Tests: ASTM C 39/C 39M; test one set of two laboratory-cured specimens at 7 days and one set of two specimens at 28 days.

- a. Test one set of two field-cured specimens at 7 days and one set of two specimens at 28 days.
- b. A compressive-strength test shall be the average compressive strength from a set of two specimens obtained from same composite sample and tested at age indicated.
- 7. When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, Contractor shall evaluate operations and provide corrective procedures for protecting and curing in-place concrete.
- 8. Strength of each concrete mixture will be satisfactory if every average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi (3.4 MPa).
- 9. Test results shall be reported in writing to Architect, concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mixture proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests.
- 10. 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.
- 11. Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Architect. Testing and inspecting agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42/C 42M or by other methods as directed by Architect.
- 12. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
- 13. Correct deficiencies in the Work that test reports and inspections indicate dos not comply with the Contract Documents.
- E. Measure floor and slab flatness and levelness according to ASTM E 1155 (ASTM E 1155M) within 24 hours of finishing.

3.18 PROTECTION OF LIQUID FLOOR TREATMENTS

A. 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

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Mortar and grout for masonry.
- B. Mortar and grout for decorative face CMU and brick veneer.
- 1.2 RELATED SECTIONS
 - A. Section 043000 Unit Masonry System: Installation of mortar and grout.
 - B. Section 081120 Standard Steel Frames.

1.3 REFERENCES

- A. ACI 530 Building Code Requirements for Masonry Structures.
- B. ACI 530.1 Specifications For Masonry Structures.
- C. ASTM C5 Quicklime for Structural Purposes.
- D. ASTM C91 Masonry Cement.
- E. ASTM C94 Ready-Mixed Concrete.
- F. ASTM C144 Aggregate for Masonry Mortar.
- G. ASTM C150 Portland Cement.
- H. ASTM C207 Hydrated Lime for Masonry Purposes.
- I. ASTM C270 Mortar for Unit Masonry.
- J. ASTM C404 Aggregates for Masonry Grout.
- K. ASTM C1142 Ready-Mixed Mortar for Unit Masonry.
- L. IMIAC (International Masonry Industry All-Weather Council) Recommended Practices and Guide Specifications for Cold Weather Masonry Construction.

1.4 SUBMITTALS

- A. Submit under provisions of Division 1 General Requirements.
- B. Include design mix, indicate whether the Proportion or Property specification of ASTM C270 is to be used, required environmental conditions, and admixture limitations.
- C. Samples: Submit two samples of mortar, illustrating mortar color and color range.
- D. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

1.5 QUALITY ASSURANCE

- A. Perform Work in accordance with ACI 530 and ACI 530.1.
- 1.6 DELIVERY, STORAGE, AND HANDLING
 - A. Deliver, store, protect, and handle products to site under provisions of Division 1 General Requirements.
 - B. Maintain packaged materials clean, dry, and protected against dampness, freezing, and foreign matter.

1.7 ENVIRONMENTAL REQUIREMENTS

- A. Cold Weather Requirements: IMIAC Recommended Practices and Guide Specifications for Cold Weather Masonry Construction.
- B. Maintain materials and surrounding air temperature to maximum 90 degrees F prior to, during, and 48 hours after completion of masonry work.

PART 2 PRODUCTS

- 2.1 MATERIALS
 - A. Portland Cement: ASTM C150, Type I, gray color.
 - B. Mortar Aggregate: ASTM C144, standard masonry type.
 - C. Hydrated Lime: ASTM C207, Type S.
 - D. Grout Course Aggregate: ASTM C404.
 - E. Grout Fine Aggregate: sand.
 - F. Water: Clean and potable.
 - G. Bonding Agent: Latex type.

2.2 MORTAR COLOR

- A. Mortar Color: Mineral oxide pigment; color to be selected by Architect. (Assume 2 colors).
- 2.3 MORTAR MIXES
 - A. Mortar for Load Bearing Walls and Partitions: ASTM C270, Type S using the Property specification.
 - B. Mortar for Non-Load Bearing Walls and Partitions: ASTM C270, Type S using the Property specification.
 - C. Mortar for Engineered Masonry: ASTM C270, Type S using the Property specification.

D. Mortar for Brick Masonry: ASTM C270, Type N.

2.4 MORTAR MIXING

- A. Thoroughly mix mortar ingredients in accordance with ASTM C270 in quantities needed for immediate use.
- B Maintain sand uniformly damp immediately before the mixing process.
- C. Add mortar color in accordance with manufacturer's instructions. Provide uniformity of mix and coloration.
- D. Do not use anti-freeze compounds to lower the freezing point of mortar.
- E. If water is lost by evaporation, re-temper only within two hours of mixing.
- F. Use mortar within two hours after mixing at temperatures of 90 degrees F, or two-andone-half hours at temperatures under 40 degrees F.

2.5 GROUT MIXES

- A. Bond Beams: 3,000 psi strength at 28 days; 8-10 inches slump; premixed type in accordance with ASTM C94.
- B. Engineered Masonry: 3,000 psi strength at 28 days; 8-10 inches slump; premixed type in accordance with ASTM C94.

2.6 GROUT MIXING

- A. Mix grout in accordance with ASTM C94.
- B. Add admixtures in accordance with manufacturer's instructions; mix uniformly.
- C. Do not use anti-freeze compounds to lower the freezing point of grout.

PART 3 EXECUTION

- 3.1 EXAMINATION
 - A. Request inspection of spaces to be grouted.

3.2 PREPARATION

- A. Apply bonding agent to existing concrete surfaces.
- B. Plug clean-out holes with brick or block masonry units. Brace masonry for wet grout pressure.

3.3 INSTALLATION

- A. Install mortar and grout in accordance with ASTM C270 and manufacturer's instructions.
- B. Work grout into masonry cores and cavities to eliminate voids.

- C. Do not install grout in lifts greater than 16 inches without consolidating grout by rodding.
- D. Do not displace reinforcement while placing grout.
- E. Remove excess mortar from grout spaces.
- 3.4 FIELD QUALITY CONTROL
 - A. Field inspection and testing will be performed under provisions of Division 1 General Requirements.
 - B. Test and evaluate mortar in accordance with ASTM C780.
 - C. Test and evaluate grout in accordance with ASTM C1019.

END OF SECTION

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Concrete masonry units.
- B. Reinforcement, anchorage, and accessories.
- C. Face Brick and decorative CMU veneer.
- D. Cast Stone Caps.
- E. Expansion Joints.
- 1.2 PRODUCTS INSTALLED BUT NOT FURNISHED UNDER THIS SECTION
 - A. Section 041000 Mortar and Masonry Grout.
 - B. Section 072726 Fluid Applied Membrane Air Barriers.
 - C. Section 081120- Standard Steel Frames: Placement of door frame anchors.
 - D. Section 051200 / 055000 Steel lintels built into masonry.
 - E. Section 061000 Wood nailers and blocking built into masonry.

1.3 RELATED SECTIONS

- A. Section 041000 Mortar and Masonry Grout.
- B. Section 055000 Metal Fabrications
- C. Section 061000 Rough Carpentry
- D. Section 076200 Sheet Metal Flashing and Trim: Cap flashings over masonry work.
- E. Section 079000 Joint Sealers: Rod and sealant at control and expansion joints.

1.4 REFERENCES

- A. ACI 530 Building Code Requirements for Masonry Structures.
- B. ACI 530.1 Specifications for Masonry Structures.
- C. ASTM A167 Stainless and heavy-resisting chromium-nickel steel plate.
- D. SMACNA Architectural sheet metal manual.
- E. ASTM C90 Load-Bearing Concrete Masonry Units.
- F. ASTM C129 Non-Load Bearing Concrete Masonry Units.
- G. IMIAC International Masonry Industry All-Weather Council: Recommended Practices

and Guide Specification for Cold Weather Masonry Construction.

- H. IMIAC International Masonry Industry All-Weather Council: Recommended Practices and Guide Specification for Hot Weather Masonry Construction.
- I. Brick Industry Association (BIA): Technical Notes on Brick Construction.
- J. National Concrete Masonry Association (NCMA): Technical Notes on CMU Construction.

1.5 SUBMITTALS

- A. Submit under provisions of Division 1 General Requirements.
- B. Product Data: Provide data for masonry units and fabricated wire reinforcement.
 - 1. Reinforcement and metal accessories including joint reinforcement and anchors and ties.
 - 2. Masonry accessories, expansion joint strips and control joint strips.
- C. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
- D. Manufacturer's specifications, installation requirements and other data needed to provide compliance with the specified requirements.
- E. Samples Pavers/Brick/Stone: Samples of the size and configuration, showing extremes of the full range of color and shading, of each paver, brick and stone shape.
- F. Shop Drawings Submit shop drawings for following items showing dimensions, locations, and relationship with adjacent materials and component:
 - 1. Reinforcing steel and accessories, including fabrication, bending, and placement to be shown on wall elevations drawn at minimum $\frac{1}{4}$ " = 1'-0" scale.
 - a. Comply with ACI 315, "Details and Detailing of Concrete Reinforcement."
 - b. No reinforcement shall be installed into the masonry wall construction without Architect and Engineer review of such shop drawings.
 - 2. Steel and Precast concrete lintels, steel shelf angles, and steel door frames.
 - 3. Reinforced masonry wall construction may not begin until the approved shop drawings have been reviewed and received in the field. Any costs associated with corrective work required to masonry wall construction because of proceeding without the approved shop drawings will be solely borne by the Contractor.
- G. Quality Control Submittals

1. Test Reports – Material test reports from qualified independent testing laboratory indicating and interpreting test results relative to compliance of following items with specified requirements:

- a. Masonry unit tests.
- b. Mortar mix complying with property requirements of ASTM C270. Refer to "Source Quality Control" article in Part 2 Products below.
- c. Grout mixes complying with compressive strength requirements of ASTM C 476. Include description of type and proportions of grout ingredients.
- 2. Certificates Signed by manufacturer and Contractor certifying that each of the following materials complies with specified requirements:
 - a. Each different clay masonry or concrete masonry unit specified in PART 2.
 - b. Each different cement product required for mortar and grout including name of manufacturer, brand, type and weight slips at time of delivery.
- 3. Cold-Weather and Hot-Weather Construction Procedures: Complete description indicating compliance with requirements specified in ACI 530.1 as adopted by the Authority hold jurisdiction over the Work.

4. Qualification Data: Demonstrating compliance with requirements specified below, including list of completed projects with project names, addresses, telephone numbers, names of owners, and other specified information.

1.6 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing the products specified in this section with minimum three years documented experience. Provide single source responsibility for the following materials:
 - 1. Masonry Units: Obtain exposed masonry unites of uniform texture and color, or a uniform blend within ranges acceptable for these characteristics, from one manufacturer for each different product required for each continuous surface or visually related surfaces.
 - 2. Mortar Materials: Obtain mortar ingredients of uniform quality, including color for exposed masonry, from one manufacturer for each cementitious component and from one source and producer for each aggregate.
- B. Testing Agency Qualifications: An independent testing agency, acceptable to authorities having jurisdiction, qualified according to ASTM C 1093 to conduct the testing indicated, as documented according to ASTM E 548.
 - 1. Testing Agency's field inspector to have a minimum of five (5) years experience in the inspection of reinforced masonry construction.
 - 2. Testing agency to submit resume of technical experience for all field personnel performing inspection of masonry construction on this project.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, protect and handle products to site under provisions of Division 1 - General Requirements.

- B. Packing and Shipping: Deliver masonry materials to project in undamaged condition.
 - 1. Pre-Blended Mortar: Deliver pre-blended mortar in reusable packages, marked with manufacturer's name and mortar type.
- C. Storage and Protection
 - 1. Store masonry construction materials off ground, under cover, and in dry location to prevent deterioration or damage due to moisture, temperature changes, contaminants, corrosion, and other causes. If units become wet, do not place until units are in air-dried condition.
 - a. Store cementitious materials off ground, under cover, and in dry location.
 - b. Store aggregates where grading and other required characteristics can be maintained, and contamination avoided.
 - c. Store pre-blended mortar in reusable packages in which delivered and in protected locations to prevent deterioration or intrusion of foreign materials.
 - d. Protect clay masonry units from moisture absorption so that, at the time of installation, the moisture content is not more than the maximum allowed at the time of delivery.
 - e. Protect Type I concrete masonry units from moisture absorption so that, at the time of installation, the moisture content is not more than the maximum allowed at the time of delivery.
 - 2. Cover materials, including reinforcement, when necessary to protect from elements.
 - 3. Store masonry accessories, including metal items, in such a manner to prevent corrosion and accumulation of dirt and oil. Corroded metal accessories will be rejected and replaced by the Contractor at its expense.

1.8 ENVIRONMENTAL REQUIREMENTS

- A. Maintain materials and surrounding air temperature to minimum 40 degrees F prior to, during, and 48 hours after completion of masonry work.
- B. Maintain materials and surrounding air temperature to maximum 90 degrees F prior to, during, and 48 hours after completion of masonry work.
- C. Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost.
 - 1. Do not build on frozen substrates coated with ice or frost.
 - 2. Contractor at its cost to remove and replace unit masonry damaged by frost or by freezing conditions.
 - 3. Comply with cold-weather construction requirements contained in ACI

530.1/ASCE 6/TMS 602 as adopted by the Authority holding jurisdiction over the Work.

- 4. 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.
- D. Hot Weather Requirements: Protect unit masonry work when temperature and humidity conditions produce excessive evaporation of water from mortar and grout.
 - 1. Provide artificial shade, wind breaks, and use cooled materials as required.
 - 2. When ambient temperature exceeds 100 deg F, or 90 deg F with a wind velocity greater than 8 mph, do not spread mortar beds more than 48 inches ahead of masonry. Set masonry units within one minute of spreading mortar.

1.9 COORDINATION

- A. Coordinate work under provisions of Division 1 General Requirements.
- B. Coordinate the masonry work with installation of window and door frame anchors.

1.10 MOCK-UP

- A. Provide mock-up under provisions of Section 01400.
- B. Construct a masonry wall into a panel sized 4 feet long by 4 feet high, which includes brick, cast stone and mortar.
- C. Locate where directed by Architect.
- D. Mock-up may not remain as part of the Work.

1.11 SYSTEM DESCRIPTION

- A. Design Requirements: Conform to requirements of ACI 530.1 for masonry construction, except as otherwise specified in this section or on Drawings.
 - 1. Concrete Masonry System Assemblage Compressive Strength (F'm):
 - a. Concrete Masonry Units assembled using Type S Mortar: F'm = 1,500 psi.

PART 2 PRODUCTS

2.1 MANUFACTURERS - CONCRETE MASONRY UNITS

- A. E.P. Henry Corporation: Standard units and special units for 90 degree corners, bond beams and lintels.
- B. Substitutions: Under provisions of Division 1 General Requirements.

2.2 CONCRETE MASONRY UNITS

- A. Hollow Load Bearing Block Units (CMU): Two cell, normal weight concrete masonry units consisting of Portland cement, water, and mineral aggregate, complying with requirements of ASTM C90 for type specified and providing minimum average net area compressive strength of 1900 psi for 3 individual units. Normal Weight Solid Units: Type I Moisture Controlled Units; weighing 125 lbs/cu.ft. or more.
 - 1. Size: Nominal 8"x 16" face dimension (7 5/8"x 15 5/8" actual) x thickness shown on Contract Documents, unless otherwise specified.
- B. Solid Load-Bearing Block Units (CMU): Concrete masonry units greater than 75% solid consisting of Portland cement, water, and mineral aggregate, complying with requirements of ASTM C90 for grade and type specified and providing minimum average net area compressive strength of 1900 psi for 3 individual units.
 - 1. Normal Weight Solid Units: Type I Moisture Controlled Units; weighing 125 Ibs/cu.ft. or more.
 - 2. Size: Nominal 8"x 16" face dimension (7 5/8"x 15 5/8" actual) x thickness shown on Contract Documents, unless otherwise specified.

2.3 FACE BRICK

- A. Sioux City Brick.
- B. Substitutions: Under the provisions of Division 1 General Requirements.
- 2.4 BRICK UNIT
 - A. Standard Face Brick: Sioux City Brick Blue Ironspot, Smooth Modular; 2-1/4" x 7-5/8" x 3-5/8".
- 2.5 DECORATIVE FACE MASONRY VENEER
 - A. York Building Products Split Face Finish.
 - B. Substitutions: Under the provisions of Division 1 General Requirements.

2.6 DECORATIVE FACE MASONRY UNIT

- A. Decorative Face Masonry Unit: York Building Products Split Face; 4" x 8" x 16" nominal; Provide corner units, L-Block and special shapes as required.
- B. Color: Slate.
- C. Substitutions: Under the provisions of Division 1 General Requirements.

2.7 REINFORCEMENT AND ANCHORAGE

- A. Single Wythe Joint Reinforcement: Truss Type: ASTM A 951, Two wire 9-gauge corrosion resistant steel; 2 wire units with 1 wire embedded in joint on each shell of CMU spaced at 16 inches on-center maximum; similar to:
 - 1. "DUR O WAL Truss" by DUR-O-WAL, Inc.

- 2. "AA600 Blok Trus" by AA Wire Products Co.
- 3. "WB302 Single Wythe Truss Type Masonry Wall Reinforcing" by Masonry Reinforcing Corp. of America.
- 4. Or approved Equal.
- B. Multiple Wythe Joint Reinforcement: Truss type with adjustable hook & eye tie system; steel wire, hot dip galvanized to ASTM A641 Class 3 after fabrication; Dur-O-Eye as manufactured by Dur-O-Wall, Inc. or approved equal.
- C. Wall Ties: Hohmann and Barnard DW-10 with box tie with drip; galvanized; or approved equal.
- D. Wall Ties: (CMU Backup) Hohmann and Barnard CWT Corrugated Wall Tie; galvanized; 18 ga., or approved equal.
- E. Reinforcing Steel: ASTM A 615, Grade 60, Deformed.
- F. Provide prefabricated units for corner and tee sections.

2.8 FLASHING

- A. Thru-Wall Flashing: Copper/Fabric 5 oz/sheet copper bonded to and between 2 layers of asphalt impregnated fiberglass or cotton fabric as manufactured by Afco Products or approved equal.
- B. Step Flashing: Aluminum sheet; ASTM B209; .032 inch thick; anodized finish as selected by Architect.
- 2.9 CAST STONE MANUFACTURERS
 - A. Continental Cast Stone East.
 - B. American Art Stone, Inc.
 - C. Substitutions: Under provisions of Division 1 General Requirements.

2.10 CAST STONE

- A. Cast Stone
 - 1. Compressive strength not less than 6,500 lbs/square inch.
 - 2. Absorption: No greater than 6%.
 - 3. Provide sizes and shapes as indicated on Drawings with integral drips under the outer edge.
 - 4. Surface finish shall be fine grained texture.
 - 5. Color: to be selected by Architect.
 - 6. Curing: Cure cast stone in a totally enclosed curing room under a water spray for 24 hours.
 - 7. Casting Method: Vibrant Dry Tamp (VDT)
 - 8. Surface Voids: No bugholes, airvoids or other surface blemishes.
 - 9. Color Variation: Compare in direct daylight at 10 feet, between cast stone units of similar age, subjected to similar weathering conditions.

- 10. Maximum Variation: Hue 2 units; Lightness, Chroma and Hue combined: 6 units.
- B. Cast Stone: Caps sized as indicated and as required with overhang for drip; slope to drain.
- C. Clamps, Dowels and Anchors: Hot dip galvanized steel, configurations as indicated, with additional attachment devices if recommended by cast stone manufacturer.
 - 1. For dowels, anchor bolts, nuts and washers, comply with ASTM A307, Grade A, for material and ASTM C153, Class C for galvanizing.

2.11 CORROSION RESISTANCE COATING REQUIREMENTS

- A. Exterior Walls and Interior Walls Exposed to Moist Environments: Provide all joint reinforcement, ties, and anchors with hot-dip galvanized coating with 1.5 oz. per square foot, as per ASTM A153, Class B2.
- B. Interior Wall Joint Reinforcement: Mill galvanized with 0.4 oz. per square foot, as per ASTM A641, Class 1.

2.12 ACCESSORIES

- A. Preformed Control Joints: PVC material. Size and profile as required to suit application. Hohman & Barnard VS Series or approved equal.
- B. Joint Filler: Closed cell polyvinyl chloride; oversized 50 percent to joint width; selfexpanding; maximum lengths.
- C. Weeps: Mortar Net weep vents; 2-1/2" x 3-1/2" x ½"; mesh polyester; bonded; color selected by Architect. (800) 664-6638.
- D. Neoprene Pads: ASTM D-1056.
- E. Cleaning Solution: Non-acidic, not harmful to masonry work or adjacent materials.
- F. Mortar Net: Mortar Net drainage system; 1-1/2" thick; high density; polyethylene. (800) 664-6638.
- G. Bond Breaker Strips At Contractor's option, provide one of following types of bond breaker strips:
 - 1. Asphalt-saturated organic roofing felt complying with ASTM D226, Type I (No. 15 asphalt felt).
 - 2. VOC-compliant form release agent suitable for brush or roller application; similar to "eucoslip VOX" by Euclid Chemical Co.
 - 3. Or Approved Equal.
- H. Miscellaneous Anchors
 - 1. Anchor Bolts: 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, Class C; of diameter and length indicated and in the following configurations:

- a. Headed bolts: A307 Non-headed bolts, bent in manner indicated.
- 2. Post-installed Anchors: Anchors as described below, with capability to sustain, without failure, load imposed within factors of safety indicated, as determined by testing per ASTM E 488, conducted by a qualified independent testing agency.
 - a. Type: Chemical adhesive anchors
 - b. Corrosion Protection: Carbon-steel components zinc plated to comply with ASTM B633, Class Fe/Zn 8 (8 microns) for Class SC 2 service condition (moderate).
 - c. For Post-installed Anchors in Concrete: Capability to sustain, without failure, a load equal to four (4) times the loads imposed.
- d. For Post-installed Anchors in Grouted Masonry Units: Capability to sustain, without failure, a load equal to six (6) times the loads imposed.

PART 3 EXECUTION

- 3.1 EXAMINATION
 - A. Verify that field conditions are acceptable and are ready to receive work.
 - B. Verify items provided by other sections of work are properly sized and located.
 - C. Verify that built-in items are in proper location, and ready for roughing into masonry work.

3.2 PREPARATION

- A. Direct and coordinate placement of metal anchors supplied to other sections.
- B. Provide temporary bracing during installation of masonry work. Maintain in place until building structure provides permanent bracing.
- C. Protection during course of work:
 - 1. Comply with chemical cleaner manufacturer's written instructions for protecting building and other surfaces against damage from exposure to its products.
 - 2. Keep wall wet below area being cleaned to prevent streaking from runoff.
 - 3. Do not clean masonry during winds of sufficient force to spread cleaning solutions to unprotected surfaces.
 - 4. Neutralize and collect alkaline and acid wastes for disposal off Owner's property.
 - 5. Dispose of runoff from cleaning operations by legal means and in a manner that prevents soil erosion, undermining of paving and foundations, damage to landscaping, and water penetration into building interiors.

- D. Wall Covering: During masonry erection, cover top of walls, projections, and sills with strong waterproof membrane at end of each day or shutdown. Cover partially completed walls when masonry construction is not in progress.
 - 1. Extend cover minimum of 24 in. down both sides and hold securely in place.
 - 2. Where one wythe of multi-wythe walls is completed in advance of other wythes, secure cover minimum 24" down face next to unconstructed wythe and hold cover in place.
- E. Staining: Prevent grout or mortar from staining face of masonry to be left exposed or painted. Remove immediately grout or mortar in contact with face of masonry.
 - 1. Protect all sill, ledges and projections from droppings of mortar.
 - 2. Protect base of walls from rain-splashed mud and mortar splatter by means of coverings spread on ground and over wall surface.
 - 3. Protect surfaces of window and door frames, as well as similar products with painted and integral finishes from mortar droppings.

3.3 COURSING

- A. Establish lines, levels, and coursing indicated. Protect from displacement.
- B. Maintain masonry courses to uniform dimension. Form vertical and horizontal joints of uniform thickness.
- C. Lay up walls in accordance with construction tolerances specified in ACI 530.1 and with courses accurately spaced and coordinated with other construction.
- D. Concrete Masonry Units:
 - 1. Bond: Running.
 - 2. Coursing: One unit and one mortar joint to equal 8 inches.
 - 3. Mortar Joints: Concave, where visible; Flush where concealed.
 - 4. Stopping and Resuming Work: In each course, rack back 1/2-unit length for onehalf running bond; do not "tooth". Clean exposed surfaces of set masonry, wet clay masonry units lightly (if required), and remove loose masonry units and mortar prior to laying fresh masonry.
- E. Face Brick:
 - 1. Bond: Running
 - 2. Coursing: Three units and three mortar joints equal 8 inches.
 - 3. Mortar Joints: Concave.
- E. Decorative Face Masonry Veneer:
 - 1. Bond: Running
 - 2. Coursing: One unit and one mortar joint equals 8".
 - 3. Mortar Joints: Concave.

3.4 PLACING AND BONDING

- A. Lay solid masonry units in full bed of mortar, with full head joints, uniformly jointed with other work.
- B. Lay hollow masonry units with face shell bedding on head and bed joints.
- C. Buttering corners of joints or excessive furrowing of mortar joints are not permitted.
- D. Protect wall cavity from excess mortar droppings and remove excess mortar as work progresses.
- E. Interlock intersections and external corners.
- F. Do not shift or tap masonry units after mortar has achieved initial set. Where adjustment must be made, remove mortar and replace.
- G. Perform job site cutting of masonry units with proper tools to provide straight, clean, unchipped edges. Prevent broken masonry unit corners or edges.
- H. Isolate masonry partitions from vertical structural framing members with a control joint.
- I. Comply with requirements of ACI 530.1 and as follows:
 - 1. Construct multi-wythe walls (including cavity walls) to full thickness shown on Drawings.
 - 2. Leave openings for equipment to be installed before completion of masonry. After installation of equipment, complete masonry to match construction immediately adjacent to opening.
 - 3. Cut masonry units with motor-drive saws to provide clean, sharp, unchipped edges. Cut units as required to provide continuous pattern and to fit adjoining construction. Use full-size units without cutting where possible. Allow units cut with water-cooled saws to dry before placing, unless wetting of units is specified. Install cut units with cut surfaces and, where possible, cut edges concealed.
 - 4. Wall reinforcing shall be installed in a manner that complies with the requirements as noted on the Contract Documents. Reinforcement shall be set into the wall construction and positioned as noted in the Contract Documents prior to placement of grout.
 - a. Lap all reinforcing bars forty-eight (48) bar diameters unless otherwise indicated or specified.
 - b. Comply with applicable requirements of AWS D1.4 for installation of all reinforcing welded to structural steel framing.
 - c. Provide bar positioners at all vertical bar locations, at top of first course and at first course below top of CMU at each grout pour height, to position reinforcing bars in CMU cores as indicated on Drawings.
 - d. Reinforcement set into freshly placed grout in lieu of placing reinforcement as wall is constructed is not acceptable and will be rejected.

3.5 REINFORCEMENT AND ANCHORAGE

- A. Install horizontal joint reinforcement 16 inches on center.
- B. Place masonry joint reinforcement in first horizontal joint above and below openings. Extend continuous minimum 16 inches each side of opening.
- C. Place joint reinforcement continuous in first joint below top of walls.
- D. Lap joint reinforcement ends minimum 6 inches.
- E. Install reinforcing as noted on Drawings.
- F. Cut or interrupt joint reinforcement at control and expansion joints, unless otherwise indicated.
- G. Provide continuity at corners and wall intersections by use of prefabricated "L" and "T" sections. Cut and bend reinforcement units as directed by manufacturer for continuity at returns, offsets, column fireproofing, pipe enclosures and other special conditions.
- H. Reinforce masonry openings greater than 1 ft. wide, with horizontal joint reinforcement placed in two (2) horizontal joints approximately 8" apart, immediately above lintel and immediately below sill. Extend reinforcement at minimum 2 ft. beyond jambs of opening except at control joints.
 - 1. In addition to wall reinforcement, provide additional reinforcement at openings as required to comply with above.

3.6 WEEPS AND ACCESSORIES

- A. Install weeps in veneer at 24 inches o.c. horizontally above thru-wall flashings.
- B. Install mortar net in accordance with manufacturer's instructions.
- C. Do not permit mortar to drop or accumulate into cavity air space or to plug weeps.

3.7 REINFORCEMENT AND ANCHORAGE - BRICK VENEER

A. Secure wall ties to stud frame or CMU back-up and embed into masonry veneer at maximum 16 inches o.c. vertically and 16 inches o.c. horizontally. Place at maximum 3 inches o.c. each way around perimeter of openings, within 12 inches of openings.

3.8 MASONRY FLASHINGS

- A. Extend flashings horizontally at foundation walls and above ledge or shelf angles and lintels.
- B. Turn flashing up minimum 8 inches and bed into mortar joint of masonry.
- C. Lap end joints minimum 6 inches and seal watertight.
- D. Turn flashing, fold, and seal at corners, bends, and interruptions.

- E. Fabricate aluminum step flashing to conform to SMACNA details.
- F. Coordinate installation of flashings with installation of mortar net.

3.9 GROUTED COMPONENTS

- A. Support and secure reinforcing bars from displacement. Maintain position within ½ inch of dimensioned position.
- B. Place and consolidate grout fill without displacing reinforcing.
- C. At bearing locations, fill masonry cores with grout for a minimum 12 inches either side of opening.
- D. All grout shall be placed in the "low-lift" method with a maximum grout pour height of 5 feet. Hold top of grout pour down 2" to form "key" for subsequent grout pours.

3.10 CAST STONE

- A. Install cast stone to withstand normal loads from wind, gravity, movement of building structure, and thermally induced movement, as well as to resist deterioration under conditions of normal use including exposure to weather, without failure.
- B. Set cast stones to comply with requirements of drawings and final shop drawings. Install anchors, supports, fasteners and other attachments indicated or necessary to secure work in place. Shim and adjust anchors, supports and accessories to set stones accurately in locations, with uniform joints, and with edges and faces aligned.
- C. Prime ends of cast stone units, insert properly sized backing rod, and install compatible sealant. Provide sealant joints at the following locations: cast stone units with exposed tops, joints at relieving angles, control and expansion joints, and as indicated on Drawings.
- D. Installation to be in complete conformance with all Manufacturer's Instructions and Recommendations.

3.11 CONTROL JOINTS

- A. Do not continue horizontal joint reinforcement through control and expansion joints.
- B. Install preformed control joint device in continuous lengths. Seal butt and corner joints in accordance with manufacturer's instructions.
- C. Size control joint in accordance with Section 07900 for sealant performance.
- D. Install expansion joint in accordance with manufacturer's instructions.
- E. Space joints as shown on Drawings; however, not more than 20'-0" spacing for control joints in exterior concrete block walls.
- F. Reinforcement, both joint reinforcement and steel reinforcement, to be discontinuous at vertical control joints. Do not form continuous span through movement joints.
- G. Unless otherwise specified, install preformed control joint gaskets designed to fit standard sash blocks.

- H. Where indicated on Drawings, fit bond breaker strips into hollow contour in ends of block units on one side of control joint. Fill resultant core with grout and rake joints in exposed faces.
- I. Install interlocking units ("sash block") designed for control joints. Install bond-breaker strips at joint. Keep head joints free and clear of mortar or rake joint.
- J. Install temporary foam-plastic filler in head joints and remove filler when unit masonry is complete.

3.12 BUILT-IN WORK

- A. Comply with requirements of ACI 530.1.
- B. As work progresses, install built-in metal door frames, wood nailing strips, anchor bolts, plates, and other items to be built-in the work and furnished by other sections.
- C. Install built-in items plumb and level.
- D. Bed anchors of metal door and glazed frames in adjacent mortar joints. Fill metal door frame voids solid with grout.
- E. Do not build in organic materials subject to deterioration.

3.13 TOLERANCES

- A. Maximum Variation from Unit to Adjacent Unit: 1/32 inch.
- B. Maximum Variation from Plane of Wall: 1/4 inch in 10 ft and ½ inch in 20 ft or more.
- C. Maximum Variation from Plumb: 1/4 inch per story non-cumulative; ½ inch in two stories or more.
- D. Maximum Variation from Level Coursing: 1/8 inch in 3 ft and 1/4 inch in 10 ft; $\frac{1}{2}$ inch in 30 ft.
- E. Maximum Variation of Joint Thickness: 1/8 inch in 3 ft.
- F. Maximum Variation from Cross Sectional Thickness of Walls: 1/4 inch.

3.14 CUTTING AND FITTING

- A. Cut and fit for chases, pipes, conduit, sleeves, and grounds. Coordinate with other sections of work to provide correct size, shape and location.
- B. Obtain approval prior to cutting or fitting masonry work not indicated or where appearance or strength of masonry work may be impaired.

3.15 STRUCTURAL BONDING OF MASONRY

A. Comply with requirements of ACI 530.1 and following requirements.
- B. Corners:
 - 1. Provide interlocking masonry unit bond in each course at corners for both load-bearing and non-load-bearing walls, unless vertical expansion or control joints are shown.
 - 2. Provide continuity with horizontal joint reinforcement at corners using prefabricated "L" and "T" units, in addition to interlocking masonry.
- C. Intersecting and Abutting Walls: Unless vertical expansion or control joints are shown at juncture, provide interlocking masonry units for intersecting or abutting walls.
 - 1. Interlocking Wall: Provide continuity with horizontal joint reinforcement using prefabricated "T" units.
 - 2. Abutting Walls: Provide individual wire mesh ties at 16" on-center vertically.

3.16 LINTELS

- A. Steel Lintels: Install steel lintels complying with requirements of SECTION 05120 or 05500 where shown on Drawings.
 - 1. Provide minimum bearing of 8 inches at each jamb, unless otherwise indicated.
 - 2. Shore all hung and loose lintels after lintel has been adjusted and before masonry is placed over lintel.
 - a. Maintain shoring in place for at least 3 days after masonry has been completed over lintel.
- B. Masonry Lintels: Provide where shown on Drawings and wherever openings of more than 1 ft. for brick size units and 2 ft. for block size units are shown without structural steel or other supporting lintels.
 - 1. Provide either precast or formed-in-place masonry lintels. Cure precast lintels before handling and installation.
 - 2. Hollow Concrete Masonry Unit Walls: For masonry openings 3'-0" or less. Use specially formed "U"-shape lintel units with minimum two (2) #4 steel reinforcement bars placed in lower third of masonry unit and filled with coarse grout unless noted otherwise on the Contract Documents.
 - 3. Shore all lintels after lintel has been installed and adjusted prior to masonry being placed over lintel.
 - a. Maintain shoring in place for at least 3 days after masonry has been completed over lintel.
 - b. All temporary shoring needed for the support of masonry during the construction of the Work is to be designed by a professional engineer licensed in the State retained by the Contractor. Neither the Architect nor the Engineer will design Contractor's temporary shoring.

4. Provide minimum bearing of 8" at each jamb, unless otherwise shown. Fill first block core adjacent to masonry opening solid with grout from base of wall to top of opening.

3.17 REINFORCED UNIT MASONRY INSTALLATION

- A. Placing Reinforcement: Comply with requirements of ACI 530.1/ASCE 6/TMS 602.
- B. Grouting: Do not place grout until entire height of masonry to be grouted has attained sufficient strength to resist grout pressure.
 - 1. Comply with requirements of ACI 530.1/ASCE 6/TMS 602 for cleanouts and grout placement, including minimum grout space and maximum pour height of five (5) feet for "Low Lift" grout method used for masonry construction on this Project.
 - 2. Grout all foundation walls solid. Hold top of grout in foundation walls 2" below top of masonry elevation to form "key" with concrete floor slab or subsequent grout pours.

3.18 FIELD QUALITY TESTS

- A. Contractor Requirements
 - 1. Provide access to site for designated representatives of Owner to conduct testing during construction, and provide unit samples, mortar cubes, and prisms required for testing upon Owner's request.
 - 2. Notify Owner's Representative at least 2 days in advance of commencement of laying to allow notification of Owner's Testing Agency. Do not grout or otherwise conceal reinforcing bars prior to inspection by the testing agency.

3.19 INSPECTION

- A. Owner's Testing Agency shall:
 - 1. Inspect masonry construction and compare with pre-approved mock-up which establishes standard of quality and workmanship.
 - 2. Inspect reinforcing for size and placement prior to pouring of grout. Inspect accessories for size, type, spacing, galvanizing coating and proper installation.
 - 3. Inspect grout and mortar mixing operations to ensure mix proportions and procedures comply with specified requirements.
 - 4. Inspect all aspects of masonry construction operations for compliance with specified cold weather and/or hot weather procedures. This may include, but is not limited to:
 - a. Monitoring the temperature of masonry units, mortar, and grout.
 - b. Inspection of protection, including windbreaks and enclosures, during construction.

5. Periodically Inspect the installation of the installed WRB and through wall flashings for compliance with the manufacturer's requirements and the construction noted in the Contract Documents. Provide mark-ups of areas inspected on the architectural elevations to document the location and extent of the inspections performed.

3.20 REPAIR/POINTING/CLEANING

- A. Remove and replace masonry units which are loose, chipped, broken, stained, or otherwise damaged, or if units do not match adjoining units as intended. Provide new units to match adjoining units and install in fresh mortar, pointed to eliminate evidence of replacement.
- B. Pointing: During tooling of joints, enlarge any voids or holes, except weep holes, and completely fill with mortar. Point-up all joints including corners, openings, and adjacent work to provide neat, uniform appearance, prepared for application of sealants.
- C. In-Progress Cleaning: Clean unit masonry as work progresses by dry brushing to remove mortar fins and smears before tooling joints.

3.21 CLEANING

- A. Clean work under provisions of Division 1 General Requirements.
- B. Remove excess mortar and mortar smears as work progresses.
- C. Replace defective mortar. Match adjacent work.
- D. Clean soiled surfaces with cleaning solution.
- E. Use non-metallic tools in cleaning operations.
- F. Apply Cleaner to cast stone in accordance with manufacturer's instructions. Remove cleaner promptly by rinsing thoroughly with clear water.
- G. Do not use harsh cleaning materials or methods that would damage or discolor surfaces.

3.22 PROTECTION OF FINISHED WORK

- A. Protect finished Work under provisions of Division 1 General Requirements.
- B. Without damaging completed work, provide protective boards at exposed external corners which may be damaged by construction activities.

END OF SECTION

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:
 - 1. Structural steel.
 - 2. Architecturally exposed structural steel.
 - 3. Grout.
- B. Related Sections:
 - 1. Division 01 "Quality Requirements" for independent testing agency procedures and administrative requirements.
 - 2. Division 05 "Architecturally Exposed Steel Framing" for additional requirements for Architecturally Exposed Structural Steel.
 - 3. Division 05 "Steel Decking" for field installation of shear connectors through deck.
 - 4. Division 05 "Metal Fabrications" for steel lintels and shelf angles not attached to structural-steel frame, miscellaneous steel fabrications, and other metal items not defined as structural steel.
 - 5. Division 05 "Metal Stairs."
 - 6. Division 09 "Painting" and for surface preparation and priming requirements.

1.3 DEFINITIONS

- A. Structural Steel: Elements of structural-steel frame, as classified by AISC 303, "Code of Standard Practice for Steel Buildings and Bridges."
- B. Architecturally Exposed Structural Steel: Structural steel designated as architecturally exposed structural steel in the Contract Documents.
- C. Heavy Sections: Rolled and built-up sections as follows:
 - 1. Shapes included in ASTM A 6/A 6M with flanges thicker than 1-1/2 inches (38 mm).
 - 2. Welded built-up members with plates thicker than 2 inches (50 mm).
 - 3. Column baseplates thicker than 2 inches (50 mm).

1.4 PERFORMANCE REQUIREMENTS

- A. Connections: Provide details of connections required by the Contract Documents to be selected or completed by structural-steel fabricator, including comprehensive engineering design by a qualified professional engineer, to withstand loads indicated and comply with other information and restrictions indicated.
 - 1. Select and complete connections using schematic details indicated and AISC 360.
 - 2. Use ASD; data are given at service-load level.
- B. Moment Connections: Type PR, partially and FR, fully restrained.

C. Construction: As indicated on Contract Documents.

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: Show fabrication of structural-steel components. The contractor shall deliver to the engineer, at the completion of the job, one (1) electronic version of the final field copies of all steel erection drawing shop drawings.
 - 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. For structural-steel connections indicated to comply with design loads, include structural design data signed and sealed by the qualified professional engineer responsible for their preparation.
- C. Welding Procedure Specifications (WPSs) and Procedure Qualification Records (PQRs): Provide according to AWS D1.1/D1.1M, "Structural Welding Code Steel," for each welded joint whether pregualified or gualified by testing, including the following:
 - 1. Power source (constant current or constant voltage).
- 1.6 INFORMATIONAL SUBMITTALS
- A. Qualification Data: For qualified Installer, Fabricator, Professional Engineer, and Testing Agency.
- B. Welding certificates.
- C. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers, certifying that shop primers are compatible with topcoats.
- D. Mill test reports for structural steel, including chemical and physical properties.
- E. Product Test Reports: For the following:
 - 1. Bolts, nuts, and washers including mechanical properties and chemical analysis.
 - 2. Direct-tension indicators.
 - 3. Tension-control, high-strength bolt-nut-washer assemblies.
 - 4. Shear stud connectors.
 - 5. Shop primers.
 - Nonshrink grout.
 - 6. Source quality-control reports.
- 1.7 QUALITY ASSURANCE
- A. Fabricator Qualifications: A qualified fabricator that participates in the AISC Quality Certification Program and is designated an AISC-Certified Plant, Category STD. In lieu of this requirement for AISC fabricator certification, it is acceptable to provide the AWS D1.1 welding certifications for all shop and field personnel with an index listing all personnel and the certifications following in one complete shop drawing package. Special inspections of an uncertified fabricator's shop shall be in accordance with Section 1704 of the International Building Code, NJ Edition.

- B. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code Steel."
- C. Comply with applicable provisions of the following specifications and documents:
 - 1. AISC 303.
 - 2. AISC 341 and AISC 341s1.
 - 3. AISC 360.
 - 4. RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."
- D. Mockups: Build mockups of architecturally exposed structural steel to set quality standards for fabrication and installation.
 - 1. Coordinate finish painting requirements with Division 09 painting Sections.
 - 2. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.
- E. Preinstallation Conference: Conduct conference at Project site.
- 1.8 DELIVERY, STORAGE, AND HANDLING
- A. Store materials to permit easy access for inspection and identification. Keep steel members off ground and spaced by using pallets, dunnage, or other supports and spacers. Protect steel members and packaged materials from erosion and deterioration.
 - 1. Do not store materials on structure in a manner that might cause distortion, damage, or overload to members or supporting structures. Repair or replace damaged materials or structures as directed.
- B. Store fasteners in a protected place in sealed containers with manufacturer's labels intact.
 - 1. Fasteners may be repackaged provided Owner's testing and inspecting agency observes repackaging and seals containers.
 - 2. Clean and relubricate bolts and nuts that become dry or rusty before use.
 - 3. Comply with manufacturers' written recommendations for cleaning and lubricating ASTM F 1852 fasteners and for retesting fasteners after lubrication.

1.9 COORDINATION

- A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' recommendations to ensure that shop primers and topcoats are compatible with one another.
- B. Coordinate installation of anchorage items to be embedded in or attached to other construction without delaying the Work. Provide setting diagrams, sheet metal templates, instructions, and directions for installation.

PART 2 PRODUCTS

- 2.1 STRUCTURAL-STEEL MATERIALS
- A. W-Shapes: ASTM A 992/A 992M
- B. Channels, Angles, M, S-Shapes: ASTM A 36/A 36M
- C. Plate and Bar: ASTM A 36/A 36M

- D. Corrosion-Resisting Structural Steel, Shapes, Plates, and Bars: ASTM A 588/A 588M, Grade 50 (345).
- E. Cold-Formed Hollow Structural Sections: ASTM A 500, Grade B structural tubing.
- F. Corrosion-Resisting Cold-Formed Hollow Structural Sections: ASTM A 847/A847M, structural tubing.
- G. Steel Pipe: ASTM A 53/A 53M, Type E or S, Grade B.
 - 1. Weight Class: As indicated on documents.
 - 2. Finish: Black, except where indicated to be galvanized.
- H. Steel Castings: ASTM A 216/A 216M, Grade WCB with supplementary requirement S11.
- I. Steel Forgings: ASTM A 668/A 668M.
- J. Welding Electrodes: Comply with AWS requirements.

2.2 BOLTS, CONNECTORS, AND ANCHORS

- A. High-Strength Bolts, Nuts, and Washers: ASTM A 325 (ASTM A 325M), Type 1, heavy-hex steel structural bolts; ASTM A 563, Grade C, (ASTM A 563M, Class 8S) heavy-hex carbon-steel nuts; and ASTM F 436 (ASTM F 436M), Type 1, hardened carbon-steel washers; all with plain finish.
 - 1. Direct-Tension Indicators: ASTM F 959, Type 325 (ASTM F 959M, Type 8.8), compressiblewasher type with plain finish.
- B. High-Strength Bolts, Nuts, and Washers: ASTM A 490 (ASTM A 490M), Type 1, heavy-hex steel structural bolts or tension-control, bolt-nut-washer assemblies with splined ends; ASTM A 563, Grade DH, (ASTM A 563M, Class 10S) heavy-hex carbon-steel nuts; and ASTM F 436 (ASTM F 436M), Type 1, hardened carbon-steel washers with plain finish.
 - 1. Direct-Tension Indicators: ASTM F 959, Type 490 (ASTM F 959M, Type 10.9), compressiblewasher type with plain finish.
- C. Zinc-Coated High-Strength Bolts, Nuts, and Washers: ASTM A 325 (ASTM A 325M), Type 1, heavy-hex steel structural bolts; ASTM A 563, Grade DH (ASTM A 563M, Class 10S) heavy-hex carbon-steel nuts; and ASTM F 436 (ASTM F 436M), Type 1, hardened carbon-steel washers.
 - 1. Finish: Hot-dip zinc coating
 - 2. Direct-Tension Indicators: ASTM F 959, Type 325 (ASTM F 959M, Type 8.8), compressiblewasher type with mechanically deposited zinc coating finish.
- D. Tension-Control, High-Strength Bolt-Nut-Washer Assemblies: ASTM F 1852, Type 1, heavy-hex or round head assemblies consisting of steel structural bolts with splined ends, heavy-hex carbon-steel nuts, and hardened carbon-steel washers.
 - 1. Finish: Plain
- E. Shear Connectors: ASTM A 108, Grades 1015 through 1020, headed-stud type, cold-finished carbon steel; AWS D1.1/D1.1M, Type B.
- F. Unheaded Anchor Rods: ASTM F1554, Grade 36 (ASTM F1554 Grade 55, weldable can be substituted for Grade 36) or as indicated on documents.
 - 1. Configuration: Straight and threaded with nut for anchorage.
 - 2. Nuts: ASTM A 563 (ASTM A 563M) heavy hex carbon steel.

- 3. Plate Washers: ASTM A 36/A 36M carbon steel to be used at all column baseplate locations.
- 4. Washers: ASTM F 436 (ASTM F 436M), Type 1, hardened carbon steel.
- 5. Finish: Plain
- G. Headed Anchor Rods: ASTM F 1554, Grade 36 (ASTM F 1554, Grade 55, weldable can be substituted for Grade 36) straight with heavy-hex head, or as indicated on documents.
 - 1. Nuts: ASTM A 563 (ASTM A 563M) heavy hex carbon steel.
 - 2. Plate Washers: ASTM A 36/A 36M carbon steel to be used at all column baseplate locations.
 - 3. Washers: ASTM F 436 (ASTM F 436M) Type 1, hardened carbon steel.
 - 4. Finish: Plain
- H. Threaded Rods: ASTM A 36/A 36M
 - 1. Nuts: ASTM A 563 (ASTM A 563M) heavy hex carbon steel.
 - 2. Washers: ASTM F 436 (ASTM F 436M) Type 1, hardened carbon steel.
 - 3. Finish: Plain
- I. Clevises and/or Turnbuckles: Made from cold-finished carbon steel bars, ASTM A 108, Grade 1035.
- J. Eye Bolts and Nuts: Made from cold-finished carbon steel bars, ASTM A 108, Grade 1030.
- K. Sleeve Nuts: Made from cold-finished carbon steel bars, ASTM A 108, Grade 1018.
- L. Expansion Anchors: Type and size as indicated on documents. Wedge type, torque-controlled, with impact section to prevent thread damage and wedge ridges to prevent spinning during installation, complete with required nuts, washers, and manufacturer's installation instructions. All expansion anchors shall be equipped with length identification markings.
 - 1. Interior Use: For use in conditioned environments free from potential moisture, provide carbon steel anchors with zinc plating in accordance with ASTM B633.
 - 2. Exposed Use: In exposed, potentially wet, or otherwise corrosive environment, provide anchors of Type 304 or Type 316 stainless steel with stainless steel nuts, and washers of matching alloy group and minimum proof stress equal to or greater than the specified minimum full-size tensile strength of the externally threaded faster. All nuts shall conform to ASTM A563 Grade A unless otherwise specified. Stainless steel anchors shall not be installed in contact with galvanized steel, aluminum, or other galvanically dissimilar metals.
 - 3. Products: Provide the following:
 - a. Hilti Kwik Bolt TZ Expansion Anchor for installation into concrete.
 - b. Hilti Kwik Bolt III Expansion Anchor for installation into masonry.
- M. Cartridge Injection Adhesive Anchors and rebar doweling: Threaded steel rod or inserts, complete with nuts, washers, polymer, cementitious, epoxy, or hybrid mortar adhesive injection system, and manufacturer's installation instructions. Type and size as indicated on documents.

Interior Use: For use in conditioned environments free from potential moisture, provide threaded carbon steel rods conforming to ISO898, ASTM A36, or ASTM A 193, Grade B7 as indicated on documents.

 Exposed Use: In exposed, potentially wet or otherwise corrosive environments provide stainless steel anchors, nuts, and washers in accordance with ASTM F593. Provide nuts and washers with matching alloy group and minimum poof stress equal to or greater than the specified minimum fullsize tensile strength of the externally threaded fastener. All nuts shall conform with ASTM F594 unless other otherwise specified. Stainless steel anchors shall not be installed in contact with galvanized steel, aluminum, or other galvanically dissimilar metals.

- 2. Products: Provide the following:
 - a. Hilti HAS or HIT threaded rods or rebar (by others) with Hilti HIT HY-150 Adhesive for anchorage to masonry or stone. Hilti HIT HY-20 Adhesive System for anchorage to brick or concrete masonry (with screen tubes).
 - b. Hilti HAS, HIS threaded rods or rebar (by others) for doweling with Hilti HIT-RE 500-SD Adhesive Anchoring System for anchorage to concrete.

2.3 PRIMER

- A. Low-Emitting Materials: Paints and coatings shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- B. Primer: Fabricator's standard lead- and chromate-free, nonasphaltic, rust-inhibiting primer, complying with MPI #79 and compatible with topcoat unless otherwise indicated on documents or in Division 09.
- C. Galvanizing Repair Paint: MPI#18, MPI#19, or SSPC-Paint 20, ASTM A 780.
- 2.4 GROUT
- A. Metallic, Shrinkage-Resistant Grout: ASTM C 1107, factory-packaged, metallic aggregate grout, mixed with water to consistency suitable for application and a 30-minute working time.
- B. Nonmetallic, Shrinkage-Resistant Grout: ASTM C 1107, factory-packaged, nonmetallic aggregate grout, noncorrosive, nonstaining, mixed with water to consistency suitable for application and a 30-minute working time.
- 2.5 FABRICATION
- A. Structural Steel: Fabricate and assemble in shop to greatest extent possible. Fabricate according to AISC's "Code of Standard Practice for Steel Buildings and Bridges" and AISC 360.
 - 1. Camber structural-steel members where indicated.
 - 2. Fabricate beams with rolling camber up.
 - 3. Identify high-strength structural steel according to ASTM A 6/ A 6M and maintain markings until structural steel has been erected.
 - 4. Mark and match-mark materials for field assembly.
 - 5. Complete structural-steel assemblies, including welding of units, before starting shop-priming operations.
- B. Architecturally Exposed Structural Steel: Comply with fabrication requirements, including tolerance limits, of AISC 303 for structural steel identified as architecturally exposed structural steel.
 - 1. Fabricate with exposed surfaces smooth, square, and free of surface blemishes including pitting, rust, scale, seam marks, roller marks, rolled trade names, and roughness.
 - 2. Remove blemishes by filling or grinding or by welding and grinding, before cleaning, treating, and shop priming.
- C. Thermal Cutting: Perform thermal cutting by machine to greatest extent possible.
 - 1. Plane thermally cut edges to be welded to comply with requirements in AWS D1.1/D1.1M.
- D. Bolt Holes: Cut, drill, mechanically thermal cut, or punch standard bolt holes perpendicular to metal surfaces.

- E. Finishing: Accurately finish ends of columns and other members transmitting bearing loads.
- F. Cleaning: Clean and prepare steel surfaces that are to remain unpainted according to SSPC-SP 3, "Power Tool Cleaning."
- G. Shear Connectors: Prepare steel surfaces as recommended by manufacturer of shear connectors. Use automatic end welding of headed-stud shear connectors according to AWS D1.1/D1.1M and manufacturer's written instructions.
- H. Steel Wall-Opening Framing: Select true and straight members for fabricating steel wall-opening framing to be attached to structural steel. Straighten as required to provide uniform, square, and true members in completed wall framing.
- I. Welded Door Frames: Build up welded door frames attached to structural steel. Weld exposed joints continuously and grind smooth. Plug-weld fixed steel bar stops to frames. Secure removable stops to frames with countersunk, machine screws, uniformly spaced not more than 10 inches (250 mm) o.c., unless otherwise indicated on documents.
- J. Holes: Provide holes required for securing other work to structural steel and for other work to pass through steel framing members with reinforcing as indicated on documents.
 - 1. Cut, drill, or punch holes perpendicular to steel surfaces.
 - 2. Base-Plate Holes: Cut, drill, mechanically thermal cut, or punch holes perpendicular to steel surfaces.
 - 3. Weld threaded nuts to framing and other specialty items indicated to receive other work.

2.6 SHOP CONNECTIONS

- A. High-Strength Bolts: Shop install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for type of bolt and type of joint specified.
 - 1. Joint Type: Snug tightened or Slip critical.
- 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. Remove backing bars or runoff tabs, back gouge, and grind steel smooth.
 - 2. Assemble and weld built-up sections by methods that will maintain true alignment of axes without exceeding tolerances of AISC 303 for mill material.
 - 3. Verify that weld sizes, fabrication sequence, and equipment used for architecturally exposed structural steel will limit distortions to allowable tolerances. Prevent weld show-through on exposed steel surfaces.
 - a. Grind butt welds flush.
 - b. Grind or fill exposed fillet welds to smooth profile. Dress exposed welds.

2.7 SHOP PRIMING

- A. Shop prime steel surfaces except the following:
 - 1. Surfaces embedded in concrete or mortar. Extend priming of partially embedded members to a depth of 2 inches (50 mm).
 - 2. Surfaces to be field welded.
 - 3. Surfaces to be high-strength bolted with slip-critical connections.
 - 4. Surfaces to receive sprayed fire-resistive materials.
 - 5. Galvanized surfaces.
- B. Surface Preparation: Clean surfaces to be painted. Remove loose rust and mill scale and spatter, slag, or flux deposits. Prepare surfaces according to the following specifications and standards:

1. SSPC-SP 3, "Power Tool Cleaning", unless indicated otherwise on documents or in Division 09.

2.8 GALVANIZING

- A. Hot-Dip Galvanized Finish: Apply zinc coating by the hot-dip process to structural steel according to ASTM A 123/ A 123M.
 - 1. Fill vent and drain holes that will be exposed in the finished Work unless they will function as weep holes, by plugging with zinc solder and filing off smooth.
 - 2. Galvanize lintels and shelf angles attached to structural-steel frames and/or located in exterior walls.
- 2.9 SOURCE QUALITY CONTROL
- A. Testing Agency: Engage an independent testing and inspecting agency to perform shop tests and inspections and prepare test reports.
 - 1. Provide testing agency with access to places where structural-steel work is being fabricated or produced to perform tests and inspections.
- B. Correct deficiencies in Work that test reports and inspections indicate does not comply with the Contract Documents.
- C. Bolted Connections: Shop-bolted connections will be tested and inspected according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."
- D. Welded Connections: In addition to visual inspection, shop-welded connections will be tested and inspected according to AWS D1.1/D1.1M and the following inspection procedures, at testing agency's option:
 - 1. Liquid Penetrant Inspection: ASTM E 165.
 - 2. Magnetic Particle Inspection: ASTM E 709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration will not be accepted.
 - 3. Ultrasonic Inspection: ASTM E 164.
 - 4. Radiographic Inspection: ASTM E 94.
- E. In addition to visual inspection, shop-welded shear connectors will be tested and inspected according to requirements in AWS D1.1/D1.1M for stud welding and as follows:
 - 1. Bend tests will be performed if visual inspections reveal either a less-than- continuous 360-degree flash or welding repairs to any shear connector.
 - 2. Tests will be conducted on additional shear connectors if weld fracture occurs on shear connectors already tested, according to requirements in AWS D1.1/D1.1M.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify, with Steel Erector present, elevations of concrete- and masonry-bearing surfaces and locations of anchor rods, bearing plates, and other embedments, for compliance with requirements.

1. Prepare a certified survey of bearing surfaces, anchor rods, bearing plates, and other embedments showing dimensions, locations, angles, and elevations.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Provide temporary shores, guys, braces, and other supports during erection to keep structural steel secure, plumb, and in alignment against temporary construction loads and loads equal in intensity to design loads. Remove temporary supports when permanent structural steel, connections, and bracing are in place unless otherwise indicated.

1. Retain subparagraph below if design of composite or diaphragm construction is based on shoring. Revise to suit Project.

2. Do not remove temporary shoring supporting composite deck construction until cast-inplace concrete has attained its design compressive strength.

3.3 ERECTION

A. Set structural steel accurately in locations, to elevations indicated, and according to AISC 303 and AISC 360.

B. Base, Bearing 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. Revise requirements in subparagraphs below to suit Project.
- 2. Set plates for structural members on wedges, shims, or setting nuts as required.
- 3. Weld plate washers to top of base plate.
- 4. 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.
- 5. Promptly pack grout solidly between bearing surfaces and plates so no voids remain. Neatly finish exposed surfaces; protect grout and allow to cure. Comply with manufacturer's written installation instructions for shrinkage-resistant grouts.

C. Maintain erection tolerances of structural steel and architecturally exposed structural steel within AISC's "Code of Standard Practice for Steel Buildings and Bridges."

D. Align and adjust various members forming part of complete frame or structure before permanently fastening. Before assembly, clean bearing surfaces and other surfaces that will be in permanent contact with members. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.

- 1. Level and plumb individual members of structure.
- 2. Make allowances for difference between temperature at time of erection and mean temperature when structure is completed and in service.

E. Splice members only where indicated.

F. Remove erection bolts on welded, architecturally exposed structural steel; fill holes with plug welds; and grind smooth at exposed surfaces.

G. If thermal cutting is permitted, retain option in first paragraph below.

H. Do not use thermal cutting during erection unless approved by Architect. Finish thermally cut sections within smoothness limits in AWS D1.1/D1.1M.

I. Do not enlarge unfair holes in members by burning or using drift pins. Ream holes that must be enlarged to admit bolts.

J. Shear Connectors: Prepare steel surfaces as recommended by manufacturer of shear connectors. Use automatic end welding of headed-stud shear connectors according to AWS D1.1/D1.1M and manufacturer's written instructions.

3.4 FIELD CONNECTIONS

A. High-Strength Bolts: Install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for type of bolt and type of joint specified.

1. Joint Type: Snug tightened or Slip critical.

B. Weld Connections: Comply with AWS D1.1/D1.1M for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.

- 1. Comply with AISC 303 and AISC 360 for bearing, alignment, adequacy of temporary connections, and removal of paint on surfaces adjacent to field welds.
- 2. Remove backing bars or runoff tabs, back gouge, and grind steel smooth.
- Assemble and weld built-up sections by methods that will maintain true alignment of axes without exceeding tolerances of AISC's "Code of Standard Practice for Steel Buildings and Bridges" for mill material.
- 4. Verify that weld sizes, fabrication sequence, and equipment used for architecturally exposed structural steel will limit distortions to allowable tolerances. Prevent weld show-through on exposed steel surfaces.
 - a. Grind butt welds flush.
 - b. Grind or fill exposed fillet welds to smooth profile. Dress exposed welds.

3.5 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified independent testing and inspecting agency to inspect field welds and high-strength bolted connections.

B. Bolted Connections: Field-bolted connections will be tested and inspected according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."

- C. Welded Connections: Field fillet welds will be visually inspected according to AWS D1.1/D1.1M.
 - 1. In addition to visual inspection, all suspect field fillet welds and all field full/partial penetration welds will be tested and inspected according to AWS D1.1/D1.1M and the following inspection procedures, at testing agency's option:
 - a. Liquid Penetrant Inspection: ASTM E 165.
 - b. Magnetic Particle Inspection: ASTM E 709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration will not be accepted.
 - c. Ultrasonic Inspection: ASTM E 164.
 - d. Radiographic Inspection: ASTM E 94.

D. In addition to visual inspection, test and inspect field-welded shear connectors according to requirements in AWS D1.1/D1.1M for stud welding and as follows:

- 1. Perform bend tests if visual inspections reveal either a less-than- continuous 360-degree flash or welding repairs to any shear connector.
- 2. Conduct tests on additional shear connectors if weld fracture occurs on shear connectors already tested, according to requirements in AWS D1.1/D1.1M.
- E. Correct deficiencies in Work that test reports and inspections indicate does not comply with the Contract Documents.

3.6 REPAIRS AND PROTECTION

A. Galvanized Surfaces: Clean areas where galvanizing is damaged or missing and repair galvanizing to comply with ASTM A 780.

B. Touchup Painting: Immediately after erection, clean exposed areas where primer is damaged or missing and paint with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.

1. Clean and prepare surfaces by SSPC-SP 2 hand-tool cleaning or SSPC-SP 3 power-tool cleaning.

C. Touch-up Painting: Cleaning and touchup painting are specified in Division 09 painting Sections.

END OF SECTION

PART 1- GENERAL

1.01 DESCRIPTION

- A. General
 - The exterior carport roof framing system will consist of Cee and Zee shapes coldformed metal purlins supported by wide-flange steel beams. The wide flange beams will be supported by HSS steel columns. The carport metal roof deck will be an exposed fastener metal roofing system. The framing shall develop a roof slope plane and that minimizes irregularities that could produce oil-canning in the metal roof system.
 - 2. Furnish labor, material, tools, equipment and services for the roof framing and metal roof deck as indicated, in accordance with provisions of the Contract Documents.
 - 3. Completely coordinate with work of other trades.
 - 4. Although such work is not specifically indicated, furnish and install supplementary or miscellaneous items, appurtenances and devices incidental to or necessary for a sound, secure and complete installation.
 - 5. See Division 1 for General Requirements.
- B. Related work specified elsewhere:
 - 1. Section 051200 Structural Steel
 - 2. Section 062000 Finish Carpentry
 - 3. Section 076200 Sheet Metal Flashing and Trim

1.02 QUALITY ASSURANCE

- A. Applicable Standards: All following referenced publications shall be the most current edition in effect on the date of solicitation.
 - 1. American Institute of Steel Construction (AISC)
 - a. AISC Specification for Structural Steel for Buildings
 - b. AISC: "2001 North American Specification for the Design of Cold Formed Structural Members," American Iron and Steel Institute.
 - 2. American Iron and Steel Institute (AISI)
 - a. AISI "Cold Form Steel Design Manual"
 - 3. American Society of Civil Engineers (ASCE)
 - a. ASCE-7-16 Minimum Design Loads for Buildings and other Structures
 - 4. American Society for Testing and Materials (ASTM) (As Applicable)
 - a. ASTM A 36/A 36M Structural Steel

- b. ASTM A 307 Steel Bolts and Studs
- c. ASTM A 525/A 525M Steel Sheet, Zinc-Coated by the Hot-Dip Method
- d. ASTM A 529/A 529M Structural Steel with 42 KSI Minimum Yield Point
- e. ASTM A1011 with 57 KSI Minimum Yield Stress
- f. ASTM A 1011/A 1011M Steel Sheet and Strip, Carbon, Hot-Rolled
- g. ASTM A 653/A 653M Specification for Steel Sheet, Zinc Coated (Galvanized) or Zinc-Iron Alloy - Coated (Galvannealed) By Hot-Dip Method
- h. ASTM A 792/A 792M AZ55 (Bare Galvalume Plus®) Steel Sheet Aluminum-Zinc Alloy Coated by the Hot Dipped Process
- i. ASTM E 1592 Structural Performance Test for Metal Panel and Siding Systems

by Uniform Static Air Pressure Difference

- 5. Steel Structures Painting Council (SSPC)
 - a. SSPC- SP10 Steel Structures Painting Manual
- 6. Local and State Building Codes
- B. Manufacturer Qualifications
 - 1. Manufacturer has a minimum of five years experience in manufacturing and fabrication of roof framing systems of this nature. Light gauge structural components specified in this section shall be produced in a factory environment (not job-site formed) with fixed-base, roll forming and press-brake equipment assuring the highest level of quality control.
 - Approval shall have been granted to any manufacturing facility producing the roof framing system components by the MBMA and IAS (International Accreditation Services), for quality assurance in manufacturing operations. A letter from the manufacturer certifying compliance will accompany the product approval submittals.
 - 3. Manufacturer shall be the same throughout the project for the exposed fastener metal roof deck and for the roof purlins.
 - 4. Manufacturer shall be the same throughout the project for the roof purlins.
- C. Installation Contractor Qualifications
 - 1. Installation contractor shall be an approved installer, certified by the manufacturer before beginning installation of the exposed fastener metal roofing system and shall meet the following minimum criteria:
 - a. Project foreman is the person having received the specific factory training in the proper installation of the specified metal roofing system and will be present to supervise whenever material is being installed.

- 1. The Project foreman must have a minimum of 5 years experience in the
 - installation of cold-formed Cee and Zee roof purlins and application of exposed fastener metal roofing system.
- b. Provide a certification letter that installation contractor has a minimum 5years of metal product installation experience immediately preceding the date upon which work is to commence.
- 2. Pre-installation Conference
 - a. Prior to installation of the roof framing system, conduct a pre-installation conference at the project site.
 - b. Attending parties shall be Owner's representative, Architect, Contractor, Project Superintendent, Metal Roofing Installer and roof framing Installer.
 - c. Agenda to include framing details and anchorage methods, critical sequencing and review of phasing if applicable and inspection sequencing.
- D. Installation Quality Control
 - The contractor shall conduct an inspection of the erected roof framing system immediately prior to metal roof panel installation. This is to ensure the purlin system is installed at the specified slope and to confirm all roof planes are properly aligned and straight to minimize oil-canning. All system component connections and anchorage will be inspected as well to ensure they have been installed in accordance with the installation documents.

1.03 SUBMITTALS

- A. Submit complete shop drawings and erection details approved by the general contractor to the architect for review. Do not proceed with manufacture, prior to review of shop drawings. Do not use drawings prepared by the architect for shop or erection drawings.
- B. Shop drawings shall show methods of erection, elevations and plans of roof framing, sections and details, interfaces with materials not supplied and proposed identification of component parts and their finishes.
- C. Shop drawings shall be accompanied by an engineering design calculation package for the structural properties of the retrofit roof framing components and metal roof panel system.
- D. Shop drawings and design calculations shall bear the seal and signature of a Professional Engineer registered to practice in the State of New Jersey.

1.04 Warranties

- A. Provide the following warranties non pro-rated
 - 1. Roof Panel Finish Manufacturer agrees to repair or replace metal panels that evidence deterioration of factory-applied finish for the period of 20 years.
- 1.05 Design Criteria
 - A. Building Code

- 1. 2021 International Building Code, New Jersey Edition
- B. Wind Load Design
 - 1. The exposed fastener metal roof decking shall support the wind loads as noted on the Contract Drawings in a three (3) span condition.
- C. Live and Snow Load Design
 - 1. The exposed fastener metal roof decking shall support the live and snow loads as noted on the Contract Drawings for a three (3) span condition.
 - 2. Horizontal deflection shall be L/180 of span after installation of components.

1.05 DELIVERY AND STORAGE

- A. Deliver exposed metal roof panels, roof purlins and miscellaneous roofing items jobsite properly packaged to provide protection against transportation damage.
- B. Exercise extreme care in unloading, storage and erecting retrofit roof framing to prevent bending, warping, twisting and surface damage.
- C. Store all materials and accessories above ground on well-skidded platforms under waterproof covering.

PART 2 – PRODUCTS

2.01 MATERIALS

- A. Roof framing System Components
 - 1. Roof purlins shall be cee and zee shapes with parallel top and bottom flanges. The roof purlins will be set atop the wide flange structural steel beams. The structural steel beams will be sloped as noted on the Contract Drawings. The roof purlins shall be attached to the wide flange beams with angle clips as noted on the Contact Drawings.
 - 2. High and low eave members shall be cee shapes with parallel top and bottom flanges.
 - 3. Purlins will conform to ASTM-A-1011, with a minimum yield strength of 57 ksi. The gauge and depth will be as noted on the Contract Drawings
 - 4. Vertical columns that support the structural steel beams shall be HSS sections and noted on the Contract Drawings.
 - 5. Bracing and connection clip angles will conform to ASTM-A-36, 36 KSI minimum, with size as noted on the Contract Drawings.
 - 6. Flat Strap Bridging shall be 2-inched wide by 16 gauge continuous and shall conform to ASTM A -446 Grade D 50 KSI minimum.
 - 7. Purlin solid blocking shall be provided as noted on the Contract Drawings and shall confirm to ASTM A446 with a 50 KSI minimum yield stress. Blocking shall have a

minimum 2-inch flange width and have a hot dipped galvanized finish conforming to ASTM A525 G90 minimum coating weight.

- 8. Supply all hardware items required for installation of roof framing system in accordance with manufacturer's installation instructions and the Contract Drawings.
- 9. Metal Roof Deck shall be minimum 24-gauge exposed fastener roof deck system. The metal roof deck shall support the load conditions as noted on the Contract Drawings and in accordance with ASCE 7-16 load combinations.
- 10. Connections bolts shall conform to ASTM A325 with size as noted on the Contract Documents. All connected bolts shall be hot dipped galvanized.
- B. Finishes:
 - 1. Roof Purlins and strap bridging shall be galvanized conforming to ASTM-A-653/653M G-90.
 - Bracing and clip angles shall be hot dipped galvanized in accordance with ASTM A123 and all hardware shall be hot dipped galvanized in accordance with ASTM A153.

2.02 MISCELLANEOUS PRODUCTS

- A. Fasteners and Anchors
 - 1. Fasteners used for the attachment of the exposed fastener metal roof panels to the roof purlins support system shall be minimum ¼" diameter with 14 threads per inch having a neoprene washer unless noted otherwise on the Contract Drawings. All fasteners shall have a corrosion resistance coating and will securely attach to the roof purlins.
 - 2. All anchors used to attach the purlins to the structural support shall be hot dipped galvanized with size and type as noted on the Construction Documents.
- B. Sealants and Sealers
 - 1. Provide sealants and tape sealers and noted on the Contract Drawings and as recommended by the metal roof deck manufacturer.

1 PART 3 – EXECUTION

- 3.01 DELIVERY AND RECEIPT
 - A. Submittals-Job Site Receiving, Storage, and Handling of Materials
 - All materials shall be unloaded, handled, hauled and delivered to storage by competent workmen in a manner which will prevent bends, dents, scratches or other damage. Damaged materials shall be rejected and promptly replaced. All materials shall be properly stored and protected from weather damage. All shipments must be thoroughly checked by the consignee. If shortage or damage is found, a notation must be placed on the bill of lading and must be confirmed by the carrier.

- 2. Primed Materials: Upon receipt, all bundles of primed material shall be stored on blocking at an angle sufficient to allow any trapped water to drain and should be protected from the weather by covers allowing air circulation. Water, ice and snow should not be allowed to collect and remain thereon.
- 3. Roof Panels: Bundles of panels shall be inspected for moisture upon receipt. If moisture is present, dry the panels and, if possible, store them in a warm, dry place. The panel bundles shall be elevated and sloped in a manner to allow moisture to drain. Cover all bundles with a tarp or plastic, leaving air spaces for adequate air circulation.

3.02 Erection

- A. General
 - 1. Install the roof purlins so to prevent waves, warpage, buckles, fastening stresses or other distortion. Extreme care should be taken when installing the roof framing purlins and other roof plane components to minimize oil canning in the metal roof panel system. Provide purlin connections to the structural wide flange beams as noted on the Contract Drawings.
 - 2. Install the exposed fastener metal roof panels as specified and in accordance with the manufacturer's approved installation documents and erection details and fastener spacing as noted on the Contract Drawings..
 - 3. Field cutting of roof purlins and metal roof deck shall be accomplished by power tools and will be done in a safe manner to prevent damage to the existing roof and adjacent materials. The contractor shall practice good material utilization of members to minimize scrap and to not jeopardize the construction schedule due to unnecessary shortages of framing and roofing components.
 - 4. Install continuous lateral bridging as located and noted on the Contract Drawings. Bridging shall be mechanically fastened to each purlin as noted in the Contract Drawings.
 - 5. Temporary shoring and bracing shall be provided until all connection have been installed and completed, including the metal roof deck system. The Contractor shall be responsible for the design of all temporary shoring and bracing. All Temporary shoring and bracing shall be designed by a New Jersey licensed professional at the Contractors Expense.
 - 6. Mechanically anchor roof purlin framing to supporting structure in accordance with the details shown on the Contract Drawings.
 - 7. Provide all roof purlin framing and accessories, as required for a complete and proper installation of the metal roof system, necessary to meet the intent of the Contract Drawings and the Manufacturer's recommendations.
 - 8. Use stainless steel fasteners and connectors to connect cold formed metal framing members to pressure treated wood members, even if not call out or indicated on the Contract Drawings.
 - 9. Abutting and lapped lengths of roof purlins shall be securely anchored to common structural element as shown on the Contract Drawings.

- 10. The Owner has the right to reject all cold formed assemblies and/or as-built construction that does not meet the intent of these specifications. The cost associated with the replacement of such items shall be borne by the Contractor with no additional cost to the Owner, Architect or Engineer.
- B. Erection Tolerances
 - 1. Variation of vertical members from plumb: 1/8 inch, maximum
 - 2. Variation of horizontal members from level: 1/8 inch, maximum over length of member
 - 3. Variation of purlins from true roof plane: 1/4 inch in 20'-0" and 3/8" maximum in 40'-0"
 - 4. Variation in purlin runs at ridge and panel end laps: 1/4 inch maximum in 20'-0"

3.03 CLEAN UP

A. The contractor will protect installed framing from damage by subsequent construction activities until final acceptance. All framing system cuttings and debris including unused anchors, framing fasteners, sealant and associated materials shall be collected and disposed of from the jobsite.

END OF SECTION

PART 1 - GENERAL

- 1.1 SUMMARY
 - A. Section Includes:
 - 1. Miscellaneous steel framing and supports.
 - 2. Shelf angles.
 - 3. Loose bearing and leveling plates.
 - 4. Metal ladders at roof hatches.
 - B. Products furnished, but not installed, under this Section include the following:
 - 1. Loose steel lintels.
 - 2. Anchor bolts, steel pipe sleeves, slotted-channel inserts, and wedge-type inserts indicated to be cast into concrete or built into unit masonry.
 - 3. Steel weld plates and angles for casting into concrete for applications where they are not specified in other Sections.

1.2 ACTION SUBMITTALS

- A. Product Data: For the following:
 - 1. Metal nosings and treads.
 - 2. Paint products.
 - 3. Grout.
- B. Shop Drawings: Show fabrication and installation details. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items.
- C. Samples for Verification: For each type and finish of extruded nosing and tread.

PART 2 - PRODUCTS

2.1 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.

2.2 METALS

- A. Metal Surfaces, General: Provide materials with smooth, flat surfaces unless otherwise indicated. For metal fabrications exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.
- B. Steel Plates, Shapes, and Bars: ASTM A 36.
- C. Stainless-Steel Bars and Shapes: ASTM A 276, Type 304, Type 316L.
- D. Steel Tubing: ASTM A 500, cold-formed steel tubing.
- E. Steel Pipe: ASTM A 53, Standard Weight (Schedule 40) unless otherwise indicated.

- F. Cast Iron: Either gray iron, ASTM A 48, or malleable iron, ASTM A 47, unless otherwise indicated.
- G. Aluminum Extrusions: ASTM B 221, Alloy 6063-T6.
- H. Aluminum-Alloy Rolled Tread Plate: ASTM B 632, Alloy 6061-T6.
- I. Aluminum Castings: ASTM B 26, Alloy 443.0-F.
- J. Bronze Extrusions: ASTM B 455, Alloy UNS No. C38500 (extruded architectural bronze).
- K. Bronze Castings: ASTM B 584, Alloy UNS No. C83600 (leaded red brass) or No. C84400 (leaded semired brass).
- L. Nickel Silver Castings: ASTM B 584, Alloy UNS No. C97600 (20 percent leaded nickel bronze).

2.3 FASTENERS

- A. General: Unless otherwise indicated, provide Type 304 or Type 316 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.
 - 2. Provide stainless-steel fasteners for fastening stainless steel.
 - 3. Provide stainless-steel fasteners for fastening nickel silver.
 - 4. Provide bronze fasteners for fastening bronze.
- B. Cast-in-Place Anchors in Concrete: Either threaded type or wedge type unless otherwise indicated; galvanized ferrous castings, either ASTM A 47 malleable iron or ASTM A 27 cast steel. Provide bolts, washers, and shims as needed, all hot-dip galvanized per ASTM F 2329.
- C. Post-Installed Anchors: Torque-controlled expansion anchors 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 or Group 2 stainless-steel bolts, ASTM F 593, and nuts, ASTM F 594.

2.4 MISCELLANEOUS MATERIALS

- A. Shop Primers: Provide primers that comply with applicable painting specification requirements by the Architect.
- 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. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.
- D. 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.
- E. Concrete: Comply with requirements in Section 033000 "Cast-in-Place Concrete" for normal-weight, air-entrained, concrete with a minimum 28-day compressive strength of 3000 psi.

2.5 FABRICATION, GENERAL

- A. Shop Assembly: Preassemble items in the shop to greatest extent possible. Use connections that maintain structural value of joined pieces.
- B. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges. Remove sharp or rough areas on exposed surfaces.
- C. 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.
- D. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners or welds where possible. Locate joints where least conspicuous.
- E. Fabricate seams and other connections that are exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.
- F. Where units are indicated to be cast into concrete or built into masonry, equip with integrally welded steel strap anchors not less than 8 inches from ends and corners of units and 24 inches o.c.
- 2.6 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.
 - C. Fabricate steel girders for wood frame construction from continuous steel shapes of sizes indicated.
 - 1. Where wood nailers are attached to girders with bolts or lag screws, drill or punch holes at 24 inches o.c.
 - D. Fabricate steel pipe columns for supporting wood frame construction from steel pipe with steel baseplates and top plates as indicated. Drill or punch baseplates and top plates for anchor and connection bolts and weld to pipe with fillet welds all around. Make welds the same size as pipe wall thickness unless otherwise indicated.

2.7 SHELF ANGLES

- A. Fabricate shelf angles from steel angles of sizes indicated and for attachment to concrete framing. Provide horizontally slotted holes to receive 3/4-inch bolts, spaced not more than 6 inches from ends and 24 inches o.c., unless otherwise indicated.
- B. For cavity walls, provide vertical channel brackets to support angles from backup masonry and concrete.
- C. Galvanize shelf angles located in exterior walls.

- D. Prime shelf angles located in exterior walls with zinc-rich primer.
- E. Furnish wedge-type concrete inserts, complete with fasteners, to attach shelf angles to cast-in-place concrete.
- 2.8 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.
- 2.9 LOOSE STEEL LINTELS
 - A. Fabricate loose steel lintels from steel angles and shapes of size indicated for openings and recesses in masonry walls and partitions at locations indicated.
 - B. Galvanize loose steel lintels located in exterior walls.
 - C. Prime loose steel lintels located in exterior walls with zinc-rich primer.
- 2.10 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.
- 2.11 FINISHES, GENERAL
 - A. Finish metal fabrications after assembly as specified by the Architect.
- 2.12 STEEL AND IRON FINISHES
 - A. Galvanizing: Hot-dip galvanize items as indicated to comply with ASTM A 153 for steel and iron hardware and with ASTM A 123 for other steel and iron products.
 - 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.
 - 1. Shop prime with universal shop primer as specified by the Architect.
 - C. Preparation for Shop Priming: Prepare surfaces to comply with SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning." Or SSPC-SP 3, "Power Tool Cleaning." requirements indicated below:
 - 1. Exterior Items: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
 - 2. Items Indicated to Receive Zinc-Rich Primer: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
 - 3. Other Items: SSPC-SP 3, "Power Tool Cleaning."
 - D. Shop Priming: Apply shop primer to comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal fabrications. Set metal fabrications accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.
- B. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.
- C. Field Welding: Comply with the following requirements:
 - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - 2. Obtain fusion without undercut or overlap.
 - 3. Remove welding flux immediately.
 - 4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.
- D. Fastening to In-Place Construction: Provide anchorage devices and fasteners where metal fabrications are required to be fastened to in-place construction.
- E. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.

3.2 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 nonshrink grout. Pack grout solidly between bearing surfaces and plates to ensure that no voids remain.

3.3 ADJUSTING AND CLEANING

- A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas. 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.
- B. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780.

END OF SECTION

PART 1 - GENERAL

1.01 SUMMARY

- A. Work under this section includes all equipment, labor, material, water, services, and incidentals to furnish, fabricate, erect, and construct wood framing as shown on the drawings and as specified herein.
- B. Structural wall, floor, and roof framing using conventional lumber
- C. Structural wall, floor, and roof framing using engineered lumber products.
- D. Built-up structural beams and columns.
- E. Floor, wall, and roof sheathing.
- F. Blocking, nailers, plates, sills, and curbs
- G. Blocking and nailers for wall and ceiling mounted fixtures.
- H. Blocking and nailers for casework.
- I. Miscellaneous ceiling and soffit framing.
- J. Roof framing (conventional wood framing)
- K. Preservative treatments required.
- L. Miscellaneous wood framing and sheathing.
- M. Concealed wood blocking for support of miscellaneous construction.

1.02 DEFINITIONS

- A. Stud: Vertical wood element forming the framing of a wall.
- B. Joist: Horizontal wood element forming a floor or roof.
- C. Rafter: Sloped wood element forming the framing for a roof.
- D. I-Joist: Engineered, pre-manufactured wood product consisting of an "I-shaped" wood member utilizing rectangular wood sections for the top and bottom flanges and a thinner vertical wood member for the web of the section.
- E. SPIB: Southern Pine Inspection Bureau (Grading Agency)
- F. WWP: Western Wood Producers (Grading Agency)

1.03 RELATED SECTIONS

- A. Related Sections:
 - 1. DIVISION I
 - 2. SECTION 6192 Metal Plate Connected Wood Trusses (roof sheathing)

- 3. SECTION 08140 Pre-Hung Wood Doors
- 4. SECTION 085213 Metal Clad Windows & Patio Doors

1.04 REFERENCES

- A. FS TT-W-550 Wood Preservative, Chromated Copper Arsenate Mixture.
- B. FS TT-W-571 Wood Preservation: Treating Practices.
- C. FS TT-W-572 Wood Preservative: Water Repellent.
- D. NFPA National Design Specification for Stress Grade Lumber and Its Fastening.
- E. PS 1 Construction and Industrial Plywood.
- F. PS 20 American Softwood Lumber Standard.
- G. 2015 IBC, NJ Edition, Chapter 23 "Wood"

PART 2 PRODUCTS

2.01 LUMBER PHYSICAL REQUIREMENTS

- A. All wood framing supplied under this section shall bear the mark of either the Southern Pine Inspection Bureau (SPIB or Western Wood Producers (WWP). Lumber observed at the site or within the completed Work not bearing such stamps will be rejected. The removal and replacement of any such lumber is the sole responsibility of the contractor.
- B. Lumber: PS 20, graded in accordance with NFPA Grading Rules; maximum moisture content of 19 percent at the time of incorporation into the Work.
- C. Standard grade light framing size lumber. No. 2 Common or Standard grade (WW P4) or No. 2 Boards per SPIB, unless otherwise notes on contract drawings. All materials shall be surfaced on four sides.
 - a. Wall Stud: size noted on Contract Drawings, No. 2 Hem Fir Fb = 850 psi, Fv = 150 psi
 - All interior load bearing stud walls shall have two (2) rows of continuous solid blocking, offset and faced nailed to each wall stud. Solid blocking shall be equally spaced along the height of walls. Blocking shall be the same size and type as wall studs.
 - b. Size: as noted on Contact Documents
 - c. Wood plates on steel beams shall be No. 1 SYP.
- D. Lumber shall be free of physical defects that may affect the strength of the member such as yet not limited to knot size, checks, wane, etc. All lumber with such defects shall be retained and used for non-structural blocking or bridging.
- E. Lumber shall be inspected prior to incorporation into the Work to eliminate members with excessive twist, warp, or other such damage that may negatively impact the installation of the architectural ceiling, wall, and floor finishes.

- F. Plywood and rough carpentry for telephone and electric closets, provide 3/4" thick C-D EXT-APA plywood, fire retardant treated as specified herein.
- G. Roof sheathing shall be APA rated plywood, 5/8" nominal thickness, Exposure 1, manufactured in accordance with Performance Standard PS-1. Comply with PS 1 "U.S. Product Standards for Construction and Industrial Plywood" Panels shall meet Exposure Durability Classification: Exposure 1, Square Edge Detail, Structural Grade, minimum 5/8" nominal thickness or as shown on the drawings. Edge clips shall be installed at mid-span on all plywood edges.
- H. Wall and parapet sheathing shall be APA rated plywood, 1/2" nominal thickness, Exposure 1, manufactured in accordance with Performance Standard PS-1. Comply with PS 1 "U.S. Product Standards for Construction and Industrial Plywood" Panels shall meet Exposure Durability Classification: Exposure 1, Square Edge Detail, Structural Grade, minimum 1/2" nominal thickness or as shown on the drawings.
- I. Engineered Lumber Anthony Power Beams or Approved Equal
 - SCHEDULE 1 Provide engineered lumber member sizes as noted on the Contract Documents as manufactured by The Anthony Forrest Products Company, LLC, 295 Cooper Drive, El Dorado, AR 71730, and as follows:
 - a. Modulus of Elasticity: E = 2,100,000 psi, Allowable Shear Stress: Fv = 300 psi, and Allowable Bending Stress: Fb = 3,000 psi.
 - b. Size: as noted on Contact Documents
 - c. Markings: all engineered lumber to bear the manufacturer's stamp indicating the product type and grade and ICC-ES evaluation report number, manufacturer's name, plant number and the independent inspection agency's logo.
 - d. Warranty: The products delivered shall be free from manufacturing errors or defects in workmanship and material. The products, when correctly installed and maintained, shall be warranted to perform as designed for the normal and expected life of the building.
 - e. Manufacturing Tolerances (Dry with MC < 19%) Finished Length (as specified): ± 1/4"

Depth/Width ≤ 5.5 " wide $/ \leq 14$ " deep: $\pm 1/8$ " > 5.5" wide / > 14" deep: $\pm 3/16$ "

- I. Preservative Treatment:
 - 1. All lumber in direct contact with concrete or masonry or exposed to weather or elevated moisture levels shall be pressure treated in accordance with the American Wood Protection Association standard U1-15 "Use Category System".
 - 2. Pressure treatment shall be Alkaline Copper Quaternary (ACQ.)
 - 3. Minimum ACQ preservative retention for all lumber not in direct contact with the ground to be 0.40 pounds per cubic feet, AWPA Use Category UC4A.
 - 4. Minimum ACQ preservative retention for all lumber in direct contact with ground shall be 0.60 pounds per cubic feet, AWPA Use Category UC4B.
 - 5. Minimum ACQ preservative retention for sill plates in direct contact with masonry or concrete shall be 0.60 pounds per cubic feet, AWPA Use Category UC4B.

- 6. Provide pressure treatment (wolmanized) for all engineered lumber products exposed to weather or in direct contact with concrete or masonry.
- 7. Pressure treated lumber except engineered lumber shall be No. 2 SYP or better.

2.02 FASTENERS

- A. Nails and Spikes: Common Wire unless otherwise noted
 - 1. Nailing of wood members shall conform to Code and as indicated in the Contract Documents. Box nails are not permitted.
 - 2. Penetration: Half-length of nail into piece receiving point.
 - 3. To connect pieces 2 inches net in thickness, 16d nails may be used.
 - 4. Do not drive nails closer together than half their length, nor closer to edge of piece of lumber or timber than 1/4 their length.
 - 5. Spacing and size of nails to be such that splitting will not occur. Pre-bore holes for nails wherever necessary to prevent splitting. Bore diameter of holes smaller than diameter of nail or spike (3/4 of nail's diameter).
 - 6. For plywood nailing, use nails, size and spacing as indicated. Nails shall have edge distances of not less than 3/8 inch.
 - 7. Use hot dipped galvanized nails where exposed to weather, where members are built-in to roofing, or in contact with pressure treated lumber.
- B. Screws: Bright steel wood screws:
 - 1. Screws are to be turned into place, not driven. Self-tapping where required for fastening to metal framing.
 - 2. Countersink where heads will interfere or as required.
 - 3. Screw bolt holes the same diameter and depth as shank; bore holes for threaded portion of screws with bit no larger than base of thread.
 - 4. Use galvanized or cadmium plated screws on fastenings exposed to weather, where members are built-in to roofing, or in contact with pressure treated lumber.
- C. Bolts: Standard mild steel, square or hex head machine bolts with square nuts and malleable iron or steel plate washers, conforming to ASTM A307.
 - 1. To be installed in drilled holes the diameter of the bolt, 1/32 inch (0.8 mm) to 1/16-inch (1.6 mm) over size.
 - 2. Bolting of wood members shall be as called for on the drawings.
 - 3. Washers: Provide bolts bearing on wood, unless noted otherwise on the drawings, with malleable iron, or steel plate washers under heads and nuts. Do no final bolting until structure has been properly aligned.
 - 4. Use galvanized bolts, nuts and washers where exposed to weather, where members are built-in to roofing, or in contact with pressure treated lumber.

- D. Lag Screws: Conform to "National Design Specification for Stress Graded Lumber and Its Fastenings," NFPA, latest edition.
 - 1. Lag screws shall be screwed and not driven into place. Penetration in each timber shall not be less than 2/3 of the length of the lag screw.
 - 2. Hole shall be bored the same diameter and depth as the shank, after which the hole shall be continued to a depth equal to the length of the lag screw with a diameter no larger than 3/4 of the shank diameter.
 - 3. Washers: Provide lag screws bearing on wood with malleable iron or steel plate washers under heads.
 - 4. Use galvanized lag screws and washers where exposed to weather, where members are built-in to roofing, or in contact with pressure treated lumber.
- E. 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 E488 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 (mild).
 - 2. Material: Stainless steel with bolts and nuts complying with ASTM F 593 and ASTM F 594, Alloy Group 1 or 2; use stainless steel for treated woods and exterior use.

2.03 HANDLING, DELIVERY & STORAGE

- A. All lumber shall be handled in a manner to prevent damage to the individual members. All damaged members shall be identified and retained for use in non-critical areas of the Work if possible.
- B. Lumber shall be delivered to the site wrapped in weather resistant protective tarps or coverings to limit the effects of moisture intrusion into the lumber. Protection of lumber must occur during all handling and delivery options to limit moisture content of lumber to that noted in this specification.
- C. Lumber stored on site shall be protected from the weather. Contractor to supply tarps or other such weather resistant covers as needed to ensure that the lumber is protected and that the moisture content of the wood is within specifications at the time it is incorporated into the Work.
- D. Lumber shall be stored at the site on skids or elevated framing in such a manner to permit air circulation around the lumber as well as prevent direct contact with the ground. Lumber, under no circumstances, shall be stored in direct contact with the ground. Any such lumber identified as having been in contact with the ground shall be rejected from the Work.
- E. Lumber stored on site shall be done is such a manner to prevent damage, warping, twisting, etc. of the members.

PART 3 – EXECUTION

- 3.01 <u>Erection</u>
 - A. Contractor shall inspect all completed construction supporting proposed wood framing and identify any areas of the completed work done by others that may negatively affect the performance of its work or the erection of the wood framing required. All such deficiencies must be corrected by the General Contractor prior to the start wood framing erection.

- B. All wood framing shall be constructed in accordance with the Contract Documents and the requirements of the International Building Code as adopted by the State of New Jersey.
- C. Wood members shall be cut to the lengths and heights required to construct the Work. All cuts shall be done so that each of the wood members in contact with one another are square, plumb, and fully contact one another.
- D. All wall studs shall be erected plumb. Walls shall be constructed within +/-1/8" in 10 feet to be considered within acceptable standards for plumbness. Wall framing exceeding this tolerance maybe rejected requiring remedial repairs by the Contractor. All costs associated with such repairs will be borne by the Contractor.
- E. Construct multiple ply-wood stud posts as individual members secured to one another with 10d nails at twelve inch spacing for the full height of the member. All plies of a site fabricated built-up wood post must be mechanically secured to one another.
- F.Construct site fabricated built-up wood headers using the members noted on the Contract Drawings. Contractor to pack out wood headers with plywood as required forming a header that is equal in width to the adjacent wall framing thickness.
- G. Contractor to provide a single jack stud and single king stud at the jamb of all door and window openings less than 6 feet in width.
- H. Wood headers shall be mechanically secured to supporting jack and king studs with nails or screws.
- I. Contractor to review insulation requirements for the Work prior to the erection of the wood framing. Contractor to coordinate as needed with insulation sub-contractor to ensure that all areas of the structure receive the required insulation.
- J. Contractor shall provide all temporary shoring, bracing, or support for the wood framing until the installation of the wall and roof sheathing and the shear wall construction is completed. The wood framed structure is a **non-self-supporting structure** and as such relies upon the installation of the wall and roof sheathing as well as the shear walls for resistance to wind and seismic loads.
- K. Contractor shall coordinate with the other trades performing work on the project to determine extent, size, and location of miscellaneous wood blocking needed for mechanical, electrical, plumbing, telephone, fire suppression, handicap grab bars, etc. Neither the Architect nor the Engineer will supply the locations of such blocking.
- L. Openings through the floor and roof structure shall be framed as illustrated on the Contract Drawings. All openings greater than 12 inches square must have supplemental wood blocking at all four sides of the opening to provide support to the floor and roof sheathing. The Contractor shall field coordinate the size and location of such openings with the Trade requiring the openings. Neither the Architect nor the Engineer will provide the locations of such openings.
- M. All penetrations through the wood framing shall be sealed for fire resistance and thermal purposes in accordance with the requirements of the Contract Documents.
- N. All wood framing shall be mechanically secured to one another as noted on the Contract Drawings. if connection not noted in the Contract Documents, Contractor to refer to Table 2304.10.2 "Fastening Schedule" contained in Chapter 23 of the 2021 International Building Code, New Jersey Edition.

3.02 BLOCKING AND MISCELLANEOUS WOOD

A. General

- 1. Erect rough carpentry true to line, levels and dimensions required; squared, aligned, plumbed, and securely fastened in place.
- 2. Shim where required to true up furring, blocking and the like. Use wood or metal shims only.
- 3. Do all cutting, fitting, drilling and tapping of other work as required to secure work in place and to perform the work included herein. Do all the cutting and fitting of carpentry work, for the work of other trades as required.
- B. Blocking and Miscellaneous Wood
 - 1. Furnish and install all wood grounds, furring, blocking, curbs, bucks, nailers, etc., that may be necessary and required in connection with the carpentry and with the work described for any other trades and including required carpentry for electrical fixtures. All blocking and nailers shall be continuous wherever required, whether or not so indicated.
 - 2. Blocking shall be as required for the proper installation of the finished work and for items in mechanical sections as required. Blocking, edgings, stops, nailing strips, etc., shall be continuous, unless distinctly noted otherwise. Provide blocking as required to install all equipment. Provide blocking and nailers where shown or required to fasten interior sheet metal work.
 - A. All interior load bearing stud walls shall have two (2) rows of continuous solid blocking, offset and faced nailed to each wall stud. Solid blocking shall be equally spaced along the height of walls. Blocking shall be the same size and type as wall studs.
 - 3. Fastening for wood grounds, furring and blocking shall be of metal and of type and spacing as best suited to conditions. Hardened steel nails, expansion screws, toggle bolts, self-clinching nails, metal plugs, inserts or similar fastenings shall be used, of suitable type and size to draw the members into place and securely hold same.
- C. Rough Lumber for Roofing and Sheet Metal
 - 1. Furnish and install all wood nailing strips and wood blocking required in connection with respective types of roofing, fans, flashings, and sheet metal work, using preservative treated wood as herein before specified.
 - 2. Wood blocking shall be of sizes and shapes as indicated on the drawings and/or designed for the reception of curb flashings for roof ventilators and similar items.
 - 3. All nailing strips and blocking shall be carried out in accordance with the printed installation instructions, and/or recommendations of the accepted manufacturer of the roofing materials, and in coordination and cooperation with the sheet metal work trades.
 - 4. All blocking and nailing strips shall be firmly secured in place using counter bored bolt and nut fastenings or secured by any other proposed flush surfaced fastenings.

- 5. Wood nailing strips or blocking required to be embedded in concrete work shall be furnished in time due for placing, prior to start of concrete operations. Locations and spacings of nailing strips or blocking shall be performed in coordination with the concrete trades, as required for respective installations.
- D. Telephone and electric equipment mounting
 - 1. Furnish and install 3/4" thick plywood panels to the walls of the telephone and electric equipment rooms for installation of telephone and electric equipment by other Trades.
 - Secure to wall using proper devices for substrates encountered, spaced twelve (12) inches on-center maximum around the edges, 1-1/2" from corners, and in three (3) rows of three (3) each in the field. Recess fastening devices flush with the plywood surface. Adjacent panels shall be butted with 1/16" space between without lapping.
- E. Rough hardware
 - 1. Securely fasten rough carpentry together. Nail, spike, lag screw or bolt as required by conditions encountered in the field and the Contract Documents.
 - 2. Provide rough or framing hardware, such as nails, screws, bolts, anchors, hangers, clips, inserts, miscellaneous fastenings, and similar items of the best quality and of the proper size and kind to adequately secure the work together and in place, in a rigid and substantial manner.
 - 3. Secure rough carpentry to masonry with countersunk bolts in expansion sleeves or other acceptable manner, with fastenings not more than sixteen (16) inches apart. Secure woodwork to hollow masonry with toggle bolts spaced not more than sixteen (16) inches apart.
 - 4. Countersink bolts in nailers and other rough woodwork and include washers and nuts. Cut bolts off flush with surfaces and peen as may be required to receive finished work.
 - 5. Inserts to secure wood nailers to concrete shall be malleable iron threaded inserts with 3/8" diameter bolts of length to allow for countersinking. Locate at end of each nailer and at intervals not exceeding thirty (30) inches on-center.
 - 6. Furnish to the mason for building into the work or attaching the work which is to be built in, anchors, bolts, wall plates bolted to masonry, corrugated wall plugs, nailing blocks, etc., which are required for the proper fastening and installation for the work or other items as called for in this Section.
 - 7. Detailed instructions with sketches of necessary requirements, shall be given to the masonry trade showing the location and other details of such nailing devices.
- F. Installation of Doors and Frames
 - 1. Preparation
 - a. Prior to installation and with installation spreaders in place, adjust and securely brace standard steel door frames for squareness, alignment, twist, and plumb 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.
- b. Drill and tap doors and frames to receive non-templated mortised and surface-mounted door hardware.
- 2. Installation
 - a. General: Provide doors and frames of sizes, thicknesses, and designs indicated. Install steel doors and frames plumb, rigid, properly aligned, and securely fastened in place; comply with Drawings and manufacturer's written instructions.
 - b. 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.
 - c. Adjustments: Check and readjust operating finish hardware items just prior to final inspection. Leave work in complete and proper operating condition. Remove and replace defective work, including doors or frames which are warped, bowed or otherwise unacceptable.
- 3.03 Cleaning Up
 - A. General: Keep the premises in a neat, safe and orderly condition at all times during execution of this portion of the work, free from accumulation of sawdust, cut-ends and debris.
 - B. Sweeping
 - 1. At the end of each working day, or more often if necessary, thoroughly sweep all surfaces where refuse from this portion of the work has settled.
 - 2. Remove the refuse to the area of the job site set aside for its storage.
 - 3. Upon completion of this portion of the work, thoroughly broom clean all areas clean.

END SECTION

PART 1 - GENERAL

1.01 SUMMARY

- A. Section includes:
 - 1. Shop fabricated metal plate connected wood roof trusses.
 - 2. Bridging, bracing, and anchorage for wood trusses
 - 3. Plywood roof sheathing
 - 4. Preservative wood treatment (as required).
- B. Related sections:
 - 2. SECTION 061000 Rough Carpentry

1.02REFERENCES

- A. Truss Plate Institute's "Design Specification for Metal Plate Connected Wood Tresses", latest edition.
- B. The American Wood Council's "National Design Specification for Wood Construction", latest edition.
- C. The American Wood Council's "Guidelines for Metal Plate Connected Wood Trusses".
- D. The American Wood Council's "Guidelines for Metal Plate Connected Wood Trusses".
- E. The Timber Construction Manual, latest edition.
- F. Lumber Grading Rules: NFPA, SPIB, WCLIB.
- G. ANSI/TPI 1 and BCSI.
- H. FS TT-W-550 Wood Preservative, Chromated Copper Arsenate Mixture.
- I. FS TT-W-571 Wood Preservation: Treating Practices.
- J. FS TT-W-572 Wood Preservative: Water Repellent.
- K. NFPA National Design Specification for Stress Grade Lumber and Its Fastening.
- L. PS 1 Construction and Industrial Plywood.
- M. PS 20 American Softwood Lumber Standard.
- N. 2021 IBC, NJ Edition, Chapter 23 "Wood"

1.03SYSTEM DESCRIPTION

A. Provide shop fabricated metal plate connected wood trusses as illustrated on the Contract Documents including the installation of all permanent truss bridging and bracing required per the Contract Documents and the Truss Plate Institute and all shop stamped and fabricated steel
anchorage straps and hardware for wind uplift and shear and as required to complete the Work illustrated on the Contact Documents.

- B. Design Roof Live and Dead Load: As noted on the Contract Documents
- C. Total Load Deflection Criteria: limited to 1/360 of span length.
- D. Minimum Truss Opening to Accommodate Mechanical Ducts: Provide truss openings sized to accommodate ducts and duct insulation at the location indicated on Drawings.

1.04 SUBMITTALS

- A. Shop Drawings: Provide truss layout shop drawing indicating location, span, bearing points, and spacing of metal plate connected wood trusses and associated components. Indicate all framed openings in the metal plate connected wood truss framing. Truss layout drawing does not require signature of professional engineer.
- B. Product Data: Submit truss configurations for each type and size truss, bearing and anchor details, bridging and bracing requirements. web and chord sizes, plate sizes, fastener descriptions and spacings, loads, and truss cambers. Truss configuration and design submittal sheets to be signed and sealed by professional engineer registered in the State of New Jersey retained by the truss manufacturer.
- C. Design Data: Submit design calculations signed and sealed by Professional Engineer retained by the truss manufacturer who is licensed in the state where the project is located.
- D. The General Contract shall review all submittals prior to submitting to the design professional for review. The submittals shall bare the General Contractor's review stamp with date reviewed and status of review.

1.05QUALITY ASSURANCE

A.Perform Work in accordance with the following:

- 1. Lumber Grading Agency: Certified by ALSC.
- 2. Plywood Grading Agency: Certified by APA/EWA.
- 3. Design Specification for Metal Plate Connected Wood Trusses, latest edition: Truss Plate Institute.

B.Truss Design, Fabrication, and Installation in accordance with the following:

- 1. Truss Plate Institute's "Design Specification for Metal Plate Connected Wood Tresses", latest edition.
- 2. The American Wood Council's "National Design Specification for Wood Construction", latest edition.
- 3. The American Wood Council's "Guidelines for Metal Plate Connected Wood Trusses".
- 4. The American Wood Council's "Guidelines for Metal Plate Connected Wood Trusses".
- 5. The Timber Construction Manual, latest edition.

- 6. ANSI/TPI 1 and BCSI.
- C. Manufacturer: Company specializing in manufacturing metal plate connected wood trusses with minimum five (5) years documented experience of the successful completion of Work similar in size and scope to this Project.
- D. Design trusses under direct supervision of a professional engineer experienced in design of this Work and licensed in State where Project is located. Truss manufacturer to retain professional engineer as part of its Work.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Handle and erect trusses in accordance with the Building Component Safety Information ("BCSI") "Guide to Good Practice for Handling, Installing, Restraining & Bracing of Metal Plate Connected Wood Trusses".
- B. Store truss depth in vertical position resting on intermittent bearing pads.
- C. Metal plate connected wood trusses shall be transported from manufacturing plant to job site in such a manner as to be protected from weather and secured in such a manner as to prevent damage to trusses.
- D. Metal plated connected wood trusses shall be unloaded in such a manner as to prevent damage to truss members. Contractor to follow all recommendations of the Truss Manufacturer for handling of wood trusses.
- E. Trusses damaged during delivery, storage and/or erection shall be replaced by truss manufacturer with no additional cost to the Owner, Architect, or Structural Engineer.
- F.Trusses shall be stored on-site on elevated supports to prevent contact with soils and water. Contractor to provide adequate supports as required to prevent distress in wood trusses due to sag.
- G. All wood trusses stored on-site shall be covered entirely with water proof traps to provide protection from the elements. Trusses stored in direct contact with the ground are considered unacceptable, will be rejected from use in the project, and will be replaced by the Contractor at its own expense.

PART 2 – PRODUCTS

2.01 MATERIALS

A.Wood Truss Members:

- 1. Species of wood used in trusses is at fabricator's option;
 - a. Provide minimum of Grade No. 2 or better grade.
 - b. Kiln Dried with a maximum moisture content of 19 percent and a minimum moisture content of 7 percent.
 - c. Provide single top and bottom chord members.
 - d. Finger jointed lumber shall not be used.
 - e. Lumber defects such as but not limited to wane, knots, splits, checks, etc. are not permitted within truss plate embedment area.

- B. Truss Connector Plates:
 - 1. Provide metal connector plates not less than 20 gage material, manufactured from steel meeting the requirements of ASTM A653, Grade 40, and shall be hot-dip galvanized after fabrication in accordance with ASTM A653, minimum G60 coating.

C. Accessories

- 1. Wood Framing for Openings: Minimum #2 Doug-Fir with maximum moisture of 19 percent and minimum moisture content of 7 percent.
- 2. Fasteners and Anchors:

a. Nails and Spikes: Common Wire unless otherwise noted

- 1. Nailing of wood members shall conform to Code and as indicated in the Contract Documents. Box nails are not permitted.
- 2. Penetration: Half-length of nail into piece receiving point.
- 3. To connect pieces 2 inches net in thickness, 16d nails may be used.
- 4. Do not drive nails closer together than half their length, nor closer to edge of piece of lumber or timber than 1/4 their length.
- 5. Spacing and size of nails to be such that splitting will not occur. Pre-bore holes for nails wherever necessary to prevent splitting. Bore diameter of holes smaller than diameter of nail or spike (3/4 of nail's diameter).
- 6. For plywood nailing, use nails, size and spacing as indicated. Nails shall have edge distances of not less than 3/8 inch.
- Use hot dipped galvanized nails where exposed to weather, where members are built-in to roofing, or in contact with pressure treated lumber. Hot dipped galvanized steel, ASTM A153.
- b. Screws: Bright steel wood screws:
 - 1. Screws are to be turned into place, not driven. Self-tapping where required for fastening to metal framing.
 - 2. Countersink where heads will interfere or as required.
 - 3. Screw bolt holes the same diameter and depth as shank; bore holes for threaded portion of screws with bit no larger than base of thread.
 - 4. Use galvanized or cadmium plated screws on fastenings exposed to weather, where members are built-in to roofing, or in contact with pressure treated lumber.
- c. Bolts: Standard mild steel, square or hex head machine bolts with square nuts and malleable iron or steel plate washers, conforming to ASTM A307.
 - 1. To be installed in drilled holes the diameter of the bolt, 1/32 inch (0.8 mm) to 1/16inch (1.6 mm) over size.

- 2. Bolting of wood members shall be as called for on the drawings.
- 3. Washers: Provide bolts bearing on wood, unless noted otherwise on the drawings, with malleable iron, or steel plate washers under heads and nuts. Do no final bolting until structure has been properly aligned.
- 4. Use galvanized bolts, nuts and washers where exposed to weather, where members are built-in to roofing, or in contact with pressure treated lumber.
- d. Lag Screws: Conform to "National Design Specification for Stress Graded Lumber and Its Fastenings," NFPA, latest edition.
 - 1. Lag screws shall be screwed and not driven into place. Penetration in each timber shall not be less than 2/3 of the length of the lag screw.
 - 2. Hole shall be bored the same diameter and depth as the shank, after which the hole shall be continued to a depth equal to the length of the lag screw with a diameter no larger than 3/4 of the shank diameter.
 - 3. Washers: Provide lag screws bearing on wood with malleable iron or steel plate washers under heads.
 - 4. Use galvanized lag screws and washers where exposed to weather, where members are built-in to roofing, or in contact with pressure treated lumber.
- e. Manufactured steel strap ties, hold-downs, hurricane ties and other steel connectors specified as part of the Work:
 - 1. Provide manufactured steel connectors need for the Work as specified on the Contract Documents, and required by the Truss Manufacturer like those manufactured by the following:
 - a. Simpson Strong-Tie
 - b. Tamlyn Metal Products
 - c. United Steel Products ("USP")
 - 2. All connectors to be hot dipped galvanized after fabrication.
 - 3. Install all connectors in strict accordance with the manufacturer's written instructions.
- f. Fabrication
 - 1. Manufacturer to fabricate metal plate connected wood trusses in accordance with the approved truss submittals based on the engineering design performed by the manufacture's engineer.
 - Design and fabrication of metal plate connected wood trusses shall be done in compliance with the Truss Plate Institute's "Design Specification for Metal Plate Connected Wood Trusses", The American Wood Council's "National Design Specification for Wood Construction", and the "Guidelines for Metal Plate Connected Wood Trusses".

- 3. Fabricate metal plate connected wood trusses to profiles illustrated in the Contract Documents including but not limited to top chord extensions, trusses to form attic spaces, minimum top chord depths in order to permit insulation installation per Code, etc.
- 4. Fabricate metal plate connected wood trusses to achieve minimum end bearings based on supporting construction provided as illustrated in the Contract Documents. Truss manufacturer to provide "bearing" blocks" as needed to increase bearing area of wood trusses. The costs of such fabrication is part of the Work and will not be accepted as an additional cost to the Owner.
- 5. Lumber defects, such as wanes, knots, splits, etc. shall not be within the embedment area for the metal connector plates.
- 6. Metal connector plates shall be provided on each side of wood truss joints and shall be fully into the members. No gaps shall exist between the metal connector plates and the wood members. Gaps found between the metal connector plates and wood members after erection is completed will not be accepted by the Architect or Engineer. Contractor to coordinate with the truss manufacturer to correct such conditions at its own cost.
- 7. All lumber shall be cut to provide tight joints and proper bearing. Truss manufacturer shall use jigs and fixtures as required to maintain alignment and fit-up of wood members during installation of the metal connector plates.
 - 8. Truss Manufacturer shall inspect installed connector plates for proper and full embedment of all metal connector plates. In addition, truss manufacturer shall verify correct orientation of connector plate teeth to achieve capacity required by truss design.
 - 9. Truss manufacturer and its engineer are responsible for the design and supply of all steel connections, hangers, straps, etc. required for truss to truss connections. Neither the Architect nor the Engineer will provide such connections.
- 10. Hip Roof Areas
 - a. At hip roof areas illustrated on the Contract Documents, steep down top chord trusses will be provided from the initial ridge down to a point at which the framing must transition using a hip roof truss girder and jack trusses. Truss manufacturer must ensure that truss design and layout of web members for step down hip trusses maintain the identical web member configuration to allow field installation of permanent bridging and bracing. The truss manufacturer, if it fails to provide products meeting this criterion, will be responsible for all additional costs associated with modifications of field installed bridging and bracing to accommodate varying truss web member locations.
- g. Wood treatment: As specified on the Contract Documents.'

Part 3 – EXECUTION

3.01 Erection

- A. Contractor shall inspect all completed construction supporting proposed metal plate connected wood trusses and identify any areas of the completed work done by others that may negatively affect the performance of its work or the erection of the wood framing required. All such deficiencies must be corrected by the General Contractor prior to the start wood framing erection.
- B. Installer to review proper placement of lifting slings for erection of wood trusses. Failure to properly rig wood trusses for hoisting may result in damage to the trusses. The General Con

tractor is responsible for the repair or replacement of any trusses damaged during hoisting and erection operations.

- C. All wood framing shall be constructed in accordance with the Contract Documents and the requirements of the International Building Code as adopted by the State of New Jersey.
- D. Set members level and plumb, in correct position in accordance with the following tolerances:

1. Location of truss placement $+/- \frac{1}{2}$ inch.

2. Plumb: Maximum 1/2 inch deviation between bottom and top chords.

- E. Make provisions for erection loads during erection of the metal plate connected wood trusses and installation of the roof sheathing. Provide sufficient temporary bracing to maintain structure plumb, and in alignment until completion of erection and installation of permanent bracing. All temporary erection bracing shall be done in strict compliance with BCSI's written guidelines.
- F. The contractor shall be responsible for all temporary shoring and bracing required during the erection of the metal plate connected wood trusses. Temporary shoring and bracing shall be in accordance with the Truss Plate Institute's "Guide to Good Practice for Handling, Installing, Restraining, and Bracing of Metal Plate Connected Wood Trusses, BCSI", latest edition. Furthermore, contractor shall provide all temporary shores, braces, and guys in accordance with all National, State, and Local requirements to maintain the safety of the job site.
 - 1. The Owner, Architect, and Structural Engineer assume no liability for damages resulting for contractor's failure to properly shore and brace trusses during erection and construction of the building.
- G. Permanent bridging and bracing illustrated on the Contract Documents is in addition to the contractor's erection bracing and shall be completely installed as shown.
- H. The design of the metal plate connected wood trusses may require that bracing be provided for specific truss web members as identified on the approved truss submittals. Contractor is responsible to install this bracing as it will not be illustrated on the Contact Documents since it is required by the truss manufacturer. Refer to truss submittals for location of all such bridging. Provide diagonal 2x4 brace every 20 feet for truss manufacturer's lateral bracing even if not shown on the Contract Documents.
- I. Permanent bridging and bracing shall be a minimum of #2 Hem-Fir and shall have a nominal size of 2-inches by 4-inches supplied in the longest lengths possible yet no shorter than 8 feet in length.
- J. All permanent bridging and bracing shall be lap spliced, refer to typical details on the Contract Documents.
 - 1. All permanent bridging and bracing shall be attached to metal plate connected wood trusses with a minimum of (3) 12d common nails.
- K. Piggyback trusses shall be fully braced like the main carrying trusses. See truss manufacturer's approved truss submittals and the Contract Documents for standard details associated with the installation of truss bracing required for the main carrying and piggyback trusses.
- L. Do not field cut or alter metal plate connected wood truss members or truss bridging and bracing without review and approval of Engineer prior to any such work.

- M. Notify truss manufacturer and Architect of any issues associated with the truss erection that require review and alterations by the truss manufacturer and installer to account for truss mis-fabrication or as-built construction not adequately prepared for truss erection.
- N. General Contractor shall alert mechanical, electrical, plumbing, and HVAC contractors that all such utilities must be run through the truss web openings. No modifications, notching, cutting, etc. of truss web members are permitted under any circumstance. General Contractor will be responsible for all costs associated with the repair of any damage to the metal plate connected wood trusses resulting during the construction operations.
- O. Secure truss to all supports with (2) 16d toenails each side of truss for a total of four (4) nails per truss unless noted otherwise.
- P. Install all metal connectors (straps, hold-downs, hurricane ties, girder hold-downs, etc.) at truss bearing points as required by the Contract Documents and the truss manufacturer's requirements. Metal connectors shall be installed in strict accordance with the connector manufacturer's written instructions.
- Q. See approved truss submittals for all truss to truss connections including steel hangers and connectors. The truss manufacturer is solely responsible for the design and supply of connections between trusses.
- R. See Contract Documents for truss to support connections.
- S. Roof Sheathing: 5/8" Nominal (19/32") APA Rated, Exposure I Plywood unless noted otherwise.
 - 1. Install plywood roof sheathing with strong axis span direction perpendicular to metal plate connected wood trusses. Provide roof sheathing in largest pieces possible yet no smaller than 48 inches square.
 - 2. Plywood to bear atop roof truss top chord allowing provisions for 1/8" gap between sheathing sheets as recommended by the American Plywood Association ("APA").
 - 3. All main carrying roof trusses must receive plywood roof sheathing even if such trusses will be overframed with additional trusses or conventional wood framing as plywood sheathing is required for lateral support of roof trusses. Failure to fully sheathe all roof trusses as required by the Contract Documents will not be accepted under any circumstance. General Contractor will be responsible foe all costs associated with work needed to correct such conditions.
 - 4. Stagger joints in plywood roof sheathing minimum 48 inches.
 - 5. Secure plywood roof sheathing to each truss using 8d common nails at 6" on-center along panel edges continuously supported by truss top chords and at 12" on-center along interior supports unless noted otherwise on the Contract Documents. Provide 3/8" inch distance from plywood edged to nails along panel edges.
 - 6. Do **NOT** overdrive nails into plywood sheathing. Contractor shall set air pressure on framing nailers to ensure that nails are driven such that head is flush with top of plywood sheathing surface. Overdriven fasteners are a basis of rejection of the roof sheathing and contractor at its own expense will make all corrective repairs required by the Architect or Engineer.

- 7. Stagger nails 1" at abutting panels so there are no two nails directly across from one another at abutting panel joints.
- 8. Do not install plywood sheathing that exceeds 19% moisture content.
- 9. Provide manufactured roof sheathing "H" clips at mid-span of sheathing between roof trusses.
- 10. Install roof underlayment as soon as possible to provide protection from weather. Roof underlayment should be installed immediately after sheathing has been installed and construction inspected by the Architect, Engineer, and Construction Official.

3.02CLEAN-UP

- 1. Contractor to clean-up debris and trash associated with the metal plate connected truss erection daily.
- 2. Contractor to remove all trash, debris, cut-off scraps, etc. from within metal plate connected wood truss framing prior to turn-over to the Owner.

END SECTION

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Pre-Finished Aluminum Copings.
- B. Pre-Finished Metal Soffits.
- C. Bollard Sleeves.
- D. Pre-finished metal siding.
- E. Metal Roofing Panels.
- F. Pre-Fabricated Canopy.
- G. Miscellaneous Items and Accessories.

1.2 RELATED SECTIONS

- A. Section 043000 Unit Masonry
- B. Section 061000 Rough Carpentry.
- C. Section 064100 Custom Casework.
- D. Section 072600 Sheet Metal Flashing and Trim: Aluminum wrapped wood trim.
- E. Section 099000 Painting: Painting and finishing of finish carpentry items.
- F. Division 16 Sections for electrical wiring, connection and installation of remote control switches for electrically operated projection screens
- 1.3 REFERENCES
 - A. ANSI American National Standards Institute.
 - B. ASTM American Society of Testing and Materials
 - C. NEMA National Electrical Manufacturers Association.

1.4 SUBMITTALS

- A. Submit under provisions of Division 1 General Requirements.
- 1.5 QUALITY ASSURANCE
 - A. Variation in component size: $\pm 1/8$ ".
 - B. Location of openings: $\pm 1/8$ ".
- 1.6 DELIVERY, STORAGE, AND HANDLING
 - A. Deliver, store and handle products to site under provisions of Division 1 General Requirements.

1.7 FIELD MEASUREMENTS

A. Verify that field measurements are as indicated on shop drawings.

1.8 WARRANTY

A. Provide manufacturer's 10 year warranty against defects in materials. Warranty shall provide material and labor to repair or replace defective materials.

1.9 COORDINATION

- A. Coordinate work under provisions of Division 1 General Requirements.
- B. Coordinate the work with plumbing rough-in.

PART 2 PRODUCTS

2.1 PRE-FINISHED METAL COPINGS/FLASHINGS

- A. Atas International, Inc.
 - 1. Rapid Lok Coping: 6" face height; .050"; width as required; pre-finished color as selected by Architect; Kynar 500.

2.2 ALUMINUM SOFFITS

- A. Manufacturer: Atas Opaline OPF
 - 1. Length: Maximum permissible.
 - 2. Thickness: .040"
 - 3. Exposure: 8"
 - 4. Projection: ³/₄"
 - 5. Finish: Kynar 500.
 - 6. Color: To be selected; standard color range.
 - 7. Surface: Smooth.
 - 8. Accessories: To match soffit finish.
- B. Provide all required trim pieces and accessories required for a complete installation including but not limited to 'J' channels and started strips; color to be selected Kynar 500. All exposed surfaces to have finish to match siding.

2.3 METAL SIDING – HORIZONTAL (MP-1)

- A. Atas "Versa-Seam" VSS080 with ¼" reveal.
 - 1. Length: 10'-0" (standard size) or as per Drawings.
 - 2. Thickness: .040"
 - 3. Exposure: 8" (7-3/4") with 1/4" reveal.
 - 4. Projection: 1"
 - 5. Finish: Kynar 500.
 - 6. Color: To be selected.
 - 7. Corners: Elite Trim mitered outside corner; to match siding size, profile and color.
 - 8. Profile: Provide panel with end fold.
 - 9. Installation Method: Running bond or as shown or Drawings.
- Provide all required trim pieces and accessories required for a complete installation including but not limited to 'J' channels and started strips; color to be selected Kynar 500. All exposed surfaces to have finish to match siding.

- 2.4 METAL SIDING VERTICAL (MP-2)
 - A. Atas "Design Wall" DWF without stiffening ribs.
 - 1. Length: Maximum permissible.
 - 2. Thickness: .040"
 - 3. Exposure: 12".
 - 4. Projection: 1 1/8"
 - 5. Finish: Kynar 500.
 - 6. Color: To be selected.
 - 7. Corners: Standard outside corner; to match siding color.
 - 8. Accessories: To match siding color.
 - B. Provide all required trim pieces and accessories required for a complete installation including but not limited to 'J' channels and starter strips; color to be selected by Architects. All exposed surfaces to have Kynar 500 finish to match siding.
- 2.5 METAL SIDING HORIZONTAL (MP-3)
 - A. Atas "Opaline" OPF 6".
 - 1. Length: Minimum of 1'-6" maximum to transportation limits.
 - 2. Thickness: .032"
 - 3. Exposure: 6".
 - 4. Projection: 3/4"
 - 5. Finish: Kynar 500.
 - 6. Color: To be selected.
 - 7. Corners: Elite Trim to match siding size, profile and color.
 - 8. Installation: Stagger vertical joints a minimum of 2"-0" or as noted on Drawings.
 - B. Provide all required trim pieces and accessories required for a complete installation, including but not limited to 'J' channels and starter strips; color to be selected by Architects. All exposed surfaces to have Kynar 500 finish to match siding.

2.6 PRE-FABRICATED CANOPY

- A. Mapes "Super Lumideck" extruded aluminum overhead hanger rod style canoy with rear drainage system and downspouts.
 - 1. Soffit: Flat Soffit
 - 2. Finish: Kynar 500
 - 3. Color: As selected by Architect
 - 4. Fascia: 8" J-Style; .125"
 - 5. Decking: .078"
- B. Provide All required trim pieces and accessories required for a complete installation. Color to be selected, Kynar 500 to match canopy unless noted otherwise.

2.7 METAL ROOF PANELS

- A. Atlas "Belvedere" BWR360 Direct Screw Down.
 - 1. Length: Maximum permissible
 - 2. Thickness: 24 ga. Metallic Coated Steel
 - 3. Exposure: 36"
 - 4. Projection: $1\frac{1}{2}$ "
 - 5. Finish: Kynar 500
 - 6. Color: To be selected

- 7. Fasteners: Gasketed; galvanized with stainless steel cap.
- B. Provide all required trim pieces and accessories required for a complete installation, including by not limited to "J" channels and starter strips; color to be selected, Kynar 500 to match roof panels.
- C. Snow Guard System: Berger Mullane #640 Snow for Metal Corrugated Roofs.
 - 1. Components: Mullane #640 Snow Boss Snow Guard System consists of individual metal snow guards attached directly to the metal roofing
 - Fasteners: mechanical fastener attachment; snow guard to be fastened into a structural member, rafter or purlin at least 1.5" through each screw point. Utilize #10 Type A self-tapping fasteners (flat or oval head) with a neoprene washer for a watertight seal. Stainless steel or corrosion resistant fasteners are required.
 - 3. Spacing: As recommended by the Manufacturer.
 - 4. Materials: Cast Aluminum.
 - 5. Installation: Coordinate with the installation of the roof to assure proper placement of the snow guards. Assume 2 rows, staggered.
 - 6. Submittals: Submit specifications and standard detail drawings with recommended layout and installation details.

2.8 BOLLARD SLEEVES

- A. Ideal Shield
 - 1. Bumper Post Sleeve: ¹/₄" thick polyethylene thermoplastic sleeve; smooth finish; size as indicated on Drawings; Color as selected by Architect.

PART 3 EXECUTION

- 3.1 EXAMINATION
 - A. Verify adequacy of backing and support framing.

3.2 INSTALLATION

- A. Install Bollard sleeves in accordance with manufacturer's instructions.
- B. Install pre-finished metal copings in accordance with manufacturer's instructions; use longest permissible lengths unless noted otherwise.
- C. Install pre-finished metal soffit in accordance with manufacturer's instructions; use longest permissible lengths. Provide all required trim pieces for a complete installation.
- D. Install pre-finished metal siding in accordance with manufacturer's instructions. Provide all required trim pieces for a complete installation.

- E. Install pre-fabricated canopy in accordance with manufacturer's instructions. Provide all required time pieces for a complete installation.
- F. Install metal roof panels using direct screw down method in accordance with manufacturer's instructions. Provide all required trim pieces and accessories for a complete installation.
- 3.3 ADJUSTING
 - A. Adjust work under provisions of Division 1 General Requirements.
- 3.4 CLEANING
 - A. Clean work under provisions of Division 1 General Requirements.
- 3.5 SCHEDULE
 - A. Exterior Finish Carpentry
 - 1. Aluminum Copings Pre-finished.
 - 2. Bollard Sleeves Pre-finished.
 - 3. Aluminum Soffits Pre-finished.
 - 4. Pre-fabricated canopy Pre-finished.
 - 5. Metal Siding Pre-finished.
 - 6. Metal Roof Panels Pre-finished.

END OF SECTION

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Custom Fabricated Plastic Laminate Cabinetry:
 - 1. Lobby / Waiting 100
 - 2. Duty Sgt. 102
 - 3. Break Area 106
 - 4. Support Office 108
 - 5. Women's Toilet Room 113
 - 6. Men's Toilet Room 117
 - 7. General Office 105
 - 8. Arrest Processing Area 137
- B. Cabinet Hardware.
- C. Solid Surface Countertops.
- D. FRP Wall Panels.
 - 1. Janitor #1– 114 (at mop sink)
 - 2. Janitor #2 134 (at mop sink)

1.2 RELATED SECTIONS

- A. Section 033000 Cast-in-Place Concrete.
- B. Section 61000 Rough Carpentry.
- C. Section 062000 Finish Carpentry.
- D. Section 096500 Resilient Flooring.
- E. Division 150000 Plumbing Fixtures.
- 1.3 REFERENCES
 - A. AWI Quality Standards.
 - B. FS MMM-A-130 Adhesive, Contact.
 - C. National Electric Manufacturers Association (NEMA) LD3 High Pressure Decorative Laminates.
 - D. PS 1 Construction and Industrial Plywood.
 - E. PS 20 American Softwood Lumber Standard.
 - F. APA American Plywood Association.

1.4 SUBMITTALS

A. Submit under provisions of Division 1 - General Requirements.

- B. Shop Drawings: Indicate materials, component profiles and elevations, assembly methods, joint details, fastening methods, accessory listings, hardware location, and schedule of finishes.
- C. Samples: Submit two (2) 4 x 4 inch size samples, illustrating cabinet, counter and sill finish color.

1.5 QUALITY ASSURANCE

- A. Perform work in accordance with AWI Premium quality.
- 1.6 DELIVERY, STORAGE, AND HANDLING
 - A. Deliver, store and handle products to site under provisions of Division 1 General Requirements.

1.7 FIELD MEASUREMENTS

A. Verify that field measurements are as indicated on shop drawings.

1.8 COORDINATION

- A. Coordinate work under provisions of Division 1 General Requirements.
- B. Coordinate the work with plumbing and electrical rough-in.

PART 2 PRODUCTS

- 2.1 COUNTERTOPS, CASEWORK MATERIALS AND MISCELLANEOUS ACCESSORIES
 - A. Wood Particleboard: #45 per AWI standard, composed of wood chips, medium density, made with high waterproof resin binders of grade to suit application; sanded faces, located as follows:

ITEM	THICKNESS
Drawer and Door Face	3/4"
Cabinet Sides and Supports	1/2"
Shelving	3/4"
Drawer Construction	1/2"
Pipe Screens	3/4"

2.2 MANUFACTURERS - PLASTIC LAMINATE

- A. Formica Corporation.
- B. Wilsonart.
- C. Substitutions: Under provisions of Division 1 General Requirements.

2.3 LAMINATE MATERIALS

A. Plastic Laminate: NEMA LD 3-1985, GP 50 Grade, .050 inch thick, General Purpose quality; All doors, drawers, countertops, backsplashes, etc. Color, pattern, and surface texture as selected by Architect. Assume 4 possible color selections.

- B. Plastic Laminate Backing Sheet: LD 3 BK-20; .020 inch thick Backing Sheet grade, smooth surface finish, undecorated plastic laminate (all concealed locations).
- C. Cabinet Liner: CL 20 grade, .020 inch thick, all interior casework surfaces.

2.4 ACCESSORIES

- A. Adhesive: FS MMM-A-130 contact adhesive, Type recommended by AWI and laminate manufacturer to suit application.
- B. Fasteners: Size and type to suit application.
- C. Bolts, Nuts, Washers, Lags, Pins, and Screws: Of size and type to suit application; finish in concealed locations and finish in exposed locations.
- D. Concealed Joint Fasteners: Threaded steel.

2.5 HARDWARE

- A. Shelf Standards: Stanley #1805 aluminum mortise mounted, size as appropriate per application.
- B. Shelf Clips: Stanley CD1806 steel, bright zinc plated.
- C. Drawer Slides: Blum BS426A (full extension), size as required.
- D. Hinges: Stanley #1501-2 (self-closing), quantity per door as recommended by manufacturer.
- E. Pulls: Stanley 4484, US26D; 4" wire pull. Color to be selected by Architect.

2.6 SOLID SURFACE

- A. DuPont Corian Surfacing.
- B. Substitutions: Under provisions of Division 1 General Requirements.

2.7 MATERIALS

- A. 33% binding resins, 66% minerals;
- B. $\frac{1}{2}$ " thick material as shown on drawings and as required.
- C. Colors: To be selected from manufacturer's full color range; Assume two (2) colors.
- D. Edge Detail: Basic Eased Edge.
- E. Lavatories: Corian No. 810 ADA compliant integral sink; color as selected from manufacturer's full color range.

2.8 FABRICATION

A. Shop assemble casework for delivery to site in units easily handled and to permit passage through building openings.

- B. Cap exposed plastic laminate finish edges with material of same finish and pattern.
- C. Door and Drawer Fronts: 3/4 inch thick; overlay style.
- D. When necessary to cut and fit on site, provide materials with ample allowance for cutting. Provide trim for scribing and site cutting.
- E. Apply plastic laminate finish in full uninterrupted sheets consistent with manufactured sizes. Fit corners and joints hairline; secure with concealed fasteners. Slightly bevel arrises. Locate counter butt joints minimum 2 feet from sink cut-outs.
- F. Apply laminate backing sheet to reverse side of plastic laminate finished surfaces.
- G. Provide cut-outs for plumbing fixtures, fixtures and fittings. Verify locations of cut-outs from on-site dimensions. Seal contact surfaces of cut edges.
- H. Solid surface fabrications to be performed by a certified corian fabricator/installer.

2.9 FRP WALL PANELS

- A. Manufacturer: Glasteel.
- B. Substitutions: Under provisions of Division 1 General Requirements.

2.10 MATERIALS

- A. Glasliner FRP wall panels; Series 1200; .090" thick; 4' x 9' sheets; embossed finish; color as selected by Architect.
- B. Accessories: Inside corner, end cap, divider bar, outside corner, outside corner angle and nylon rivets; color as selected by Architect.
- C. Adhesive: Fast Grab FRP adhesive or as recommended by panel manufacturer.

PART 3 EXECUTION

- 3.1 EXAMINATION
 - A. Verify adequacy of backing and support framing.

3.2 INSTALLATION

- A. Set and secure casework in place; rigid, plumb, and level.
- B. Use fixture attachments in concealed locations for wall mounted components.
- C. Use concealed joint fasteners to align and secure adjoining cabinet units and counter tops.
- D. Carefully scribe casework abutting other components, with maximum gaps of 1/32 inch. Do not use additional overlay trim for this purpose.
- E. Secure cabinet and counter bases to floor using appropriate angles and anchorages.

3.3 ADJUSTING

- A. Adjust work under provisions of Division 1 General Requirements.
- B. Adjust moving or operating parts to function smoothly and correctly.

3.4 CLEANING

- A. Clean work under provisions of Division 1 General Requirements.
- B. Clean casework, counters, shelves, hardware, fittings and fixtures.

END OF SECTION

PART 1 - GENERAL

- 1.1 SUMMARY
 - A. Section Includes:
 - 1. Cavity wall insulation at exterior CMU walls and where shown on Drawings (Polyisocyanurate).
 - 2. Perimeter insulation at foundation (Polystyrene).
 - 3. Batt insulation at all exterior walls, at the bottom chord of roof trusses and at all exterior soffits.
 - 4. Batt insulation for sound attenuation.
 - B. Related Sections:
 - 1. Section 048100 Unit Masonry Assemblies.
 - 2. Section 092900 Gypsum Board Systems.

1.3 REFERENCES

- A. American Society for Testing and Materials:
 - 1. ASTM C209 Cellulosic Fiber Insulating Board, Water Absorption.
 - 2. ASTM C1289 Type 1, Class 2: Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board.
 - 3. ASTM D1622 Apparent Density of Rigid Cellular Plastics.
 - 4. ASTM E84 Surface Burning Characteristics of Building Materials.
 - 5. ASTM E96 Water Vapor Transmission of Materials.
 - 6. ASTM C665 Mineral Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing.
 - 7. National Fire Protection Association: NFPA 255 Test of Surface Burning Characteristics of Building Materials.
 - 8. Underwriters Laboratories: UL 723 Tests for Surface Burning Characteristics of Building Materials.
- 1.4 SYSTEM DESCRIPTION
 - A. Provide continuity of thermal barrier at building enclosure elements.
 - B. Provide acoustical attenuation of sound via sound batt insulation installed in gypsum wallboard partitions and assemblies.
 - C. Provide batt insulation in acoustical gypsum wall board assemblies installed above and as an acoustical continuation of acoustically rated CMU partition walls where noted on Drawings.
- 1.5 SUBMITTALS
 - A. Submit product data for specified items.
 - B. Submit manufacturer's installation instructions.

PART 2 - PRODUCTS

- 2.1 INSULATION MATERIALS POLYISOCYANURATE
 - A. Manufacturers:
 - 1. Celotex Corporation: Tuff-R "C" (Polyisocyanurate).

- 2. Dow Chemical Corporation: Thermax Sheathing.
- 3. R-max Inc.: Thermasheath-3.
- 4. Or approved equal.
- B. Materials: Closed Cell Glass Fiber Reinforced Polyisocyanurate Insulation Board: ASTM C1289, Type I, Class 2, conforming to the following:
 - 1. Board Size: up to 48 x 96 inch.
 - 2. Board Thickness: 1 inch.
 - 3. Thermal Resistance: "R" of 6.5 per inch (stabilized R value).
 - 4. Water Absorption: In accordance with ASTM C209, 0.30 maximum percent by volume maximum.
 - 5. Compressive Strength: Minimum 25 psi.
 - 6. Board Edges: Square edges.
 - 7. Surface Burning Characteristics:
 - a. Flame spread: 30 maximum in accordance with ASTM E84.
 - b. Smoke developed: 450 maximum in accordance with ASTM E84.
 - 8. Density: 2 PCF in accordance with ASTM D1622.
 - 9. Water Vapor Permeance: .03 maximum perm in accordance with ASTM E96.
 - 10. Facing: Factory applied facers of aluminum foil, reflective on both faces.

2.2 INSULATION MATERIALS - EXTRUDED POLYSTYRENE

- A. Manufacturers:
 - 1. DiversiFoam Products: CertiFoam 40.
 - 2. Owens Corning Insulating Systems, LLC: Foamular 250.
 - 3. Or approved equal.
- B. Materials: Extruded Polystyrene Insulation: ASTM C578 Type IV; cellular type, conforming to the following:
 - 1. Board Size: 24 or 24 x 96 inch.
 - 2. Board Thickness: 2 inches.
 - 3. Thermal Resistance: "R" of 5.0 per inch.
 - 4. Water Absorption: In accordance with ASTM C272, 0.10 percent by volume maximum.
 - 5. Water Vapor Permeance: 1.1 maximum in accordance with ASTM E96.
 - 6. Compressive Strength: Minimum 25 psi.
 - 7. Board Edges: Square edges.
 - 8. Surface Burning Characteristics:
 - a. Flame spread: 5 in accordance with ASTM E84.
 - b. Smoke developed: 45/175 in accordance with ASTM E84.

2.3 INSULATION MATERIALS – THERMAL BATT

- A. Manufacturers:
 - 1. CertainTeed Corporation: Partition Batts.
 - 2. Guardian Fiberglass: Unfaced Building Insulation.
 - 3. Johns Manville: Unfaced Batts.
 - 4. Or approved Equal.
- B. Products:
 - 1. Thermal Batt Insulation: ASTM C665; preformed glass fiber batt roll type with kraft faced membrane one side; For use in concealed locations only in substantial contact with building finish.
 - 2. Thermal Batt Insulation: ASTM C655; preformed glass fiber batt roll type with FSK-25 faced membrane one side; flame spread 25; smoke developed 50. For use when exposed to view in attic areas and walls when facing is not in contact

with the unexposed surface of the ceiling, floor or wall finish.

2.4 ACOUSTICAL INSULATION MATERIALS

- A. Manufacturers:
 - 1. CertainTeed Corporation: Partition Batts.
 - 2. Guardian Fiberglass: Unfaced Building Insulation.
 - 3. Johns Manville: Unfaced Batts.
 - 4. Or approved Equal.
- B. Products:
 - 1. Insulation: preformed glass fiber batt roll type unfaced:
 - a. ASTM Standard C 665: Type I.
 - b. ASTM E84: flame spread 25 maximum; smoke developed 50 maximum.
 - c. Thickness as indicated on Drawings and as required.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that substrate, adjacent materials, and insulation boards are dry and ready to receive insulation and adhesive.
- B. Verify substrate surface is flat, free of honeycomb, fins, irregularities and materials or substances that may impede adhesive bond.
- C. Verify insulation boards are unbroken, free of damage.
- 3.2 INSTALLATION CAVITY WALL
 - A. Install boards on exterior wall, horizontally, between wall reinforcement in accordance with manufacturer's instructions.
 - B. Butt edges and ends tight to adjacent board and to protrusions.
 - C. Cut and fit insulation tight to protrusions or interruptions to the insulation plane.
- 3.3 INSTALLATION THERMAL BATT
 - A. Install insulation in accordance with insulation manufacturer's instructions.
 - B. Install in exterior walls and roof spaces without gaps or voids. Do not compress insulation.
 - C. Trim insulation neatly to fit spaces. Insulate miscellaneous gaps and voids.
 - D. Fit insulation tight in spaces and tight to exterior side of mechanical and electrical services within the plane of insulation.
 - E. Install with factory applied vapor retarder membrane facing warm side of building spaces unless noted otherwise. Lap ends and side flanges of membrane over framing members.
 - F. Tape, seal butt ends, lapped flanges, and tears or cuts in membrane.

3.4 INSTALLATION - ACOUSTICAL BATT INSULATION

- A. Install insulation in accordance with insulation manufacturer's instructions.
- B. Install continuous without gaps or voids. Do not compress insulation.
- C. Trim insulation neatly to fit spaces.
- D. Fit insulation tight in spaces and tight to exterior side of mechanical and electrical services within the plane of insulation.

3.5 PROTECTION OF FINISHED WORK

- A. Do not permit work to be damaged prior to covering insulation.
- B. Protect ventilated insulation work from exposure to moisture damage and deterioration, primarily by prompt installation of the roofing and waterproofing work.

END OF SECTION

PART GENERAL

1.1 SECTION INCLUDES

- A. Fireproof firestopping and firesafing materials and accessories.
- 1.2 RELATED SECTIONS
 - A. Section 043000 Unit Masonry: Firesafing at floor deck.
 - B. Section 092600 Gypsum Board Systems: Gypsum wallboard firesafing.
 - C. Division 15 Mechanical: Mechanical work requiring firesafing.
 - D. Division 16 Electrical: Electrical work requiring firesafing.

1.3 REFERENCES

- A. ASTM E84 Test Method for Surface Burning Characteristics of Building Materials.
- B. ASTM E119 Method for Fire Tests of Building Construction and Materials.
- C. ASTM E814 Test Method of Fire Tests of Through Penetration Firestops.
- D. FM (Factory Mutual) Fire Hazard Classifications.
- E. UL Fire Hazard Classifications.
- F. UL 263 Fire Tests of Building Construction and Materials.
- G. UL 723 Test for Surface Burning Characteristics of Building Materials.
- H. UL 1479 Fire Tests of Through-Penetration Firestops.
- I. WH (Warnock Hersey) Certification Listings.

1.4 DEFINITION

A. Firestopping (Firesafing): A sealing or stuffing material or assembly placed in spaces between building materials to arrest the movement of smoke, heat, gases, or fire through wall or floor openings.

1.5 SYSTEM DESCRIPTION

- A. Firestopping Materials: ASTM E119 and ASTM E814 to achieve a fire rating as noted on Drawings.
- B. Firestop all interruptions to fire rated assemblies, materials and components.

1.6 SUBMITTALS

A. Submit under provisions of Division 1 - General Requirements.

- B. Product Data: Provide data on product characteristics, performance and limitation criteria.
- C. Manufacturer's Installation Instructions: Indicate preparation and installation instructions.
- D. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

1.7 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing the products specified in this section with minimum three years experience.
- B. Applicator: Company specializing in performing the work of this section with minimum three years experience.
- 1.8 REGULATORY REQUIREMENTS
 - A. Conform to applicable code for fire resistance ratings and surface burning characteristics.

1.9 ENVIRONMENTAL REQUIREMENTS

- A. Do not apply materials when temperature of substrate material and ambient air is below 60 degrees F.
- B. Maintain this minimum temperature before, during, and for 3 days after installation of materials.
- C. Provide ventilation in areas to receive solvent cured materials.

PART 2 PRODUCTS

- 2.1 MANUFACTURERS FIRESAFING MATERIALS
 - A. United States Gypsum Co. Product: Thermafiber mineral firesafing insulation.
 - B. United States Gypsum Co. Product: Firecode Compound.
 - C. Substitutions: Under provisions of Section 01600.

2.2 ACCESSORIES

- A. Primer: Type recommended by firestopping manufacturer for specific substrate surfaces.
- B. Installation Accessories: Galvanized steel safing impaling clips and other devices required to position and retain materials in place.
- C. Water: Clean and potable.

2.3 FINISHES

A. Thermafiber Safing: Regular color, unfaced.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify site conditions under provisions of Division 1 General Requirements.
- B. Verify openings are ready to receive the work of this section.

3.2 PREPARATION

- A. Clean substrate surfaces of dirt, dust, grease, oil, loose material, or other matter which may affect bond of firestopping material.
- B. Remove incompatible materials which may affect bond.
- C. Install damming materials to arrest liquid material leakage.
- 3.3 APPLICATION SAFING INSULATION
 - A. Safing insulation to be nominal 6" thick or as indicated on drawings; install safing insulation recessed a minimum of 1" from the surface of the concrete floor. Provide minimum 1" thick layer of fill material (Firecode Compound).
 - B. Cut safing ½" wider than opening to insure compression fit. Friction fit in the safe-off area to be protected.
 - C. For poke-through penetrations, install safing insulation in opening. Compress or install on wire hangers in all floor slab openings, to seal completely around telephone cables, ducts, piping or other utilities.
- 3.4 APPLICATION FIRECODE COMPOUND
 - A. Mix compound in accordance with manufacturer's instructions.
 - B. Apply compound to a minimum of 1 inch thickness on top of safing insulation. Ensure that compound is in contact with all surfaces and that entire opening is filled with safing and compound.
 - C. For poke-through penetrations, trowel compound and work into penetrating opening.

3.5 CLEANING

- A. Clean Work under provisions of Division 1 General Requirements.
- D. Clean adjacent surfaces of firestopping materials.
- 3.6 PROTECTION OF FINISHED WORK
 - A. Protect finished Work under provisions of Division 1 General Requirements.
 - B. Protect adjacent surfaces from damage by material installation.

END OF SECTION

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes fluid-applied, vapor-retarding membrane air barriers installed over plywood sheathing and CMU.

1.2 DEFINITIONS

- A. Air-Barrier Material: A primary element that provides a continuous barrier to the movement of air.
- B. Air-Barrier Accessory: A transitional component of the air barrier that provides continuity.
- C. Air-Barrier Assembly: The collection of air-barrier materials and accessory materials applied to an opaque wall, including joints and junctions to abutting construction, to control air movement through the wall.

1.3 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.
- B. Review air-barrier requirements and installation, special details, mockups, air-leakage and bond testing, air-barrier protection, and work scheduling that covers air barriers.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include manufacturer's written instructions for evaluating, preparing, and treating substrate; technical data; and tested physical and performance properties of products.
- B. Shop Drawings: For air-barrier assemblies.
 - 1. Show locations and extent of air barrier. Include details for substrate joints and cracks, counterflashing strips, penetrations, inside and outside corners, terminations, and tie-ins with adjoining construction.
 - 2. Include details of interfaces with other materials that form part of air barrier.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer. Include list of ABAA-certified installers and supervisors employed by the Installer, who work on Project.
- B. Product Certificates: From air-barrier manufacturer, certifying compatibility of air barriers and accessory materials with Project materials that connect to or that come in contact with the barrier.
- C. Product Test Reports: For each air-barrier assembly, for tests performed by a qualified testing agency.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.
 - 1. Installer shall be licensed by ABAA according to ABAA's Quality Assurance Program and shall employ ABAA-certified installers and supervisors on Project.
- B. Mockups: Incorporate air barrier in masonry mockup specified in Division 4 Masonry to set quality standards for materials and execution.
 - 1. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Remove and replace liquid materials that cannot be applied within their stated shelf life.
- B. Protect stored materials from direct sunlight.

1.8 FIELD CONDITIONS

- A. Environmental Limitations: Apply air barrier within the range of ambient and substrate temperatures recommended by air-barrier manufacturer.
 - 1. Protect substrates from environmental conditions that affect air-barrier performance.
 - 2. Do not apply air barrier to a damp or wet substrate or during snow, rain, fog, or mist.

PART 2 - PRODUCTS

- 2.1 MATERIALS, GENERAL
 - A. Source Limitations: Obtain primary air-barrier materials and air-barrier accessories from single source from single manufacturer.
 - B. VOC Content: 250g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24) and complying with VOC content limits of authorities having jurisdiction.
 - C. Low-Emitting Materials: Air barriers shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

2.2 PERFORMANCE REQUIREMENTS

A. General: Air barrier shall be capable of performing as a continuous vapor-retarding air barrier and as a liquid-water drainage plane flashed to discharge to the exterior incidental condensation or water penetration. Air-barrier assemblies shall be capable of accommodating substrate movement and of sealing substrate expansion and control joints, construction material changes, penetrations, tie-ins to installed waterproofing, and transitions at perimeter conditions without deterioration and air leakage exceeding specified limits.

2.3 VAPOR-RETARDING MEMBRANE AIR BARRIER

- A. Liquid-Applied, Vapor-Retarding Membrane Air and Water Barrier: Elastomeric, modified bituminous membrane.
 - 1. Products: Subject to compliance with requirements, provide the following:
 - a. Elastomeric, Modified Bituminous Membrane:
 - 1) Henry Company Air-Bloc 16 MR.
 - 2) Or approved equal.
 - 2. Physical and Performance Properties:
 - a. Water Vapor Permeance: 0.03 perms; ASTM E96, Method A .
 - b. Elongation: 270% percent; ASTM D 412.
 - c. Tensile Strength: 100 PSI; ASTM D412.
 - d. Film Thickness: 60 mils wet; 36 mils dry.

2.5 ACCESSORY MATERIALS

- B. General: Accessory materials recommended by air-barrier manufacturer to produce a complete airbarrier assembly and compatible with primary air-barrier material.
- C. Primer: Liquid solvent-borne primer recommended for substrate by air-barrier material manufacturer.
- D. Counterflashing Strip: Modified bituminous, 40-mil thick, self-adhering sheet consisting of 32 mils of rubberized asphalt laminated to an 8-mil thick, cross-laminated polyethylene film with release liner backing.
- E. Joint Reinforcing Strip: Air-barrier manufacturer's glass-fiber-mesh tape.
- F. Substrate-Patching Membrane: Manufacturer's standard trowel-grade substrate filler.
- G. Adhesive and Tape: Air-barrier manufacturer's standard adhesive and pressure-sensitive adhesive tape.
- H. Modified Bituminous Transition Strip: Vapor retarding, 40 mils thick, smooth surfaced, self-adhering; consisting of 36 mils of rubberized asphalt laminated to a 4-mil thick polyethylene film with release liner backing.
- I. Joint Sealant: ASTM C 920, single-component, neutral-curing silicone; Class 100/50 (low modulus), Grade NS, Use NT related to exposure, and, as applicable to joint substrates indicated, Use O. Comply with Division 07 Section "Joint Sealants."
- J. Termination Mastic: Air-barrier manufacturer's standard cold fluid-applied elastomeric liquid; trowel grade.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements and other conditions affecting performance of the Work.
 - 1. Verify that substrates are sound and free of oil, grease, dirt, excess mortar, or other contaminants.

- 2. Verify that concrete has cured and aged for minimum time period recommended by air-barrier manufacturer.
- 3. Verify that concrete is visibly dry and free of moisture. Test for capillary moisture by plastic sheet method according to ASTM D 4263.
- 4. Verify that masonry joints are flush and completely filled with mortar.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 SURFACE PREPARATION

- A. Clean, prepare, treat, and seal substrate according to manufacturer's written instructions. Provide clean, dust-free, and dry substrate for air-barrier application.
- B. Mask off adjoining surfaces not covered by air barrier to prevent spillage and overspray affecting other construction.
- C. Remove grease, oil, bitumen, form-release agents, paints, curing compounds, and other penetrating contaminants or film-forming coatings from concrete.
- D. Remove fins, ridges, mortar, and other projections and fill honeycomb, aggregate pockets, holes, and other voids in concrete with substrate-patching membrane.
- E. Remove excess mortar from masonry ties, shelf angles, and other obstructions.
- F. At changes in substrate plane, apply sealant or termination mastic beads at sharp corners and edges to form a smooth transition from one plane to another.
- G. Cover gaps in substrate plane and form a smooth transition from one substrate plane to another with stainless-steel sheet mechanically fastened to structural framing to provide continuous support for air barrier.

3.3 JOINT TREATMENT

- A. Concrete and Masonry: Prepare, treat, rout, and fill joints and cracks in substrate according to ASTM C 1193 and air-barrier manufacturer's written instructions. Remove dust and dirt from joints and cracks complying with ASTM D 4258 before coating surfaces.
 - 1. Prime substrate and apply a single thickness of air-barrier manufacturer's recommended preparation coat extending a minimum of 3 inches (75 mm) along each side of joints and cracks. Apply a double thickness of fluid air-barrier material and embed a joint reinforcing strip in preparation coat.
- B. General: Install strips, transition strips, and accessory materials according to air-barrier manufacturer's written instructions to form a seal with adjacent construction and maintain a continuous air barrier.
 - 1. Coordinate the installation of air barrier with installation of roofing membrane and base flashing to ensure continuity of air barrier with roofing membrane.
- C. Apply primer to substrates at required rate and allow it to dry. Limit priming to areas that will be covered by fluid air-barrier material on same day. Re-prime areas exposed for more than 24 hours.

- D. Connect and seal exterior wall air-barrier material continuously to roofing-membrane air barrier, concrete below-grade structures, floor-to-floor construction, exterior glazing and window systems, glazed curtain-wall systems, storefront systems, exterior louvers, exterior door framing, and other construction used in exterior wall openings, using accessory materials.
- E. At end of each working day, seal top edge of strips and transition strips to substrate with termination mastic.
- F. Apply joint sealants forming part of air-barrier assembly within manufacturer's recommended application temperature ranges. Consult manufacturer when sealant cannot be applied within these temperature ranges.
- G. Fill gaps in perimeter frame surfaces of windows, curtain walls, storefronts, and doors, and miscellaneous penetrations of air-barrier material with foam sealant.
- H. Seal strips and transition strips around masonry reinforcing or ties and penetrations with termination mastic.
- I. Seal top of through-wall flashings to air barrier with an additional 6-inch wide, modified bituminous counterflashing strip.
- J. Repair punctures, voids, and deficient lapped seams in strips and transition strips. Slit and flatten fishmouths and blisters. Patch with transition strips extending 6 inches beyond repaired areas in strip direction.

3.4 FLUID AIR-BARRIER MEMBRANE INSTALLATION

- A. General: Apply fluid air-barrier material to form a seal with strips and transition strips and to achieve a continuous air barrier according to air-barrier manufacturer's written instructions. Apply fluid air-barrier material within manufacturer's recommended application temperature ranges.
- B. Membrane Air Barriers: Apply a continuous unbroken air-barrier membrane to substrates according to the following thickness. Apply air-barrier membrane in full contact around protrusions such as masonry ties.
 - 1. Vapor-Retarding Membrane Air Barrier: Total dry film thickness as recommended in writing by manufacturer to meet performance requirements, but not less than 40-mil dry film thickness
- C. Correct deficiencies in or remove air barrier that does not comply with requirements; repair substrates and reapply air-barrier components.

3.5 FIELD QUALITY CONTROL

A. Inspections: Air-barrier materials, accessories, and installation are subject to inspection for compliance with requirements

3.6 CLEANING AND PROTECTION

A. Protect air-barrier system from damage during application and remainder of construction period, according to manufacturer's written instructions.

- 1. Protect air barrier from exposure to UV light and harmful weather exposure as required by manufacturer. If exposed to these conditions for more than 30 days, remove and replace air barrier or install additional, full-thickness, air-barrier application after repairing and preparing the overexposed membrane according to air-barrier manufacturer's written instructions.
- 2. Protect air barrier from contact with incompatible materials and sealants not approved by airbarrier manufacturer.
- B. Clean spills, stains, and soiling from construction that would be exposed in the completed work using cleaning agents and procedures recommended by manufacturer of affected construction.
- C. Remove masking materials after installation.

END OF SECTION

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Tapered and non-tapered insulation at new roof.
- B. Membrane roofing, base flashings, roofing membrane and counter flashings at new and existing roof.
- C. Walkway Pads.
- D. Roof Hatch.

1.2 RELATED SECTIONS

- A. Section 061000 Rough Carpentry.
- B. Section 061730 Metal Plate Connected Wood Roof Trusses.
- C. Section 076200 Sheet Metal Flashing and Trim: Counter flashings and copings.
- D. Division 15 Mechanical: Roof Drains.

1.3 REFERENCES

- A. ASTM C177 Test Method for Steady-State Thermal Transmission Properties by Means of the Guarded Hot Plate.
- B. ASTM C578 Preformed, Cellular Polystyrene Thermal Insulation.
- C. ASTM D412 Rubber Properties in Tension.
- D. ASTM D471 Standard Test Method for Rubber Property Effect of Liquids.
- E. ASTM D624 Rubber Property Tear Resistance.
- F. ASTM D746 Brittleness Temperature of Plastics and Elastomeric by Impact.
- G. ASTM D1004 Initial Tear Resistance of Plastic Film and Sheeting.
- H. ASTM E96 Water Vapor Transmission of Materials.
- I. FM 4470 (Factory Mutual Engineering Corporation) Roof Assembly Classifications.
- J. NRCA (National Roofing Contractors Association) Roofing and Waterproofing Manual.
- K. UL 790 Fire Hazard Classifications.

1.4 SYSTEM DESCRIPTION

A. Elastomeric Sheet Membrane Conventional Roofing System: One ply membrane system with insulation, and adhesive applied membrane finish.

1.5 SUBMITTALS

- A. Submit under provisions of Division 1 General Requirements.
- B. Product Data: Provide characteristics on membrane materials, flashing materials and insulation.
- C. Shop Drawings: Indicate outline on roof and size, location and type of all penetrations, joint or termination detail conditions and conditions of interface with other materials.
- D. Manufacturer's Installation Instructions: Indicate special precautions required for seaming the membrane.
- E. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
- F. Manufacturer's Field Reports: Submit under provisions of General Requirements.
- G. Reports: Indicate procedures followed; ambient temperatures, humidity, wind velocity during application.
- H. Final Shop Drawings shall be approved and assigned a number by Carlisle.

1.6 QUALITY ASSURANCE

- A. Manufacturer: Company specializing in manufacturing the products specified in this section with three years documented experience.
- B. Applicator: Company specializing in performing the work of this section with three years documented experience and approved by system manufacturer.
- C. Perform Work in accordance with NRCA Roofing and Waterproofing Manual.

1.7 REGULATORY REQUIREMENTS

- A. Conform to applicable code for roof assembly fire hazard requirements.
- B. UL 790: Class A Fire Hazard Classification.

1.8 DELIVERY, STORAGE, AND PROTECTION

- A. Division 1 Material and Equipment: Transport, handle, store, and protect products.
- B. Store products in weather protected environment, clear of ground and moisture.

1.9 ENVIRONMENTAL REQUIREMENTS

- A. Do not apply roofing membrane during inclement weather or at temperatures unacceptable to roofing manufacturer.
- B. Do not apply roofing membrane to damp or frozen deck surface.
- C. Do not expose materials vulnerable to water or sun damage in quantities greater than can be weatherproofed during same day.

1.10 COORDINATION

A. Coordinate work under provisions of Division 1 - General Requirements.

B. Coordinate the work with the installation of associated metal flashings, as the work of this section proceeds.

1.11 WARRANTY

- A. Provide a twenty (20) year total systems warranty covering both labor and material with no dollar limitation under provisions of Division 1 General Requirements.
- B. Provide a complete system warranty including 80 mph wind speed rating.
- C. Pro-rated system warranties shall not be accepted.

PART 2 PRODUCTS

- 2.1 MANUFACTURERS MEMBRANE MATERIAL
 - A. Carlisle SynTec Systems. Model Sure-Seal Adhered Roofing System.
 - B. Johns Manville. Model JM EPDM Adhered Roofing System.
 - C. Substitutions: Under provisions of Division 1.

2.2 MEMBRANE AND ASSOCIATED MATERIALS

A. Membrane: EPDM; non-reinforced, .060 inch thick, 120 inch wide roll; black color; to the following criteria:

1. 2. 3. 4.	P ro p ertie s Tolerance on Nominal Thickness Breaking Strength Elongation Tear Strength	T e st ASTM D-751 ASTM D-751A ASTM D-412 ASTM D-751B	Re sults ±10% 90 lbf 250% minimum 10 lbs.
5. 6.	Ozone Resistance Heat Aging	ASTM D-1149 ASTM D-573	minimum No cracks Exceeds ASTM
7. 8.	Brittleness Point Water Vapor Permeability	ASTM D-2137 ASTM E-96	-49° F 2.0 perm mils maximum

- B. Seaming Materials: Splice tape as recommended by membrane manufacturer.
- C. Washer Disc: Membrane material with adhesive backing.

2.3 ADHESIVE MATERIALS

- A. Surface Conditioner: As recommended by membrane manufacturer, compatible with membrane.
- B. Membrane Adhesives: As recommended by membrane manufacturer.
- C. Insulation Adhesive: As recommended by insulation manufacturer, compatible with sheet membrane.

D. Thinner and Cleaner: As recommended by adhesive manufacturer, compatible with sheet membrane.

2.4 MANUFACTURERS - INSULATION

- Α. Manufacturers:
 - 1. Carlisle SynTec Systems. Model - Secure Shield polyiso.
 - 2. Johns Manville. Model - JM ENRGY 3 CGF
 - Substitutions: Compatible with and acceptable by roofing manufacturer as 3. required to maintain 15 year total systems warranty.
- Β. Insulation: Polyisocyanurate with coated glass facer.
 - Board Size 48 x 96 inch 1. 1 1/2"
 - Board Thickness 2. 3.
 - **Board Edges** square
 - 4. Slopes
 - Flat (on 1/4" sloped structure) as indicated on drawings; a.
 - Provide overlay or underlay crickets at twice (2x) running roof slope of b. 1/2"/1'-0" tapered material on 1/4" roof slopes as indicated on drawings.
 - Slope roof drain sumps at 1/2"/1'-0 at roof drain. Typical four-sided sumps c. are 4'x4' at $\frac{1}{2}$ "/1'-0" taper for a total drop of 1" in sumps.
 - 5. Insulation with properties as follows:

а.	Compressive Strength	ASTM D-1621	20 psi, min.
b.	R-Value	R-5.7 per inch	
C.	Density	ASTM D-1622	20 psi, typical
d.	Dimensional Stability	ASTM D-2126	< 2%
e.	Moisture Vapor Transmission	ASTM E-96	<1.0 perm
f.	Water Absorption	ASTM C-209	<1% by Volume
g.	Flame Spread	ASTM E-84	75 Max.
ĥ.	Service Temp.	-100 to 250 degrees F	

C. See Architectural Drawings for insulation thickness and configuration.

2.5 **FLASHINGS**

- Flexible Flashings: Same material as membrane; black color; manufactured by roofing Α. manufacturer.
- Β. Metal Flashings: Use the longest pieces of material practical. All flashings and terminations shall be done in accordance with applicable manufacturer's details.
- C. Counterflashings: Metal, as specified in Section 07620.
- 2.6 FLASHING - OTHER PENETRATIONS
 - Α. General: Flash all penetrations passing through the membrane with flashing according to the applicable manufacturer's details.
- 2.7 ACCESSORIES

- A. Insulation Fasteners: Appropriate for purpose intended and approved by Factory Mutual and system manufacturer; length required for thickness of material with metal washers; manufactured by Carlisle SynTec Systems/Johns Manville.
- B. Sealants: As recommended by membrane manufacturer.
- C. Provide preservative treated wood blocking as recommended by membrane manufacturer.
- D. Termination Bar: Extruded aluminum as required to suit application.
- E. Walkway Pads: 30" x 30" EPDM walkway pad with three rows splice tape.
- F. Roof Hatch: Bilco Type S; 3'-0" x 3'-0"; see architectural Drawings for additional information.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that surfaces and site conditions are ready to receive work.
- B. Verify deck is supported and secure.
- C. Verify deck is clean and smooth, free of depressions, waves, or projections, properly sloped to valleys or eaves.
- D. Verify deck surfaces are dry and free of snow or ice.
- E. Verify roof openings, curbs, pipes, sleeves, ducts, and vents through roof are solidly set, and wood nailing strips are in place.
- F. Verify existing roof deck has been replaced as required and is supported and secure.

3.2 INSULATION APPLICATION

- A. Mechanically fasten insulation to deck in accordance with insulation manufacturer's instructions.
- B. Place fasteners as recommended by manufacturer.
- C. Lay boards with edges in moderate contact without forcing. Cut insulation to fit neatly to perimeter blocking and around penetrations through roof.
- D. Apply no more insulation than can be covered with membrane in same day.
- E. Install tapered rigid insulation where indicated on roof plan and building sections and where required for drainage.
- F. Minimum Total Insulation Thickness: 1 ½" or as indicated on Drawings.
- 3.3 MEMBRANE APPLICATION
 - A. Apply membrane and primer in accordance with manufacturer's instructions.
 - B. Apply adhesive at a rate recommended by manufacturer.
- C. Roll out membrane, free from air pockets, wrinkles, or tears. Firmly press sheet into place without stretching.
- D. Bond sheet to substrate except those areas directly over or within 3 inches of a control or expansion joint.
- E. Overlap edges and ends and seal by contact adhesive, minimum 3 inches. Seal permanently waterproof. Apply uniform bead of sealant to joint edge.
- E. Shingle joints on sloped substrate in direction of drainage.

3.4 FLASHINGS AND ACCESSORIES

- A. Apply flexible flashings to seal membrane to vertical elements.
- B. Secure to nailing strips at 4 inches oc.
- C. Install walkway pads in accordance with manufacturer's requirements.
- D. Install Roof Hatch in accordance with manufacturer's instructions.

3.5 FIELD QUALITY CONTROL

- A. Division 1 General Requirements Quality Assurance: Field inspection and testing.
- B. Correct identified defects or irregularities.

3.6 CLEANING

- A. Division 1 General Requirements Contract Closeout: Cleaning installed work.
- B. In areas where finished surfaces are soiled by Work of this section, consult manufacturer of surfaces for cleaning advice and conform to their instructions.
- C. Repair or replace defaced or disfigured finishes caused by Work of this section.

3.7 PROTECTION OF FINISHED WORK

- A. Division 1 General Requirements Contract Closeout: Protecting installed work.
- B. Protect building surfaces against damage from roofing work.
- C. Where traffic must continue over finished roof membrane, protect surfaces.

1.1 SECTION INCLUDES

- A. Sill and lintel flashings.
- B. Counterflashings over EPDM base flashings.
- C. Counterflashings at roof mounted equipment and vent stacks.
- D. Miscellaneous aluminum trim.
- 1.2 PRODUCTS FURNISHED BUT NOT INSTALLED UNDER THIS SECTION
 - A. Section 04300 Unit Masonry System: Placement of flashing reglets and accessories.

1.3 RELATED SECTIONS

- A. Section 043000 Unit Masonry System: Placement of flashing reglets and accessories.
- B. Section 061140 Wood Blocking and Curbing.
- C. Section 075310 Single Ply Roofing Folly adhered conventional.
- D. Section 076310 Gutters and Downspouts.
- E. Section 079000 Joint Sealers.
- F. Division 15 Mechanical: Roof curbs for mechanical equipment.
- G. Division 15 Mechanical: Flashing sleeves and collars for mechanical items protruding through roofing membrane.
- H. Division 16 Electrical: Flashing sleeves and collars for electrical items protruding through roofing membrane.

1.4 REFERENCES

- A. ASTM B209 Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
- B. NRCA (National Roofing Contractors Association) Roofing Manual.
- C. SMACNA (Architectural Sheet Metal Manual) Fourth Edition, 1987.

1.5 SUBMITTALS

A. Submit under provisions of Division 1 - General Requirements.

Shop Drawings: Indicate material profile, jointing pattern, jointing details, fastening methods, flashings, terminations, and installation details.

- 1.6 QUALITY ASSURANCE
 - A. Perform work in accordance with SMACNA standard details and requirements.

B. Maintain one copy of each document on site.

1.7 QUALIFICATIONS

A. Fabricator and Installer Qualifications: Company specializing in sheet metal work with 5 years documented experience.

1.8 DELIVERY, STORAGE, AND PROTECTION

- A. Deliver, store, protect and handle products to site under provisions of Division 1 General Requirements.
- B. Stack material to prevent twisting, bending, and abrasion, and to provide ventilation. Slope metal sheets to ensure drainage.
- C. Prevent contact with materials which may cause discoloration or staining.

1.9 COORDINATION

- A. Coordinate work under provisions of Division 1 General Requirements.
- B. Coordinate with the work of Section 043000 for installing flashing reglets.

PART 2 PRODUCTS

2.1 SHEET MATERIALS

- A. Aluminum Sheet for Concealed Applications: ASTM B209; 6063-T2 alloy, minimum .032 inch thick; mill finish.
- B. Aluminum Sheet for Exposed Applications (Trim, Fascias, Drips, Copings, etc.): ASTM B209; 6063-T2 alloy, minimum .050 inch thick; fluoropolymer Kynar 500 finish; colors as selected by Architect.

2.2 ACCESSORIES

- A. Fasteners: Same material and finish as flashing metal with soft neoprene washers.
- B. Underlayment: ASTM D226, No. 15 asphalt saturated roofing felt.
- C. Slip Sheet: Rosin sized building paper.
- D. Protective Backing Paint: Bituminous.
- E. Sealant: Specified in Section 079000.

2.3 FABRICATION

A. Form sections true to shape, accurate in size, square, and free from distortion or defects.

- B. Fabricate cleats of aluminum type sheet metal, same material as sheet, interlocking with sheet.
- E. Form pieces in longest possible lengths.
- F. Hem exposed edges on underside 1/2; miter and seam corners.
- G. Form material with flat lock seams.
- H. Fabricate corners from one piece with minimum 18 inch long legs; seam for rigidity, seal with sealant.
- I. Fabricate vertical faces with bottom edge formed outward 1/4 inch and hemmed to form drip.

2.4 BACK PAINT

A. Back paint concealed metal surfaces with protective backing paint to a minimum dry film thickness of 15 mil.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify roof openings, curbs, pipes, sleeves, ducts, and vents through roof are solidly set, reglets in place, and nailing strips located.
- B. Verify roofing termination and base flashings are in place, sealed, and secure.

3.2 PREPARATION

- A. Install starter and edge strips, and cleats before starting installation.
- B. Install surface mounted reglets true to lines and levels. Seal top of reglets with sealant.

3.3 INSTALLATION

- A. Conform to drawing details included in the SMACNA manual.
- B. Insert flashings into reglets to form tight fit. Secure in place with lead wedges. Pack remaining spaces with lead wool. Seal flashings into reglets with sealant.
- C. Apply plastic cement compound between metal flashings and felt flashings.

D. Fit flashings tight in place. Make corners square, surfaces true and straight in planes, and lines accurate to profiles.

- E. Seal metal joints watertight.
- F. Apply bituminous protective backing on surfaces in contact with dissimilar materials.

3.4 FIELD QUALITY CONTROL

A. Field inspection will be performed under provisions of Division 1 - General Requirements.

B. Inspection will involve surveillance of work during installation to ascertain compliance with specified requirements.

- 1.1 SECTION INCLUDES
 - A. Gutters.
 - B. Downspouts.
 - C. Accessories.
- 1.2 RELATED SECTIONS
 - A. Section 062000 Finish Carpentry: Metal Roof Panels.
 - B. Section 079000 Joint Sealants.
- 1.3 REFERENCES
 - A. SMACNA Architectural Sheet Metal Manual.
- 1.4 SUBMITTALS

Т

- A. Submit two (2) samples 4 x 6 inch in size illustrating metal finish color.
- 1.5 QUALITY ASSURANCE
 - A. Perform work in accordance with SMACNA standard details and requirements.

1.6 QUALIFICATIONS

- A. Fabricator and Installer: Company specializing in sheet metal flashing work with 3 years documented experience.
- 1.7 DELIVERY, STORAGE, AND HANDLING
 - A. Deliver, store, protect and handle products to site.
 - B. Stack preformed and prefinished material to prevent twisting, bending, or abrasion, and to provide ventilation. Slope metal sheets to ensure drainage.
 - C. Prevent contact with materials which may cause discoloration or staining.

1.8 COORDINATION

A. Coordinate the work with downspout discharge into downspout boot and PVC site drainage piping.

PART 2 PRODUCTS

- 2.1 ACCEPTABLE DOWNSPOUT MANUFACTURERS
 - A. Englert, Inc., Perth Amboy, NJ (908) 826-8614.

2.2 MATERIALS

A. Aluminum Sheet (Gutters & Downspouts): ASTM B209, aluminum alloy, smooth, Kynar 500; color as selected by Architect. (See schedule for thickness).

2.3 ACCESSORIES

- A. Fasteners: Manufacturer's standard type to suit application, stainless steel; any exposed fastener caps to be same color as adjacent material.
- B. Protective Backing Paint: Bituminous.
- C. Sealant: Manufacturer's standard type suitable for use with installation of system; non-staining; non-skinning.
- D. Downspout Anchorage Devices: Type recommended by fabricator.
- E. Downspout Supports: Brackets and Straps.
- F. PVC leaders to connect downspouts to perimeter drainage system.

2.4 COMPONENTS

- A. Gutters: See Schedule.
- B. Downspouts: See Schedule; fabricate rectangular downspouts. Furnish with metal hangers, from same material as downpouts and anchors.
- C. Accessories: Profiled to suit gutters and downspouts.

2.5 FABRICATION

- A. Form sections true to shape, accurate in size, square, and free from distortion or defects.
- B. Fabricate cleats of stainless steel sheet metal, interlockable with sheet.
- C. Form pieces in longest possible lengths.
- D. Hem exposed edges on underside 1/2 inch; miter and seam corners.
- E. Fabricate corners from one piece with minimum 18 inch long legs; seam for rigidity, seal with sealant.
- F. Fabricate vertical faces with bottom edge formed outward 1/4 inch and hemmed to form drip.
- G. Form flashings to protect roofing materials from physical damage and shed water.
- H. Form sections square and accurate to profile, in maximum possible lengths, free from distortion or defects detrimental to appearance or performance.

2.6 FINISH

A. Back paint concealed metal surfaces with protective backing paint to a minimum dry film

thickness of 15 mil.

2PART EXECUTION

2.1 INSTALLATION

- A. Conform to drawing details included in the SMACNA manual.
- B. Seal metal joints watertight.
- C. Secure gutters and downspouts in place using concealed fasteners.
- D. Weather lap joints minimum 2 inches and seal weathertight with plastic cement.
- E. Terminate downspouts at concrete splashblocks or pipe underground into site drainage system.

2.2 SCHEDULE

	Location	Metal Type	Style	Thickness	Size	Finish
A.	Gutters	Pre-coated Aluminum	F	.050	6" wide x 4-3/4" deep	Kynar 500
В.	Downspouts	Pre-coated Aluminum	Plain Rectangular	.040	3-3/4" x 4-3/4"	Kynar 500

1.1 SECTION INCLUDES

- A. Preparing substrate surfaces.
- B. Sealant and joint backing.
- 1.2 RELATED SECTIONS
 - A. Section 033000 Cast-In-Place Concrete: Sealants required in conjunction with cast-inplace concrete.
 - B. Section 043000 Unit Masonry System: Sealants required in conjunction with masonry.

1.3 REFERENCES

- A. ASTM C790 Use of Latex Sealing Compounds.
- B. ASTM C804 Use of Solvent-Release Type Sealants.
- C. ASTM C834 Latex Sealing Compounds.
- D. ASTM C919 Use of Sealants in Acoustical Applications.
- E. ASTM C920 Elastomeric Joint Sealants.
- F. ASTM D1056 Flexible Cellular Materials Sponge or Expanded Rubber.
- G. ASTM D1565 Flexible Cellular Materials Vinyl Chloride Polymers and Copolymers (Open-Cell Foam).
- H. SWRI (Sealant, Waterproofing and Restoration Institute) Sealant and Caulking Guide Specification.

1.4 SUBMITTALS

- A. Submit under provisions of Division 1 General Requirements.
- B. Product Data: Provide data indicating sealant chemical characteristics, performance criteria, substrate preparation, limitations, and color availability.
- C. Samples: Submit two samples, illustrating sealant colors for selection.
- D. Manufacturer's Installation Instructions: Indicate special procedures, surface preparation, and perimeter conditions requiring special attention.

1.5 QUALITY ASSURANCE

- A. Perform work in accordance with sealant manufacturer's requirements for preparation of surfaces and material installation instructions.
- B. Maintain one copy of each document on site.

1.6 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.
- B. Applicator: Company specializing in performing the work of this section with minimum three years documented experience and approved by manufacturer.

1.7 ENVIRONMENTAL REQUIREMENTS

A. Maintain temperature and humidity recommended by the sealant manufacturer during and after installation.

1.8 COORDINATION

- A. Coordinate work under provisions of Division 1 General Requirements.
- B. Coordinate the work with all sections referencing this section.

1.9 WARRANTY

- A. Provide five year warranty under provisions of Division 1 General Requirements.
- B. Warranty: Include coverage for installed sealants and accessories which fail to achieve air tight seal, water tight seal, and exhibit loss of adhesion or cohesion, or do not cure.

PART 2 PRODUCTS

2.1 SEALANTS

A.	Location Doors & Windows to Masonry	<u>Type</u> Silicone: GE Siliglaze #N2501	<u>Color</u> Selected by Architect
В.	Wood Frame to Masonry	Polyurethane, Pecora 'Dynatrol II'	Selected by Architect
C.	Expansion/Control Joints in Masonry	Silicone Single Component	To match mortar color
D.	Laminate Counters	Silicone Single Component	Clear
E.	Door Frame/Walls	Acrylic, Latex	Paint to match
F.	Under Thresholds	Butyl Rubber	Black
G.	Ceramic Tile	Silicone, Fungus Resistant	to match grout color
H.	Doors & Windows to Metal Siding	Silicone Pecora 890 FTS	Selected by Architect

Ι.	Doors & Windows to	Silicone	Selected
	Metal Trim	Pecora 890 FTS	by Architect
J.	Metal Siding to Metal Trim	Silicone Pecora 890 FTS	Selected by Architect

2.2 ACCESSORIES

- A. Primer: Non-staining type, recommended by sealant manufacturer to suit application.
- B. Joint Cleaner: Non-corrosive and non-staining type, recommended by sealant manufacturer; compatible with joint forming materials.
- C. Joint Backing: ASTM D1056; round, closed foam rod; oversized 30 to 50 percent larger than joint width.
- D. Bond Breaker: Pressure sensitive tape recommended by sealant manufacturer to suit application.

PART 3 EXECUTION

- 3.1 EXAMINATION
 - A. Verify that substrate surfaces and joint openings are ready to receive work.
 - B. Verify that joint backing and release tapes are compatible with sealant.

3.2 PREPARATION

- A. Remove loose materials and foreign matter which might impair adhesion of sealant.
- B. Clean and prime joints in accordance with manufacturer's instructions.
- C. Perform preparation in accordance with manufacturer's instructions.
- D. Protect elements surrounding the work of this section from damage or disfiguration.

3.3 INSTALLATION

- A. Install sealant in accordance with manufacturer's instructions.
- B. Measure joint dimensions and size materials to achieve required 2:1 width/depth ratios.
- C. Install joint backing to achieve a neck dimension no greater than 1/3 of the joint width.
- D. Install bond breaker where joint backing is not used.
- E. Install sealant free of air pockets, foreign embedded matter, ridges, and sags.
- F. Apply sealant within recommended application temperature ranges. Consult

manufacturer when sealant cannot be applied within these temperature ranges.

G. Tool joints concave.

3.4 CLEANING

- A. Clean work under provisions of Division 1 General Requirements.
- B. Clean adjacent soiled surfaces.

3.5 PROTECTION OF FINISHED WORK

- A. Protect finished installation under provisions of Division 1 General Requirements.
- B. Protect sealants until cured.

1.1 SECTION INCLUDES

- A. Non-rated steel doors.
- B. Bullet resistant steel doors.
- C. Soundproof steel doors.

1.2 RELATED SECTIONS

- A. Section 041000 Mortar and Masonry Grout: Masonry mortar fill of metal frames.
- B. Section 043000 Unit Masonry System: Masonry openings.
- C. Section 081120 Standard Steel Frames.
- D. Section 087100 Door Hardware.
- E. Section 088000 Glazing.
- F. Section 099000 Painting: Field painting of doors.

1.3 REFERENCES

- A. ANSI A117.1 Specifications for Making Buildings and Facilities Accessible to and Usable by Physically Handicapped People.
- B. ANSI/SDI-100 Standard Steel Doors and Frames.
- C. ASTM A525 Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process.
- D. ASTM C236 Test Method for Steady-State Thermal Performance of Building Assemblies by Means of a Guarded Hot-Box.
- E. Door Hardware Institute (DHI) The Installation of Commercial Steel Doors and Steel Frames, Insulated Steel Doors in Wood Frames and Builder's Hardware.

1.4 SUBMITTALS

- A. Submit under provisions of Division 1 General Requirements.
- B. Shop Drawings: Indicate door elevations, internal reinforcement, closure method, cutouts for glazing and finish.
- C. Product Data: Indicate door configurations, location of cut-outs for hardware reinforcement.
- D. Manufacturer's Installation Instructions: Indicate special installation instructions.
- E. Manufacturer's Certificate: Certify that Products meet or exceed specified requirements.
- 1.5 QUALITY ASSURANCE

A. Conform to requirements of ANSI/SDI-100 and ANSI A117.1.

1.6 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, protect, and handle products to site under provisions of Division 1 General Requirements.
- B. Protect doors with resilient packaging sealed with heat shrunk plastic.
- C. Accept doors on site in manufacturer's packaging. Inspect for damage.
- D. Break seal on-site to permit ventilation.

1.8 FIELD MEASUREMENTS

A. Verify that field measurements are as indicated on shop drawings.

1.9 COORDINATION

- A. Coordinate work under provisions of Division 1 General Conditions.
- B. Coordinate the work with door opening construction, door frame and door hardware installation.

PART 2 PRODUCTS

- 2.1 DOOR MANUFACTURERS STANDARD STEEL DOORS
 - A. Pioneer Product: Series CHP.
 - B. Substitutions: Under provisions of Division 1 General Requirements.

2.2 DOORS

- A. Interior Doors: SDI-100, 18 gage, Grade II, flush door style M; narrow lite door style NL 4 x 25; vision panel door style VP with 12"x4" security lite kit; provide with operable steel panel for viewing.
- B. Exterior (Non-rated): SDI-100, 18 gage, Grade II, Insulated with R-7 polystyrene core; flush door style M; narrow lite door style NL 4x25.

2.3 DOOR CONSTRUCTION – STANDARD STEEL DOORS

- A. Face: Steel sheet in accordance with ANSI/SDI-100.
- B. Core: Polystyrene.
- C. Edges: Fully welded and ground smooth (seamless).

D. Continuous channel reinforcement - 14 gage full perimeter.

2.4 DOOR MANUFACTURERS – BULLET RESISTANT STEEL DOORS/FRAMES

- A. Total Security Solutions Product: TSS Steel Door.
- B. Substitutions: Under provisions from Division I General Requirements.

2.5 DOORS/FRAMES

- A. Interior Bullet Resistant Frame: Frame to be prime painted 16 ga. steel door frame lined with U.L. Rated Level 4 armor plate.
- B. Interior Bullet Resistant Door: Door to be prime painted 16 ga. U.L. Level 4 rated steel door with U.L. rated Level 4 bullet resistant fiberglass.
- C. Frame and door size and configuration as per Architectural Drawings. The penetration through the bullet resistant door core shall only be large enough to accommodate the specified door hardware. No other penetrations shall be permitted.

2.6 DOOR MANUFACTURERS – SOUNDPROOF STEEL DOORS/FRAMES

- A. Overly Door Company Product: Architectural Acoustic Doors.
- B. Substitutions: Under provisions of Division 1 General Requirements.

2.7 DOORS/FRAMES

- A. Model No. 5292185; STC 52 flush sound control door and frame assembly with single compression gaskets.
- B. Provide Single H frame perimeter seal and Super H door bottom. Fill door frame with soundproof material over STC 39.
- C. Frame and door size and configuration as per Architectural drawings.
- D. CAM lift hinges and gasketing to be provided by the manufacturer.

2.8 ACCESSORIES

- A. Removable Stops: Rolled steel channel shape; mitered corners; prepared for countersunk type screws (18 gauge).
- B. Primer: Zinc chromate type.

2.9 FABRICATION

- A. Astragals for Double Doors: Steel, T shaped, specifically for double doors.
- B. Fabricate doors with hardware reinforcement welded in place.
- C. Close top and bottom edge of exterior doors with inverted steel channel closure. Seal

joints watertight.

2.10 FINISH

- A. Steel Sheet: Galvanized to ASTM A525, A60.
- B. Primer: Air dried.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify substrate conditions under provisions of Division 1 General Requirements.
- B. Verify that opening sizes and tolerances are acceptable.

3.2 INSTALLATION

- A. Install doors in accordance with ANSI/SDI-100 and DHI.
- B. Install glazing in accordance with FGMA Glazing and Sealant Manuals.
- C. Coordinate installation of doors with installation of frames specified in Section 08112 and hardware specified in Section 087100.
- D. Touch-up factory finished doors.
- E. Install bullet resistant doors and frames in accordance with manufacturer's instructions to meet all specification requirements.
- F. Install soundproof doors and frames in accordance with manufacturer's instructions to meet all specification requirements.

3.3 ERECTION TOLERANCES

A. Maximum Diagonal Distortion: 1/16 inch measured with straight edge, corner to corner.

3.4 ADJUSTING

- A. Adjust work under provisions of Division 1 General Requirements.
- B. Adjust door for smooth and balanced door movement.

1.1 SECTION INCLUDES

- A. Non-rated steel door frames.
- 1.2 PRODUCTS FURNISHED BUT NOT INSTALLED UNDER THIS SECTION
 - A. Section 043000 Unit Masonry: Placement of anchors into wall construction.

1.3 RELATED SECTIONS

- A. Section 041000 Mortar and Masonry Grout: Masonry mortar fill of metal frames.
- B. Section 043000 Unit Masonry: Masonry Openings.
- C. Section 081110 Standard Steel Doors.
- D. Section 082110 Wood Doors.
- E. Section 087120 Door Hardware.
- F. Section 088000 Glazing.
- G. Section 099000 Painting: Field painting of frames.

1.4 REFERENCES

- A. ANSI A117.1 Specifications for Making Buildings and Facilities Accessible to and Usable by Physically Handicapped People.
- B. ANSI/SDI-100 Standard Steel Doors and Frames.
- C. ASTM E152 Methods of Fire Tests of Door Assemblies.
- D. DHI Door Hardware Institute: The Installation of Commercial Steel Doors and Steel Frames, Insulated Steel Doors in Wood Frames and Builder's Hardware.
- E. NFPA 80 Fire Doors and Windows.
- F. NFPA 252 Fire Tests for Door Assemblies.
- G. UL 10B Fire Tests of Door Assemblies.

1.5 SUBMITTALS

- A. Submit under provisions of Division 1 General Requirements.
- B. Shop Drawings: Indicate frame elevations, reinforcement, and finish.
- C. Product Data: Indicate frame configuration, anchor types and spacings, location of cutouts for hardware, reinforcement.
- D. Manufacturer's Installation Instructions: Indicate special installation instructions.

E. Manufacturer's Certificate: Certify that Products meet or exceed specified requirements.

1.6 QUALITY ASSURANCE

A. Conform to requirements of ANSI/SDI-100 and ANSI A117.1.

1.7 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.

1.8 REGULATORY REQUIREMENTS

- A. Fire Rated Frame Construction: Conform to ASTM E152, NFPA 252 and UL 10B.
- B. Installed Frame Assembly: Conform to NFPA 80 for fire rated class same as fire door.
- 1.9 DELIVERY, STORAGE, AND HANDLING
 - A. Deliver, store, protect, and handle products to site under provisions of Division 1 General Conditions.
 - B. Accept frames on site in manufacturer's packaging. Inspect for damage.

1.10 FIELD MEASUREMENTS

A. Verify that field measurements are as indicated on shop drawings.

1.11 COORDINATION

- A. Coordinate work under provisions of Division 1 General Requirements.
- B. Coordinate the work with frame opening construction, door and hardware installation.

PART 2 PRODUCTS

- 2.1 FRAME MANUFACTURERS
 - A. Pioneer Product: Series F
 - B. Substitutions: Under provisions of Division 1 General Requirements.
- 2.2 FRAMES
 - A. Exterior Frames: 14 gage thick material, base metal thickness, galvanized.
 - B. Interior Frames: 16 gage thick material, base metal thickness.

2.3 ACCESSORIES

- A. Silencers: Resilient rubber, fitted into drilled hole.
- B. Bituminous Coating: Fibered asphalt emulsion.

- C. Primer: Zinc chromate type.
- D. Steel Channel Glazing Beads: As provided by manufacturer for installation of glass in borrowed lites.
- E. Mortar guard boxes.

2.4 FABRICATION

- A. Fabricate frames as welded unit.
- B. Fabricate frames with hardware reinforcement plates welded in place. Provide mortar guard boxes.
- C. Reinforce frames wider than 48 inches with roll formed steel channels fitted tightly into frame head, flush with top.
- D. Prepare frame for silencers. Provide three single silencers for single doors on strike side. Provide two single silencers on frame head at double doors without mullions.
- E. Fabricate frames to suit masonry wall coursing with 2 inch head member or as indicted on Drawings.
- F. Fabricate frames to suit gypsum wall board with 2 inch head member or as indicated on Drawings
- G. Jamb depth as indicated on drawings and to suit application.
- H. Jamb depth as indicated on Drawings and to suit appication.

2.5 FINISH

- A. Steel Sheet: Galvanized to ASTM A525 A60.
- B. Primer: Air dried.
- C. Coat inside of frame profile with bituminous coating to a thickness of 1/16 inch for frames in contact with masonry.

PART 3 EXECUTION

- 3.1 EXAMINATION
 - A. Verify substrate conditions under provisions of Division 1 General Requirements.
 - B. Verify that opening sizes and tolerances are acceptable.

3.2 INSTALLATION

- A. Install frames in accordance with ANSI/SDI-100 and DHI.
- B. Coordinate with masonry and wallboard wall construction for anchor placement.

C. Coordinate installation of frames with installation of hardware specified in Section 08710 and doors in Section 08111.

3.3 ERECTION TOLERANCES

A. Maximum Diagonal Distortion: 1/16 inch measured with straight edges, crossed corner to corner.

1.1 SECTION INCLUDES

A. Flush wood doors; non-rated.

1.2 RELATED SECTIONS

- A. Section 081120 Standard Steel Frames.
- B. Section 087120 Door Hardware.
- C. Section 088000 Glazing

1.3 REFERENCES

- A. ANSI/HPMA HP Hardwood and Decorative Plywood.
- B. ASTM E413 Classification for Determination of Sound Transmission Class.
- C. AWI Quality Standards of the Architectural Woodwork Institute.
- D. NFPA 80 Fire doors and windows.
- E. UL 10B Fire tests of door accessories.
- F. Warnock Hersey Certification listings for fire doors.

1.4 SUBMITTALS

- A. Submit under provisions of Division 1 General Requirements.
- B. Shop Drawings: Illustrate door opening criteria, elevations, sizes, types, swings, undercuts required, identify cutouts for hardware, glazing, etc.
- C. Product Data: Indicate door core materials and construction; veneer species, type and characteristics; and factory machining criteria.
- D. Samples: Submit two samples of door veneer, 4 x 4 inch in size illustrating wood grain, stain color, and sheen.
- E. Manufacturer's Installation Instructions: Indicate special installation instructions.

1.5 QUALITY ASSURANCE

- A. Perform work in accordance with AWI Quality Standard Section 1300, Premium Grade.
- B. Finish doors in accordance with AWI Quality Standard Section 1500.

1.6 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, protect, and handle products to site under provisions of Division 1 General Requirements.
- B. Package, deliver and store doors in accordance with AWI Section 1300.
- C. Protect doors with resilient packaging sealed with heat shrunk plastic. Do not store in damp or wet areas; or in areas where sunlight might bleach veneer. Seal top and bottom edges if stored more than one week. Break seal on-site to permit ventilation.

1.8 FIELD MEASUREMENTS

A. Verify that field measurements are as indicated on shop drawings.

1.9 COORDINATION

- A. Coordinate work under provisions of Division 1 General Requirements.
- C. Coordinate the work with door opening construction, door frame and door hardware installation.

1.10 WARRANTY

- A. Provide warranty under provisions of Division 1 General Requirements.
- B. Include life time warranty coverage for delamination of veneer, warping beyond specified installation tolerances, defective materials, and telegraphing core construction.

PART 2 PRODUCTS

- 2.1 MANUFACTURERS
 - A. Doors:
 - 1. VT Industries: Heritage Collection Flush Wood Veneer Doors.
 - 2. Substitutions: Under provisions of Division 1 General Requirements.

2.2 DOOR TYPES

- A. Flush Interior Doors: 1-3/4" thick; solid core and hollow core construction; non-rated.
- B. Flush Interior Doors with Glazing/Louver: 1-3/4" thick; solid core construction with factory cut openings as per Drawings.
- 2.3 DOOR CONSTRUCTION
 - A. Solid non-rated and fire rated core: AWI Section 1300.
 - 1. Non-Rated: SRC-Stile and rail, particle core bonded to stiles and rails.
 - 2. Rated: Stile and rail, mineral core; label as per schedule.
 - 3. 5-Ply construction.

2.4 DOOR FACING

A. Veneer Facing: AWI Custom quality plain sliced select White Birch; pre-finished from manufacturer's rull range of standard stains; to be selected by Architect.

2.5 ADHESIVE

A. Facing Adhesive: Type II - water resistant.

2.6 FABRICATION

- A. Fabricate non-rated doors in accordance with AWI Quality Standards requirements.
- B. Fabricate fire rated doors in accordance with AWI Quality Standards and to UL requirements. Attach fire rating label to door.
- C. Provide lock blocks at lock edge and top of door for closer and hardware reinforcement.
- D. Vertical Exposed Edge of Stiles: Of same species as veneer facing. Hardwood for transparent finish facing.
- E. Fit door edge trim to edge of stiles after applying veneer facing.
- F. Bond edge banding to cores.
- G. Factory machine doors for finish hardware in accordance with hardware requirements and dimensions. Do not machine for surface hardware.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that opening sizes and tolerances are acceptable.
- C. Do not install doors in frame openings that are not plumb or are out-of-tolerance for size or alignment.

3.2 INSTALLATION

- A. Install doors in accordance with AWI Quality Standards.
- B. Trim door width by cutting equally on both jamb edges.
- C. Trim door height by cutting bottom edges to a maximum of 3/4 inch.
- D. Pilot drill screw and bolt holes.
- E. Machine cut for hardware. Core for handsets and cylinders.
- F. Coordinate installation of doors with installation of frames.

3.3 INSTALLATION TOLERANCES

- A. Conform to AWI requirements for fit and clearance tolerances.
- B. Conform to AWI Section 1300 requirements for maximum diagonal distortion.

3.4 ADJUSTING

- A. Adjust work under provisions of Division 1 General Requirements.
- B. Adjust door for smooth and balanced door movement.

3.5 SCHEDULE

A. See Drawings.

- 1.1 SECTION INCLUDES
 - A. Insulated Sectional Overhead Doors.
 - B. Electric Operators and Controls.
 - C. Operating Hardware, tracks, and support.

1.2 RELATED SECTIONS

- A. Section 033000 Cast-In-Place Concrete: Prepared opening in concrete. Execution requirements for placement of anchors in concrete wall construction.
- B. Section 043000 Unit Masonry Assemblies: Prepared opening in masonry. Execution requirements for placement of anchors in masonry wall construction.
- C. Section 055000 Metal Fabrications: Steel frame and supports.
- D. Section 061000 Rough Carpentry: Rough wood framing and blocking for door opening.
- E. Section 079000 Joint Sealers: Perimeter sealant and backup materials.
- F. Division 16 Sections for electrical wiring, connection and installation of remote door controls.

1.3 REFERENCES

A. <u>ANSI/DASMA 102</u> - American National Standard Specifications for Sectional Overhead Type Doors.

1.4 DESIGN / PERFORMANCE REQUIREMENTS

- A. Wind Loads: Design and size components to withstand loads caused by pressure and suction of wind acting normal to plane of wall as calculated in accordance with applicable code.
 - 1. Design pressure of <u>13.3</u> lb/sq ft. / 20psf test load standard.
- B. Wiring Connections: Requirements for electrical characteristics.
 - 1. 115 volts, single phase, 60 Hz.
- C. Single-Source Responsibility: Provide doors, tracks, motors, and accessories from one manufacturer for each type of door. Provide secondary components from source acceptable to manufacturer of primary components.

1.5 SUBMITTALS

- A. Submit under provisions of Section 01300.
- 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.

SECTION 083620 - STANDARD INSULATED OVERHEAD DOORS

- C. Shop Drawings: Indicate plans and elevations including opening dimensions and required tolerances, connection details, anchorage spacing, hardware locations, and installation details.
- D. Manufacturer's Certificates: Certify products meet or exceed specified requirements.
- E. Operation and Maintenance Data.

1.6 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with minimum five years documented experience.
- B. Installer Qualifications: Authorized representative of the manufacturer with minimum five years documented experience.
- C. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories, Inc. acceptable to authority having jurisdiction as suitable for purpose specified.
- 1.7 DELIVERY, STORAGE, AND HANDLING
 - A. Store products in manufacturer's unopened labeled packaging until ready for installation.
 - B. Protect materials from exposure to moisture until ready for installation.
 - C. Store materials in a dry, ventilated weathertight location.

1.8 PROJECT CONDITIONS

A. Pre-Installation Conference: Convene a pre-installation conference just prior to commencement of field operations, to establish procedures to maintain optimum working conditions and to coordinate this work with related and adjacent work.

1.9 WARRANTY

A. Warranty: Manufacturer's limited door and operators System warranty for 10 year against delamination of polyurethane foam from steel face and all other components for 3 years or 20,000 cycles, whichever comes first.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable Manufacturer: Overhead Door Corp., 2501 S. State Hwy. 121, Suite 200, Lewisville, TX 75067. ASD. Tel. Toll Free: (800) 275-3290. Phone: (469) 549-7100. Fax: (972) 906-1499. Web Site: <u>www.overheaddoor.com</u>. E-mail: <u>sales@overheaddoor.com</u>.
- Requests for substitutions will be considered in accordance with provisions of Division 1 General Requirements.

2.2 INSULATED SECTIONAL OVERHEAD DOORS

- A. Insulated Steel Sectional Overhead Doors: 591 Series Thermacore Insulated Steel Doors by Overhead Door Corporation. Units shall have the following characteristics:
 - 1. Door Assembly: Metal/foam/metal sandwich panel construction, with PVC thermal break and weather-tight ship-lap design meeting joints.
 - a. Panel Thickness: 1-5/8 inches (41 mm).
 - b. Exterior Surface: Ribbed, textured.
 - c. Exterior Steel: .015 inch (.38 mm), hot-dipped galvanized.
 - d. End Stiles: 16 gauge.
 - e. Spring Counterbalance: Sized to weight of the door, with a helically wound, oil tempered torsion spring mounted on a steel shaft; cable drum of diecast aluminum with high strength galvanized aircraft cable. Sized with a minimum 7 to 1 safety factor.
 - 1) High cycle spring: 25,000 cycles.
 - f. Insulation: CFC-free and HCFC-free polyurethane, fully encapsulated.
 - g. Thermal Values: R-value of 14.86; U-value of 0.067.
 - h. Air Infiltration: 0.08 cfm at 15 mph; 0.08 cfm at 25 mph.
 - 2. Finish and Color:
 - a. Two coat baked-on polyester:
 - 1) Interior color, white.
 - 2) Exterior color, gray.
 - 3. Windload Design: Provide to meet the Design/Performance requirements required.
 - 4. Hardware: Galvanized steel hinges and fixtures. Ball bearing rollers with hardened steel races.
 - 5. Weatherstripping:
 - a. EPDM bulb-type strip at bottom section.
 - b. Flexible Jamb seals.
 - c. Flexible Header seal.
 - 6. Track: Provide track as recommended by manufacturer to suit loading required and clearances available.
 - a. Size:

b.

- 1) 3 inch (76 mm).
- Type:
 - 1) Standard lift.
- 7. Electric Motor Operation: Provide UL listed electric operator, size and type as recommended by manufacturer to move door in either direction at not less than 2/3 foot nor more than 1 foot per second. Operator shall meet UL325/2010 requirements for continuous monitoring of safety devices; model RSX or approved equal.
 - a. Entrapment Protection: Required for momentary contact, includes radio control operation.
 - 1) Electric sensing edge monitored to meet UL 325/2010.
 - b. Operator Controls:
 - Push-button operated control stations with open, close, and stop buttons. Provide 3 Button Station for each overhead door at desk in Room 102 – Duty Sgt.; Coordinate final location with Owner. Provide 3 – button, 3 – gang recessed operator as manufactured by Gate-Opener Safety, model no. MMTC LCE-3-3G or approved equal.
 - 2) Numbered Keypad operated control stations at each door opening; coordinate final locations with Owner. Liftmaster model no. KPR 2000 or approved equal.
 - 3) Flush mounting.
 - 4) Interior and exterior location at each door.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Do not begin installation until openings have been properly prepared.
- B. Verify wall openings are ready to receive work and opening dimensions and tolerances are within specified limits.
- C. Verify electric power is available and of correct characteristics.
- D. If preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.2 PREPARATION

- A. Clean surfaces thoroughly prior to installation.
- B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.3 INSTALLATION

- A. Install overhead doors and track in accordance with approved shop drawings and the manufacturer's printed instructions.
- B. Coordinate installation with adjacent work to ensure proper clearances and allow for maintenance.
- C. Anchor assembly to wall construction and building framing without distortion or stress.
- D. Securely brace door tracks suspended from structure. Secure tracks to structural members only.
- E. Fit and align door assembly including hardware.
- F. Coordinate installation of electrical service. Complete power and control wiring from disconnect to unit components.

3.4 CLEANING AND ADJUSTING

- A. Adjust door assembly to smooth operation and in full contact with weatherstripping.
- B. Clean doors, frames and glass.
- C. Remove temporary labels and visible markings.

3.5 PROTECTION

- A. Do not permit construction traffic through overhead door openings after adjustment and cleaning.
- B. Protect installed products until completion of project.
- C. Touch-up, damaged coatings and finishes and repair minor damage before Substantial Completion.

1.1 SECTION INCLUDES

- A. Exterior aluminum doors and storefront entrance frames.
- B. Perimeter sealant.
- 1.2 PRODUCTS INSTALLED BUT NOT FURNISHED UNDER THIS SECTION
 - A. Section 087100 Door Hardware: Hardware items for aluminum and glass entry doors.

1.3 RELATED SECTIONS

- A. Section 033000 Cast-in-Place-Concrete: Floor closers.
- B. Section 079000 Sealants: System perimeter sealant and back-up materials.
- C. Section 087100 Door Hardware.
- D. Section 088000 Glazing.

1.4 REFERENCES

- A. AAMA Metal Curtain Wall, Window, Store Front and Entrance Guide Specifications Manual.
- B. AAMA Curtain Wall Manual #10 Care and Handling of Architectural Aluminum From Shop to Site.
- C. AAMA 606.1 Specifications and Inspection Methods for Integral Color Anodic Finishes for Architectural Aluminum.
- D. AAMA 605.2-92 Specifications for High Performance Organic Coatings on Architectural Extrusions and Panels.
- E. AAMA SFM-1 Aluminum Storefront and Entrance Manual.
- F. ANSI A117.1 Safety Standards for the Handicapped.
- G. ANSI/ASTM E283 Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors.
- H. ANSI/ASTM E330 Structural Performance of Exterior Windows, Curtain Walls, and Doors by Uniform Static Air Pressure Difference.
- I. ANSI/ASTM E331 Test Method for Water Penetration of Exterior Windows, Curtain Walls, and Doors by Uniform Static Air Pressure Difference.

1.5 SYSTEM DESCRIPTION

A. Aluminum entrance and storefront system includes tubular aluminum sections, doors, shop fabricated, factory pre-finished, related flashings, anchorage and attachment devices.

1.6 PERFORMANCE REQUIREMENTS

- A. Design and size components to withstand dead and live loads caused by positive and negative wind pressure acting normal to plane of wall as measured in accordance with ANSI/ASTM E330.
- B. Limit mullion deflection to flexure limit of glass L/175; with full recovery of glazing materials.
- C. System to accommodate, without damage to components or deterioration of seals, movement within system, movement between system and peripheral construction, dynamic loading and release of loads, deflection of structural support framing.
- D. Limit air leakage through assembly to 0.06 cfm/min/sq ft of wall area, measured at a reference differential pressure across assembly of 6.24 psf as measured in accordance with AAMA 501 and ANSI/ASTM E283.
- E. Water Leakage: None, when measured in accordance with AAMA 501 with a test pressure difference of 15 lbf/sq ft.
- F. Maintain continuous air and vapor barrier throughout assembly, primarily in line with pane of glass and heel bead of glazing compound.
- G. System to provide for expansion and contraction within system components caused by a cycling temperature range of 170 degrees F over a 12 hour period without causing detrimental affect to system components.
- H. Drain water entering joints, condensation occurring in glazing channels, or migrating moisture occurring within system, to the exterior by a weep drainage network.

1.7 SUBMITTALS

- A. Submit under provisions of Division 1 General Requirements.
- B. Shop Drawings: Indicate system dimensions, framed opening requirements and tolerances, affected related work and expansion and contraction joint location and details.
- C. Product Data: Provide component dimensions, describe components within assembly, anchorage and fasteners, glass door hardware, and internal drainage details.
- D. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

1.8 QUALITY ASSURANCE

- A Perform Work in accordance with AAMA SFM-1 and AAMA Metal Curtain Wall, Window, Store Front and Entrance - Guide Specifications Manual.
- B Conform to requirements of ANSI A117.1.
- 1.9 QUALIFICATIONS

A. Manufacturer and Installer: Company specializing in manufacturing aluminum glazing systems with minimum three years documented experience.

1.10 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, protect and handle products to site under provisions of Division 1 General Requirements.
- B. Handle work of this section in accordance with AAMA Curtain Wall Manual #10.
- C. Protect pre-finished aluminum surfaces with wrapping or stripable coating. Do not use adhesive papers or sprayed coatings which bond when exposed to sunlight or weather.

1.11 ENVIRONMENTAL REQUIREMENTS

A. Do not install sealants when ambient temperature is less than 40 degrees F during and 48 hours after installation.

1.12 FIELD MEASUREMENTS

- A. Verify that field measurements are as indicated on shop drawings.
- 1.13 COORDINATION
 - A. Coordinate Work under provisions of Division 1 General Requirements.
- 1.14 WARRANTY
 - A. Provide three year warranty under provisions of Division 1 General Requirements.
 - B. Warranty: Include coverage for complete system for failure to meet specified requirements.

PART 2 PRODUCTS

- 2.1 MANUFACTURERS
 - A. YKK YES 45TU Center Set Storefront Framing System; Series 35D Medium Stile Doors.
 - B. Accessories: As specified.
 - C. Substitutions: Under provisions of Division 1 General Requirements.

2.2 MATERIALS

- A. Extruded Aluminum: ANSI/ASTM B221.
- B. Sheet Aluminum: ANSI/ASTM B209.
- C. Fasteners: Stainless steel.
- 2.3 COMPONENTS (DOORS & FRAME) YKK YES 45 TU CENTER SET
 - A. Frame: 2" x 4¹/₂" nominal; thermally broken; flush glazing stops; internal weep

drainage system.

- B. Intermediate mullion: $2^{x} 4^{1/2}$ nominal, thermally broken, flush glazing stops.
- C. High Performance Sill Flashing: Compatible with system.
- D. Base: sidelight base; non-thermally broken, 2" x 4½" nominal.
- E. Doors: 1-3/4 inches thick, 3¹/₂ inch wide top rail, 3¹/₂ inch wide vertical stiles, 12 inch ADA base bottom rail; beveled glazing stops.
- F. Flashings: .040 inch minimum, aluminum, finish to match mullion sections where exposed.
- G. Heavy Wall Mullion: 2" x 4¹/₂" nominal; thermally broken; locations as required by system manufacturer.
- H. Thermal Flat Filler: Compatible with system; continuous filler strips.
- I. Strap Anchor: Compatible with system.
- J. Shims: Plastic horseshoe type.

2.4 GLASS AND GLAZING MATERIALS

A. Glass and Glazing Materials: As specified in Section 088000 or as described above.

2.5 SEALANT MATERIALS

A. Sealant and Backing Materials: As specified in Section 079000.

2.6 HARDWARE

A. See Hardware Schedule - Section 087100 for all door hardware sets or as described above.

2.7 FABRICATION

- A. Fabricate components with minimum clearances and shim spacing around perimeter of assembly, yet enabling installation and dynamic movement of perimeter seal.
- B. Accurately fit and secure joints and corners. Make joints flush, hairline, and weatherproof.
- C. Prepare components to receive anchor devices. Fabricate anchors.
- D. Arrange fasteners and attachments to conceal from view.
- E. Prepare components with internal reinforcement for door hardware.
- F. Reinforce framing members as required for imposed loads.

SECTION 08410 - ALUMINUM ENTRANCES AND STOREFRONTS

2.8 FINISHES

- A. Finish coatings: YKK AP standard paint colors and PPG Duranar Liquid coatings (2-coat solid colors); 70% PVDF (Kynar 500 or Hylar 5000); color to be selected by Architect.
- B. Concealed Steel Items: Galvanized in accordance with ANSI/ASTM A386 to 2.0 oz/sq ft.
- C. Apply one coat of bituminous paint to concealed aluminum surfaces in contact with cementitious or dissimilar materials.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify site opening conditions under provisions of Division 1 General Requirements.
- B. Verify dimensions, tolerances, and method of attachment with other work.
- C. Verify wall openings and adjoining air and vapor seal materials are ready to receive work of this Section.

3.2 INSTALLATION

- A. Install system in accordance with manufacturer's instructions and AAMA Metal Curtain Wall, Window, Store Front and Entrance Guide Specifications Manual.
- B. Attach to structure to permit sufficient adjustment to accommodate construction tolerances and other irregularities.
- C. Provide alignment attachments and shims to provide permanent fastening to building structure.
- D. Align assembly plumb and level, free of warp or twist. Maintain assembly dimensional tolerances, aligning with adjacent work.
- E. Pack fibrous insulation in shim spaces at perimeter of assembly to maintain continuity of thermal barrier.
- F. Install required flashings.
- G. Set thresholds in bed of mastic and secure.
- H. Install hardware using templates provided. Refer to Section 087120 for installation requirements.
- I. Install glass in accordance with Section 088000, to glazing method required to achieve performance criteria.
- J. Install perimeter sealant to method required to achieve performance criteria.

SECTION 08410 - ALUMINUM ENTRANCES AND STOREFRONTS

3.3 TOLERANCES

- A. Maximum Variation from Plumb: 0.06 inches every 3 ft non-cumulative or 1/16 inches per 10 ft, whichever is less.
- B. Maximum Misalignment of two adjoining members abutting in plane: 1/32 inch.

3.4 ADJUSTING

- A. Adjust work under provisions of Division 1 General Requirements.
- B. Adjust operating hardware for smooth operation.

3.5 CLEANING

- A. Clean work under provisions of Division 1 General Requirements.
- B. Remove protective material from pre-finished aluminum surfaces.
- C. Wash down surfaces with a solution of mild detergent in warm water, applied with soft, clean wiping cloths. Take care to remove dirt from corners. Wipe surfaces clean.
- D. Remove excess sealant by method acceptable to sealant manufacturer.

3.6 PROTECTION OF FINISHED WORK

- A. Protect finished work under provisions of Division 1 General Requirements.
- B. Protect finished work from damage.

1.1 SECTION INCLUDES

- A. Extruded aluminum fixed non-operable windows.
- B. Perimeter Sealant.
- 1.2 RELATED SECTIONS
 - A. Section 062000 Finish Carpentry.
 - B. Section 079000 Joint Sealers.
 - C. Section 088000 Glazing.
 - D. Section 092600 Gypsum Board Systems.

1.3 REFERENCES

- A. AA (Aluminum Association) Designation System for Aluminum Finishes.
- B. AAMA (American Architectural Manufacturers' Association) Curtain Wall Manual #10 Care and Handling of Architectural Aluminum From Shop to Site.
- C. AAMA 607.1 Specifications and Inspection Methods for Clear Anodic Finishes for Architectural Aluminum.
- D. AAMA 1502.7 Test Method for Condensation Resistance of Windows, Doors, and Glazed Wall Sections.
- E. ASTM B209 Aluminum and Aluminum-Alloy Sheet and Plate.
- F. ASTM E283 Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors.
- G. ASTM E330 Structural Performance of Exterior Windows, Curtain Walls, and Doors by Uniform Static Air Pressure Difference.
- H. ASTM E331 Test Method for Water Penetration of Exterior Windows, Curtain Walls, and Doors by Uniform Static Air Pressure Difference.
- I. ASTM B221 Aluminum Alloy Extruded Bars, Rods, Wire, Shapes and Tubes.

1.4 SYSTEM DESCRIPTION

- A. Windows: Tubular and single thickness aluminum sections, factory fabricated, factory finished, vision glass, infill panels, related flashings, anchorage and attachment devices.
- B. Glazing: Interior.
1.5 PERFORMANCE REQUIREMENTS

- A. System Design: Design size components to withstand dead loads and live loads cause by positive and negative wind loads acting normal to plane of wall as calculated in accordance with 2000 International Building Code - New Jersey Addition in accordance with ASTM E330.
- B. Deflection: Limit member deflection to flexure limit of glass or L/175 with full recovery of glazing materials.
- C. Assembly: To accommodate, without damage to components or deterioration of seals, movement between window and perimeter framing and deflection of lintel.
- D. Air filtration: Limit air filtration through assembly of 0.06 cfm/min/sq ft of wall area, as measured in accordance with ASTM E283.
- E. Condensation Resistance Factor shall be as follows when measured in accordance with AAMA 1502.7:
 - 1. 670 D.H. .10 cfm/ft2 @ 1.56 psf
 - 2. 6600 Fixed .06 cfm/ft2 @ 6.24 psf
- F. Conductive Thermal Transmission (U-Value) shall be as follows when measured in accordance with AAMA 1502.7:
 - 1. 670 D.H. Maximum .63
 - 2. 6600 Fixed Maximum .61
- G. Water Leakage: None, when measured in accordance with ASTM E331. No water leakage @ 12.0 psf.
- H. System Internal Drainage: Drain water entering joints, condensation occurring in glazing channels, ormigrating moisture occurring within system, to the exterior by a weep drainage network.
- I. Air and Vapor Seal: Maintain continuous air barrier and vapor retarder throughout assembly, primarily inline with inside pane of glass and heel bead of glazing compound.

1.6 SUBMITTALS FOR REVIEW

- A. Submit under provisions of Division 1 General Requirements.
- B. Product Data: Provide component dimensions, describe components within assembly, anchorage and fasteners, internal drainage details, glass and operating hardware.
- C. Shop Drawings: Indicate opening dimensions, framed opening tolerances, affected related work and installation requirements.
- D. Submit samples illustrating window frame section mullion section, screen and frame, factory finished aluminum surfaces, infill panels and glazing materials.
- E. Submit sample of operating hardware.

1.7 SUBMITTALS FOR INFORMATION

- A. Submit under provisions of Division 1 General Requirements.
- B. Manufacturer's Certificate: Certify that Products meet or exceed specified requirements.

1.8 QUALITY ASSURANCE

A. Manufacturer and Installer: Company specializing in manufacturing aluminum windows with minimum three years documented experience.

1.9 PRE-INSTALLATION MEETING

- A. Division 1 General Requirements Coordination and Meetings: Pre-installation meeting.
- B. Convene one week before starting work of this section.

1.10 DELIVERY, STORAGE, AND PROTECTION

- A. Transport, handle, store, and protect products under provisions of Division 1 General Requirements.
- B. Handle work of this section in accordance with AAMA Curtain Wall Manual #10.
- C. Protect factory finished aluminum surfaces with wrapping or strippable coating. Do not use adhesive papers or sprayed coatings that bond when exposed to sunlight or weather. Puncture wrappings at ends for ventilation.

1.11 ENVIRONMENTAL REQUIREMENTS

- A. Division 1 General Requirements Material and Equipment: Environmental conditions affecting products on site.
- B. Do not install sealants when ambient temperature is less than 40 degrees F.
- C. Maintain this minimum temperature during and after installation of sealants.

1.12 WARRANTY

- A. Division 1 General Requirements: Contract Closeout.
- B. Provide manufacturer's standard two (2) year warranty for aluminum window components against defects in material and workmanship.
- C. Provide ten (10) year manufacturer warranty for insulated glass units from seal failure, interpane dusting or misting, and replacement of same.
- D. Warranty: Include coverage for degradation of color finish.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. YKK YES 45TU Center Set Storefront Framing System
- B. Substitutions: Under provisions of Division 1 General Conditions.

2.2 MATERIALS

- A. Extruded Aluminum: ASTM B221; 6063 alloy, T5 temper.
- B. Sheet Aluminum: ASTM B209.
- C. Fasteners: To suit application; compatible with aluminum.

2.3 COMPONENTS

- A. Frame: 2" x 4 1/2" nominal; thermally broken; flush glazing stops; internal weep drainage system.
- B. Intermediate Mullion: 2" x 4 1/2" nominal; thermally broken; flush glazing stops.
- C. Fasteners: Stainless steel.
- D. Miscellaneous break formed aluminum components: .040 inch minimum; finish to match mullion section where exposed to view.
- E. Flashings: .040 inch minimum aluminum, finish to match mullion sections where exposed.
- F. High Performance Sill Flashing: Compatible with system.
- G. Heavy Wall Mullion: 2" x 4 1/2" nominal; thermally broken; locations as required by window manufacturer.
- H. Thermal Flat Filler: Compatible with system, continuous filler strips.
- I. Strap Anchor: Compatible with system.
- J. Shims: Plastic horseshoe type.
- K. Subsill: Continuous subsill with end dams.

2.4 FABRICATION

- A. Fabricate components with minimum clearances and shim spacing around perimeter of assembly, yet enabling installation and dynamic movement of perimeter seal.
- B. Accurately fit and secure joints and corners. Make joints flush, hairline, and weatherproof.
- C. Prepare components to receive anchor devices. Fabricate anchors.
- D. Arrange fasteners and attachments to ensure concealment from view.

E. Permit internal drainage weep holes and channels to migrate moisture to exterior. Provide internal drainage of glazing spaces to exterior through weep holes.

2.5 FINISHES

- A. Finish Coatings: YKK AP standard paint colors and PPG Duranar liquid coatings (2-coat solid colors); 70% PVDF (Kynar 500 or Hylar 5000); color to be selected by Architect.
- B. Apply one coat of bituminous paint to concealed aluminum surfaces in contact with treated wood, cementitious, or dissimilar materials.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify wall openings and adjoining air and vapor seal materials are ready to receive work of this Section.

3.2 INSTALLATION

- A. Install window frames and glazing in accordance with manufacturer's instructions.
- B. Attach window frame and shims to perimeter opening to accommodate construction tolerances and other irregularities.
- C. Align window plumb and level, free of warp or twist. Maintain dimensional tolerances and alignment with adjacent work.
- D. Provide thermal isolation where components penetrate or disrupt building insulation. Pack fibrous insulation in shim spaces at perimeter of assembly to maintain continuity of thermal barrier.
- E. Coordinate attachment and seal of perimeter air barrier and vapor retarder materials.
- F. Install perimeter sealant in accordance with Section 07900.

3.3 PREPARATION

- A. Clean contact surfaces with solvent and wipe dry.
- B. Seal porous glazing channels or recesses with substrate compatible primer or sealer.
- C. Prime surfaces scheduled to receive sealant.

3.4 ERECTION TOLERANCES

A. Maximum Variation from Level or Plumb: 1/16 inches every 3 ft non-cumulative or 1/8 Inches per 10 ft, whichever is less.

3.5 CLEANING

- A. Division 1 General Requirements Contract Closeout: Cleaning installed work.
- B. Remove protective material from factory finished aluminum surfaces.
- C. Wash surfaces by method recommended and acceptable to sealant and window manufacturer; rinse and wipe surfaces clean.
- D. Remove excess sealant by moderate use of mineral spirits or other solvent acceptable to sealant and window manufacturer.
- E. Clean glass.

END OF SECTION

PART 1 - GENERAL

1.01 SUMMARY

- A. Section includes:
 - 1. Mechanical and electrified door hardware
 - 2. Electronic access control system components
- B. Section excludes:
 - 1. Windows
 - 2. Cabinets (casework), including locks in cabinets
 - 3. Signage
 - 4. Toilet accessories
 - 5. Overhead doors
- C. Related Sections:
 - 1. Division 01 Section "Alternates" for alternates affecting this section.
 - 2. Division 06 Section "Rough Carpentry"
 - 3. Division 06 Section "Finish Carpentry"
 - 4. Division 07 Section "Joint Sealants" for sealant requirements applicable to threshold installation specified in this section.
 - 5. Division 08 Sections:
 - a. "Metal Doors and Frames"
 - b. "Flush Wood Doors"
 - 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 2016 Edition 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: 3 years
 - 3) Closers
 - a) LCN 4050 Series: 25 years
 - b. Electrical Warranty
 - 1) Locks
 - a) Schlage: 1 year
 - 2) Exit Devices
 - a) Von Duprin: 1 year

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:
 - Scheduled Manufacturer and Product: a. Ives 5BB series
 - 2. Acceptable Manufacturers and Products:
 - a. Hager BB1191/1279 series
 - b. Best FBB series
- B. Requirements:
 - 1. Provide hinges conforming to ANSI/BHMA A156.1.
 - 2. Provide five knuckle, ball bearing hinges.
 - 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. Select
 - b. ABH
 - c. Hager
- 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
 - c. Precision EPT-12C
- 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:
 - Provide automatic, constant latching, and manual flush bolts with forged bronze or stainless-steel face plates, extruded brass levers, and with wrought brass guides and strikes. Provide 12 inch (305 mm) steel or brass rods at doors up to 90 inches (2286 mm) in height. For doors over 90 inches (2286 mm) in height increase top rods by 6 inches (152 mm) for each additional 6 inches (152 mm) of door height. Provide dust-proof strikes at each bottom flush bolt.

2.07 MORTISE LOCKS

- A. Manufacturers and Products:
 - Scheduled Manufacturer and Product: a. Schlage L9000 series
 - Acceptable Manufacturers and Products:
 a. or Approved Equal
- B. Requirements:
 - 1. Provide mortise locks conforming to ANSI/BHMA A156.13 Series 1000, Grade 1, and UL Listed for 3-hour fire doors.
 - 2. Indicators: Where specified, provide indicator window measuring a minimum 2-inch x 1/2 inch with 180-degree visibility. Provide messages color-coded with full text and/or symbols, as scheduled, for easy visibility.
 - 3. Provide locks manufactured from heavy gauge steel, containing components of steel with a zinc dichromate plating for corrosion resistance.
 - 4. Provide lock case that is multi-function and field reversible for handing without opening case. Cylinders: Refer to "KEYING" article, herein.
 - 5. Provide locks with standard 2-3/4 inches (70 mm) backset with full 3/4 inch (19 mm) throw stainless steel mechanical anti-friction latchbolt. Provide deadbolt with full 1-inch (25 mm) throw, constructed of stainless steel.
 - 6. Provide standard ASA strikes unless extended lip strikes are necessary to protect trim. Provide electrified options as scheduled in the hardware sets. Where scheduled, provide switches and sensors integrated into the locks and latches.
 - 7. 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.

- 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: Sparta (SPA)

2.08 CYLINDRICAL LOCKS – GRADE 1

- A. Manufacturers and Products:
 - Scheduled Manufacturer and Product: a. Schlage ND series
 - Acceptable Manufacturers and Products:
 a. or Approved Equal
- 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. Cylinders: Refer to "KEYING" article, herein.
 - 3. 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.
 - 4. Provide locksets with separate anti-rotation thru-bolts, and no exposed screws.
 - 5. Provide independently operating levers with two external return spring cassettes mounted under roses to prevent lever sag.
 - 6. Provide standard ASA strikes unless extended lip strikes are necessary to protect trim.
 - 7. Provide electrified options as scheduled in the hardware sets.
 - Lever Trim: Solid cast levers without plastic inserts and wrought roses on both sides.
 a. Lever Design: Sparta (SPA)

2.09 DEADBOLTS

- A. Manufacturers and Products:
 - Scheduled Manufacturer and Product: a. Schlage B500 Series
 - Acceptable Manufacturers and Products:
 a. or Approved Equal
- B. Requirements:
 - 1. Provide grade 2 deadbolt series conforming to ANSI/BHMA A156.
 - 2. Cylinders: Refer to "KEYING" article, herein.
 - 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.

2.10 EXIT DEVICES

A. Manufacturers and Products:

- Scheduled Manufacturer and Product: a. Von Duprin 98/35A series
- Acceptable Manufacturers and Products:
 a. or Approved Equal
- B. Requirements:
 - 1. Provide exit devices tested to ANSI/BHMA A156.3 Grade 1 and UL listed for Panic Exit or Fire Exit Hardware.
 - 2. Cylinders: Refer to "KEYING" article, herein.
 - 3. Provide smooth touchpad type exit devices, fabricated of brass, bronze, stainless steel, or aluminum, plated to standard architectural finishes to match balance of door hardware.
 - 4. Touchpad must extend a minimum of one half of door width. No plastic inserts are allowed in touchpads.
 - 5. Provide exit devices with deadlatching feature for security and for future addition of alarm kits and/or other electrified requirements.
 - 6. Provide exit devices with weather resistant components that can withstand harsh conditions of various climates and corrosive cleaners used in outdoor pool environments.
 - 7. Provide flush end caps for exit devices.
 - 8. Provide exit devices with manufacturer's approved strikes.
 - 9. Provide exit devices cut to door width and height. Install exit devices at height recommended by exit device manufacturer, allowable by governing building codes, and approved by Architect.
 - 10. Mount mechanism case flush on face of doors or provide spacers to fill gaps behind devices. Where glass trim or molding projects off face of door, provide glass bead kits.
 - 11. Provide cylinder 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.

2.11 ACCESS CONTROL READER

- A. Manufacturers and Products:
 - Scheduled Manufacturer and Product: a. Schlage MT Series
 - Acceptable Manufacturers and Products:
 a. or Approved Equal
- B. Requirements:
 - 1. Provide access control card readers manufactured by a global company who is a recognized leader in the production of access control devices. Card reader manufactured for non-access control applications are not acceptable
 - 2. Provide multi-technology contactless readers complying with ISO 14443.

- 3. Provide access control card readers capable of reading the following technologies:
 - a. CSN DESFire® CSN, HID iCLASS® CSN, Inside Contactless PicoTag® CSN, ST Microelectronics® CSN, Texas Instruments Tag-It®, CSN, Phillips I-Code® CSN
 - b. 125 KHz proximity Schlage® Proximity, HID® Proximity, GE/CASI® Proximity, AWID® Proximity, LenelProx®
 - c. 13.56 MHz Smart card Schlage smart cards using MIFARE Classic® EV1, Schlage smart cards using MIFARE Plus®, Schlage smart cards using MIFARE® DESFire® EV1, Schlage smart cards using MIFARE® DESFire® EV2/EV3

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. Precision ELR series
 - b. Dvnalock 5000 series
 - c. 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. or Approved Equal

- 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 bitting list and keys separately from cylinders, by means as directed by Owner. Failure to comply with forwarding requirements will be cause for replacement of cylinders/cores involved at no additional cost to Owner.
 - c. Provide keys with the following features:
 - 1) Material: Nickel silver; minimum thickness of .107-inch (2.3mm)
 - 2) Patent Protection: Keys and blanks protected by one or more utility patent(s).
 - 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 4050A series
 - 2. Acceptable Manufacturers and Products:
 - a. Falcon SC70A series
 - b. or Approved Equal
- B. Requirements:
 - Provide door closers conforming to ANSI/BHMA A156.4 Grade 1 requirements by BHMA certified independent testing laboratory. ISO 9000 certify closers. Stamp units with date of manufacture code.
 - 2. Provide door closers with fully hydraulic, full rack and pinion action with cast aluminum cylinder.
 - 3. Closer Body: 1-1/2-inch (38 mm) diameter with 11/16-inch (17 mm) diameter heat-treated pinion journal and full complement bearings.

- 4. Hydraulic Fluid: Fireproof, passing requirements of UL10C, and all weather 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 back check.
- 7. Pressure Relief Valve (PRV) Technology: Not permitted.
- 8. Provide stick on templates, 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 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.

2.18 PROTECTION PLATES

- A. Manufacturers:
 - 1. Scheduled Manufacturer: a. lves
 - 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.
 - 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.

2.19 OVERHEAD STOPS AND OVERHEAD STOP/HOLDERS

A. Manufacturers:

- 1. Scheduled Manufacturers: a. Glynn-Johnson
- 2. Acceptable Manufacturers: a. ABH
 - b. or Approved Equal
- B. Requirements:
 - 1. Provide overhead stop at any door where conditions do not allow for a wall stop or floor stop presents tripping hazard.

2.20 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.

2.21 THRESHOLDS, SEALS, DOOR SWEEPS, AUTOMATIC DOOR BOTTOMS, AND GASKETING

- A. Manufacturers:
 - 1. Scheduled Manufacturer:
 - a. Zero International
 - 2. Acceptable Manufacturers:
 - a. National Guard
 - b. Reese
- B. Requirements:
 - 1. Provide thresholds, weather-stripping, and gasketing systems as specified and per architectural details. Match finish of other items.
 - 2. Smoke- and Draft-Control Door Assemblies: Where smoke- and draft-control door assemblies are required, provide door hardware that meets requirements of assemblies tested according to UL 1784 and installed in compliance with NFPA 105.
 - 3. Provide door sweeps, seals, astragals, and auto door bottoms only of type where resilient or flexible seal strip is easily replaceable and readily available.

4. Size thresholds 1/2 inch (13 mm) high by 5 inches (127 mm) wide by door width unless otherwise specified in the hardware sets or detailed in the drawings.

2.22 SILENCERS

- A. Manufacturers:
 - 1. Scheduled Manufacturer: a. Ives
 - 2. Acceptable Manufacturers:
 - a. Burns
 - b. Trimco
- 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.

2.23 DOOR POSITION SWITCHES

- A. Manufacturers:
 - 1. Scheduled Manufacturer: a. Schlage
 - 2. Acceptable Manufacturers:
 - a. GE-Interlogix
 - b. or Approved Equal
- 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.

2.24 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. 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.
- M. Overhead Stops/Holders: Mount overhead stops/holders on room side of corridor doors, inside of exterior doors, and stair side of stairway doors.
- N. 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.
- O. Thresholds: Set thresholds in full bed of sealant complying with requirements specified in Division 07 Section "Joint Sealants."
- P. 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.
- Q. Perimeter Gasketing: Apply to head and jamb, forming seal between door and frame.
- R. Meeting Stile Gasketing: Fasten to meeting stiles, forming seal when doors are closed.
- S. 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.

Abbreviation	Name
DRM	Dorma Architectural Hardware
GLY	Glynn-Johnson Corp
IVE	H.B. Ives
LCN	LCN Commercial Division
SCE	Schlage Electronic Security
SCH	Schlage Lock Company
TBD	Manufacturer To Be Determined
VON	Von Duprin
ZER	Zero International Inc

D. Hardware Sets:

99910 OPT0343655 Version 6

Legend:

■ Link to catalog cut sheet. ✓ Electrified Opening

Hardw	vare Gro	oup No. 01,						
		107 1	109 1	100 1	110 1		1 1 1 1	
Drovia		107-1 SCL door(a) with the fr		109-1	110-1		144-1	
	ie each /		bilowing.				EINIGH	MED
2			т			e	FINION 626	
3	EA	HINGES	11	3DD1 4.3 A 4.3			020	IVE
1	EA	ENTRANCE LOCK		ND53TD SPA			626	SCH
1	EA	PERMANENT FSIC	CORE	23-030 CKC EV29 T			626	SCH
1	EA	WALL STOP		WS401/402CCV			626	IVE
3	EA	SILENCER		SR64			GRY	IVE
Hardw	vare Gro	oup No. 02						
For us	se on Do	oor #(s):						
123-	-1	123-2						
Provic	le each	SGL door(s) with the fo	ollowing:					
QTY	/	DESCRIPTION		CATALOG NUMBER			FINISH	MFR
3	EA	STANDARD WEIGH HINGES	łT	5BB1 4.5 X 4.5			626	IVE
1	EA	CLASSROOM LOCH	K	ND70TD SPA			626	SCH
1	EA	PERMANENT FSIC	CORE	23-030 CKC EV29 T			626	SCH
1	EA	SURFACE CLOSER	R	4050A REG OR PA AS	REQ		689	LCN
1	EA	KICK PLATE		8400 10" X 2" LDW B-0	CS		630	IVE
1	EA	WALL STOP		WS401/402CCV			626	IVE
3	EA	SILENCER		SR64			GRY	IVE
Hardw For us	vare Gro	oup No. 03						
120-	-1	122-1	126-1	127-1				
Provid	le each	SGL door(s) with the fo	ollowing.					
QTY	/	DESCRIPTION	ono ming.	CATALOG NUMBER			FINISH	MFR
3	EA	STANDARD WEIGH	IT	5BB1 4.5 X 4.5			626	IVE
1	FA	STOREROOM LOC	к	ND80TD SPA			626	SCH
1	FA	PERMANENT ESIC	CORE	23-030 CKC EV29 T		Ē	626	SCH
1	EA	SURFACE CLOSER	20112	4050A REG OR PA AS	REQ		689	I CN
1	EA		•	8400 10" X 2" I DW R-0	25		630	
1	ΕΛ	WALL STOP		WS401/402CCV		Ē	626	
3				SR6/		E	GRV	
5		OILLINOLIN						

Hardw For us 114-	vare Grou e on Doo 1	up No. 03.1 or #(s): 134-1						
Provid	e each S	GL door(s) with the	following:					
QTY		DESCRIPTION		CATALOG NUMBER	R		FINISH	MFR
3	EA	STANDARD WEIG HINGES	HT	5BB1 4.5 X 4.5 NRP			626	IVE
1	EA	STOREROOM LOO	СК	ND80TD SPA			626	SCH
1	EA	PERMANENT FSIC	CORE	23-030 CKC EV29 T			626	SCH
1	EA	SURFACE CLOSE CUSH ARM	RW/	4050A CUSH			689	LCN
1	EA	KICK PLATE		8400 10" X 2" LDW E	3-CS		630	IVE
1	EA	MOP PLATE		8400 4" X 1" LDW B-	-CS		630	IVE
3	EA	SILENCER		SR64			GRY	IVE
Hardw For us	are Grou e on Doo	up No. 04 or #(s):						
111-	1	113-1	115-1	117-1				
Provid	e each S	SGL door(s) with the	following:					
QTY		DESCRIPTION	-	CATALOG NUMBER	R		FINISH	MFR
3	EA	HEAVY WEIGHT H	IINGES	5BB1HW 4.5 X 4.5 N	IRP		626	IVE
1	EA	PUSH PLATE		8200 4" X 16"			630	IVE
1	EA	PULL PLATE		8303 8" 4" X 16"			630	IVE
1	EA	SURFACE CLOSE	R	4050A REG OR PA	AS REQ		689	LCN
1	EA	KICK PLATE		8400 10" X 2" LDW E	3-CS		630	IVE
1	EA	MOP PLATE		8400 4" X 1" LDW B-	-CS		630	IVE
1	EA	WALL STOP		WS401/402CCV			626	IVE
3	EA	SILENCER		SR64			GRY	IVE
Hardw	are Grou	ıp No. 05						
For us	e on Doo	or #(s):						
129-	1	133-1	139-1	140-1	141-1	1		
Provid	e each S	GL door(s) with the	following:					
QTY		DESCRIPTION		CATALOG NUMBER	R		FINISH	MFR
3	EA	STANDARD WEIG HINGES	HT	5BB1 4.5 X 4.5			626	IVE
1	EA	PRIVACY LOCK		ND40S SPA			626	SCH
1	EA	DOOR BOLT OCC	IND	B571			626	SCH
1	EA	SURFACE CLOSE	R	4050A REG OR PA	AS REQ		689	LCN
1	EA	KICK PLATE		8400 10" X 2" LDW E	3-CS		630	IVE
1	EA	MOP PLATE		8400 4" X 1" LDW B-	-CS		630	IVE
1	EA	WALL STOP		WS401/402CCV			626	IVE
3	EA	SILENCER		SR64			GRY	IVE

Hardw For us 118-	vare Gro se on Do ∙1	oup No. 06 oor #(s):			
Provid	le each	PR door(s) with the following:			
QTY	/	DESCRÍPTION	CATALOG NUMBER	FINISH	MFR
6	EA	HEAVY WEIGHT HINGES	5BB1HW 4.5 X 4.5	626	IVE
2	EA	MANUAL FLUSH BOLT WD	FB457	626	IVE
1	EA	DUST PROOF STRIKE	DP2	626	IVE
1	EA	PASSAGE SET	ND10S SPA	626	SCH
1	EA	CONCEALED OVERHEAD STOP	100S INACTIVE	630	GLY
1	EA	SURFACE CLOSER	4050A REG OR PA AS REQ ACTIVE	689	LCN
2	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
2	EA	MOP PLATE	8400 4" X 2" LDW B-CS	630	IVE
1	EA	WALL STOP	WS401/402CCV	626	IVE
2	EA	SILENCER	SR64	GRY	IVE
RH AG	CT = CL	OSER / LH INACTIVE = CON	C OH STOP		
Hardw For us 118-	vare Gro se on Do ·2	oup No. 06.1 oor #(s):			
Provid	le each	PR door(s) with the following:			
QTY	/	DESCRÍPTION	CATALOG NUMBER	FINISH	MFR
6	EA	HEAVY WEIGHT HINGES	5BB1HW 4.5 X 4.5 NRP	626	IVE
1	EA	MANUAL FLUSH BOLT HM	FB458 12"	626	IVE
1	EA	DUST PROOF STRIKE	DP2	626	IVE
1	EA	ENTRANCE/OFFICE LOCK	ND50TD SPA	626	SCH
1	EA	PERMANENT FSIC CORE	23-030 CKC EV29 T	626	SCH
1	EA	CONCEALED OVERHEAD STOP	100S INACTIVE	630	GLY
1	EA	SURFACE CLOSER	4050A REG OR PA AS REQ ACTIVE	689	LCN
2	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
2	EA	MOP PLATE	8400 4" X 2" LDW B-CS	630	IVE
1	EA	WALL STOP	WS401/402CCV	626	IVE
2	EA	SILENCER	SR64	GRY	IVE

RHR ACT = CLOSER X WALL STOP / LHR INACTIVE = CONC OH STOP

Hardware Group No. 08

For use on Door #(s):

100-1

3

ΕA

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER			FINISH	MFR
1	EA	CONT HINGE W/ EPT	224HD EPT			628	IVE
1	EA	POWER TRANSFER	EPT10 CON		×	689	VON
1	EA	ELEC PANIC HARDWARE	RX-QEL-35A-NL-OP-388-CON 24 VDC		N	626	VON
1	EA	RIM CYLINDER	20-057 ICX			626	SCH
1	EA	PERMANENT FSIC CORE	23-030 CKC EV29 T			626	SCH
1	EA	90 DEG OFFSET PULL 10"	8190HD 10" O			630	IVE
1	EA	SURFACE CLOSER W/ CUSH ARM	4050A CUSH			689	LCN
1	EA	H/C SADDLE THRESHOLD	545A-223			A	ZER
1	EA	PERIMETER GASKETING BY ALUM DR MFG	BY ALUMINUM DOOR MANUFACTURE				TBD
1	EA	WIRE HARNESS TO POWER SUPPLY	CON-192P				VON
1	EA	LOCK TO HINGE CONNECTOR	CON-32				VON
1	EA	MULTITECH READER	MT11 12 VDC		×	BLK	SCE
1	EA	DOOR CONTACT	679-05HM		×	BLK	SCE
1	EA	POWER SUPPLY	PS902 900-2RS 900-BBK 120/240 VAC		×		VON
Hardwa For use	are Grou e on Doc	ıp No. 09 or #(s):					
125-2	<u> </u>						
	each S						MED
2			5PP1 4 5 Y 4 5	E		626	
3	EA	HINGES	3DD1 4.3 X 4.3			020	
1	EA	CLASSROOM LOCK	ND70TD SPA			626	SCH
1	EA	PERMANENT FSIC CORE	23-030 CKC EV29 T			626	SCH
1	EA	SURFACE CLOSER	4050A REG OR PA AS REQ			689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS			630	IVE
1	EA	WALL STOP	WS401/402CCV			626	IVE

SR64

SILENCER

GRY

IVE

Hardware Group No. 10

For use on Door #(s):

138-3

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HEAVY WEIGHT HINGES	5BB1HW 4.5 X 4.5 NRP		626	IVE
1	EA	POWER TRANSFER	EPT10 CON	×	689	VON
1	EA	EL MORTISE LOCK I/S O/S LOCKED	L9095TEL 17A RX CON 12/24 VDC	N	626	SCH
2	EA	PERMANENT FSIC CORE	23-030 CKC EV29 T		626	SCH
1	EA	SURFACE CLOSER	4050A REG OR PA AS REQ		689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS		630	IVE
1	EA	WALL STOP	WS401/402CCV		626	IVE
1	EA	GASKETING	488SBK PSA		BK	ZER
1	EA	DOOR SWEEP	39A		A	ZER
1	EA	H/C SADDLE THRESHOLD	545A-223		A	ZER
1	EA	WIRE HARNESS TO POWER SUPPLY	CON-192P			VON
1	EA	LOCK TO HINGE CONNECTOR	CON-32			VON
2	EA	MULTITECH READER	MT11 12 VDC	×	BLK	SCE
1	EA	DOOR CONTACT	679-05HM	×	BLK	SCE
1	EA	POWER SUPPLY	PS902 900-2RS 900-BBK 120/240 VAC	×		VON

** CARD READER BOTH SIDES

OPERATION: CREDENTIAL (OR KEY) REQUIRED BOTH SIDES FOR ENTRY, FIRE ALARM RELEASES BOTH LEVERS.

Hardware Group No. 10.1

For use on Door #(s):

131-1

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HEAVY WEIGHT HINGES	5BB1HW 4.5 X 4.5 NRP		630	IVE
1	EA	POWER TRANSFER	EPT10 CON	×	689	VON
1	EA	EL MORTISE LOCK I/S O/S LOCKED	L9095TEL 17A RX CON 12/24 VDC	×	630	SCH
2	EA	PERMANENT FSIC CORE	23-030 CKC EV29 T		626	SCH
1	EA	SURFACE CLOSER	4050A REG OR PA AS REQ		689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS		630	IVE
1	EA	WALL STOP	WS401/402CCV		626	IVE
1	EA	GASKETING	488SBK PSA		BK	ZER
1	EA	DOOR BOTTOM	355AA		AA	ZER
1	EA	H/C SADDLE THRESHOLD	545A-223		A	ZER
1	EA	WIRE HARNESS TO POWER SUPPLY	CON-192P			VON
1	EA	LOCK TO HINGE CONNECTOR	CON-32			VON
2	EA	MULTITECH READER	MT11 12 VDC	×	BLK	SCE
1	EA	DOOR CONTACT	679-05HM	×	BLK	SCE
1	EA	POWER SUPPLY	PS902 900-2RS 900-BBK 120/240 VAC	×		VON

** CARD READER BOTH SIDES

OPERATION: CREDENTIAL (OR KEY) REQUIRED BOTH SIDES FOR ENTRY, FIRE ALARM RELEASES BOTH LEVERS.

Hardware Group No. 10.2

For use on Door #(s):

138-1

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HEAVY WEIGHT HINGES	5BB1HW 4.5 X 4.5 NRP		630	IVE
1	EA	POWER TRANSFER	EPT10 CON	×	689	VON
1	EA	EL MORTISE LOCK	L9092TEL 17A RX LX CON 12/24 VDC	×	630	SCH
1	EA	PERMANENT FSIC CORE	23-030 CKC EV29 T		626	SCH
1	EA	SURFACE CLOSER	4050A REG OR PA AS REQ		689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS		630	IVE
1	EA	WALL STOP	WS401/402CCV		626	IVE
1	EA	GASKETING	488SBK PSA		BK	ZER
1	EA	DOOR BOTTOM	355AA		AA	ZER
1	EA	H/C SADDLE THRESHOLD	545A-223		A	ZER
1	EA	WIRE HARNESS TO POWER SUPPLY	CON-192P			VON
1	EA	LOCK TO HINGE CONNECTOR	CON-32			VON
1	EA	MULTITECH READER	MT11 12 VDC	×	BLK	SCE
1	EA	DOOR CONTACT	679-05HM	×	BLK	SCE
1	EA	POWER SUPPLY	PS902 900-2RS 900-BBK 120/240 VAC	×		VON
1	EA	CREDENTIAL	2440		GWT	SCE

FAIL SECURE LOCK

OPERATION: CREDENTIAL (OR KEY) REQUIRED FOR ENTRY. FIRE ALARM LOCKS O/S LEVER. INSIDE ALWAYS FREE EGRESS. Hardware Group No. 11

For use	on Doo	or #(s):				
119-1		125-1 138-2				
Provide	each S	GL door(s) with the following				
QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HEAVY WEIGHT HINGES	5BB1HW 4.5 X 4.5 NRP		626	IVE
1	EA	POWER TRANSFER	EPT10 CON	×	689	VON
1	EA	EU STOREROOM LOCK	ND80TDEU SPA RX CON 12V/24V DC	M	626	SCH
1	EA	PERMANENT FSIC CORE	23-030 CKC EV29 T		626	SCH
1	EA	SURFACE CLOSER W/ CUSH ARM	4050A CUSH		689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS		630	IVE
1	EA	WIRE HARNESS TO POWER SUPPLY	CON-192P			VON
1	EA	LOCK TO HINGE CONNECTOR	CON-32			VON
1	EA	MULTITECH READER	MT11 12 VDC	×	BLK	SCE
1	EA	DOOR CONTACT	679-05HM	×	BLK	SCE
1	EA	POWER SUPPLY	PS902 900-2RS 900-BBK 120/240 VAC	×		VON

OPERATION: CREDENTIAL (OR KEY) REQUIRED FOR ENTRY. FIRE ALARM UNLOCKS O/S LEVER. INSIDE ALWAYS FREE EGRESS. Hardware Group No. 11.1

For use	e on Doo	or #(s):						
101-1	1	121-1	127-2	131-2	137-1			
Provide	e each S	GL door(s) with the	following:					
QTY		DESCRIPTION		CATALOG NUMBER			FINISH	MFR
3	EA	HEAVY WEIGHT H	HINGES	5BB1HW 4.5 X 4.5 NRF	C		626	IVE
1	EA	POWER TRANSFI	ER	EPT10 CON		×	689	VON
1	EA	EU STOREROOM	LOCK	ND80TDEU SPA RX C0 12V/24V DC	NC	N	626	SCH
1	EA	PERMANENT FSI	C CORE	23-030 CKC EV29 T			626	SCH
1	EA	SURFACE CLOSE	R	4050A REG OR PA AS	REQ		689	LCN
1	EA	KICK PLATE		8400 10" X 2" LDW B-C	S		630	IVE
1	EA	WALL STOP		WS401/402CCV			626	IVE
3	EA	SILENCER		SR64			GRY	IVE
1	EA	WIRE HARNESS T POWER SUPPLY	ГО	CON-192P				VON
1	EA	LOCK TO HINGE CONNECTOR		CON-32				VON
1	EA	MULTITECH REAI	DER	MT11 12 VDC		×	BLK	SCE
1	EA	DOOR CONTACT		679-05HM		×	BLK	SCE
1	EA	POWER SUPPLY		PS902 900-2RS 900-BI 120/240 VAC	ЗK	×		VON
OPER/ FIRE A	ATION: (ALARM (CREDENTIAL (OR I JNLOCKS O/S LEV	KEY) REG ER. INSID	UIRED FOR ENTRY. E ALWAYS FREE EGRE	ESS.			
Hardwa For use	are Grou e on Doo	up No. 12 or #(s):						
135-1	1	143-1						
Provide	e each S	GL door(s) with the	following:	• • • • • • • • • • • • • • • • • • •				
QTY		DESCRIPTION		CATALOG NUMBER			FINISH	MFR
1	EA	PASSAGE SET		ND10S RHO			626	SCH
1	EA	SURFACE CLOSE	R	4050A REG OR PA AS	REQ		689	LCN

1	EA	SURFACE CLOSER	4050A REG OR PA AS REQ	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	WALL STOP	WS401/402CCV	626	IVE
3	EA	SILENCER	SR64	GRY	IVE

STC SOUND RATED DOOR - HINGES, AUTO DOOR BOTTOM, THRESHOLD & SEALS BY DOOR MFG.

Hardw For us 145-	vare Gro se on Do -1	oup No. 12.1 por #(s):					
Provid	le each	SGL door(s) with the following:					
QTY	/	DESCRIPTION	CATALOG NUMBER			FINISH	MFR
3	EA	STANDARD WEIGHT HINGES	5BB1 4.5 X 4.5			626	IVE
1	EA	PASSAGE SET	ND10S SPA			626	SCH
1	EA	SURFACE CLOSER	4050A REG OR PA AS REQ			689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS			630	IVE
1	EA	WALL STOP	WS401/402CCV			626	IVE
3	EA	SILENCER	SR64			GRY	IVE
Hardw	vare Gro	oup No. 12.2					
For us	se on Do	oor #(s):					
128-	-1	130-1 136-1					
Provic	le each	SGL door(s) with the following:					
QTY	/	DESCRIPTION	CATALOG NUMBER	_		FINISH	MFR
3	EA	STANDARD WEIGHT HINGES	5BB1 4.5 X 4.5			626	IVE
1	EA	PASSAGE SET	ND10S SPA			626	SCH
1	EA	SURFACE CLOSER W/ CUSH ARM	4050A CUSH			689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS			630	IVE
3	EA	SILENCER	SR64			GRY	IVE
Hardw	vare Gro	oup No. 13					
For us	se on Do -1	oor #(s):					
Provid	le each	SGL door(s) with the following:					
QTY	/	DESCRIPTION	CATALOG NUMBER			FINISH	MFR
3	EA	STANDARD WEIGHT HINGES	5BB1 4.5 X 4.5			626	IVE
1	EA	CIPHER LOCK LFIC	LR-10-2-S-26D LFIC SCH			626	DRM
1	EA	PERMANENT FSIC CORE	23-030 CKC EV29 T			626	SCH
1	EA	SURFACE CLOSER	4050A REG OR PA AS REQ			689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS			630	IVE
1	EA	WALL STOP	WS401/402CCV			626	IVE
3	EA	SILENCER	SR64			GRY	IVE
1	EA	DOOR CONTACT	679-05HM	Ē	×	BLK	SCE
Hardware Group No. KEYS & CARDS -NOTE: ** CREDENTIAL CARDS REQUIREMENT QUANTITY TO BE VARIFIED BY OWNER. For use on Door #(s): **KEYS &** CARDS Provide each SGL door(s) with the following: QTY DESCRIPTION FINISH MFR CATALOG NUMBER 250 EA CREDENTIAL 2440 GWT SCE 50 ΕA **KEY BLANKS** SCHLAGE KEYBLANKS OWNER STOCK Hardware Group No. O7 - OHD - CYL ONLY For use on Door #(s): 131-3 131-4 Provide each RU door(s) with the following: QTY DESCRIPTION FINISH MFR CATALOG NUMBER 1 ΕA MORTISE CYLINDER 20-061 ICX XQ11-948 36-083 626 SCH 1 ΕA PERMANENT FSIC CORE 23-030 CKC EV29 T 626 SCH 1 BALANCE OF HARDWARE BY DOOR MANUFACTURER ALL OTHER HARDWARE BY DOOR MFG ** CONFIRM CYLINDER TYPE REQUIRED

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Glass and glazing for doors, windows and storefronts.
- 1.2 RELATED SECTIONS
 - A. Section 079000 Joint Sealers: Sealant and back-up material.
 - B. Section 081110 Standard Steel Doors.
 - C. Section 081120 Standard Steel Frames.
 - D. Section 082110 Wood Doors.
 - E. Section 084100 Aluminum Entrances and Storefronts.
 - F. Section 085200 Aluminum Windows.
- 1.3 REFERENCES
 - A. ANSI/ASTM E330 Structural Performance of Exterior Windows, Curtain Walls, and Doors by Uniform Static Air Pressure Difference.
 - B. ANSI Z97.1 Safety Performance Specifications and Methods of Test for Safety Glazing Used in Buildings.
 - C. ASTM C1036 Flat Glass.
 - D. ASTM C1048 Heat-Treated Flat Glass Kind HS, Kind FT Coated and Uncoated Glass.
 - E. FGMA Glazing Manual.
 - F. FGMA Sealant Manual.
 - G. FS TT-S-001657 Sealing Compound, Single Component, Butyl Rubber Based, Solvent Release Type.
 - H. FS TT-S-00230 Sealing Compounds, Synthetic-Rubber Base, Single Component, Chemically Curing.
 - I. FS TT-S-01543 Sealing Compound, Silicone Rubber Base.
 - J. Laminators Safety Glass Association Standards Manual.
- 1.4 PERFORMANCE REQUIREMENTS
 - A. Glass and glazing materials of this Section shall provide continuity of building enclosure vapor and air barrier:
 - 1. In conjunction with materials described in Section 07900.
 - 2. Maintain continuous air and vapor barrier throughout glazed assembly from glass pane to heel bead of glazing sealant.

- B. Size glass to withstand dead loads and positive and negative live loads acting normal to plane of glass as calculated in accordance with applicable code in accordance with ANSI/ASTM E330.
- C. Limit glass deflection to 1/200 or flexure limit of glass with full recovery of glazing materials, whichever is less.
- 1.5 SUBMITTALS
 - A. Submit under provisions of Division 1 General Requirements.
 - B. Product Data on Glass Types Specified: Provide structural, physical and environmental characteristics, size limitations, special handling or installation requirements.
 - C. Product Data on Glazing Compounds: Provide chemical, functional, and environmental characteristics, limitations, special application requirements. Identify available colors.
 - D. Manufacturer's Installation Instructions: Indicate special precautions required.
- 1.6 QUALITY ASSURANCE
 - A. Perform Work in accordance with FGMA Glazing Manual FGMA Sealant Manual for glazing installation methods.
- 1.7 ENVIRONMENTAL REQUIREMENTS
 - A. Do not install glazing when ambient temperature is less than 50 degrees F.
 - B. Maintain minimum ambient temperature before, during and 24 hours after installation of glazing compounds.
- 1.8 FIELD MEASUREMENTS
 - A. Verify that field measurements are as indicated on shop Drawings.
- 1.9 COORDINATION
 - A. Coordinate Work under provisions of Division 1 General Requirements.
 - B. Coordinate the Work with glazing frames, wall openings, and perimeter air and vapor seal to adjacent Work.
- 1.10 WARRANTY
 - A. Provide five year manufacturer's warranty under provisions of Division 1 General Requirements.
 - B. Warranty: Include coverage for reflective coating on mirrors and replacement of same.

PART 2 PRODUCTS

- 2.1 MANUFACTURERS FLAT GLASS MATERIALS
 - A. Pittsburgh Plate Glass.

- B. Technical Glass Products (TGP) Laminated Glass
- C. Substitutions: Under provisions of Division 1 General Requirements.

2.2 FLAT GLASS MATERIALS

- A. Insulated Glass: ASTM E774 and ASTM E773; double pane with glass elastomer edge seal; outer pane of ¼" clear annealed glass and interior pane of ¼" clear annealed Solarban 60 Low-E #3 surface glass; purge interior space with dry hermetic air; total unit thickness of 1" minimum; Type G-1.
- B. Insulated Safety Glass: ASTM E774 and ASTM E773; double pane with glass elastomer edge seal; outer pane of ¼" tempered clear glass and interior pane of ¼" tempered clear Solarban 60 Low-E #3 surface glass; purge interpane space with dry hermetic air; total unit thickness of 1" minimum; Type G-2.
- C. Safety Glass: Clear, fully tempered with horizontal tempering conforming to ANSI Z97.1; 1/4 inch thick; **Type G-3.**
- D. See Architectural Drawings for additional glazing types/requirements.
- 2.3 GLAZING COMPOUNDS
 - A. Acrylic Sealant: FS TT-S-00230, Type II, Class A; single component; cured Shore A hardness of 15- 25 non-bleeding color as selected.
- 2.4 GLAZING ACCESSORIES
 - A. Setting Blocks: Neoprene 80 90 Shore A durometer hardness, length of 0.1 inch for each square foot of glazing or minimum 4 inch x width of glazing rabbet space minus 1/16 inch x height to suit glazing method and pane weight and area.
 - B. Spacer Shims: Neoprene 50 60 Shore A durometer hardness, minimum 3 inch long x one half the height of the glazing stop x thickness to suit application, self adhesive on one face.
 - C. Glazing Clips: Manufacturer's standard type.

PART 3 EXECUTION

- 3.1 EXAMINATION
 - A. Verify prepared openings under provisions of Division 1 General Requirements.
 - B. Verify that openings for glazing are correctly sized and within tolerance.
 - C. Verify that surfaces of glazing channels or recesses are clean, free of obstructions, and ready to receive glazing.
- 3.2 PREPARATION
 - A. Clean contact surfaces with solvent and wipe dry.
 - B. Seal porous glazing channels or recesses with substrate compatible primer or sealer.

- C. Prime surfaces scheduled to receive sealant.
- 3.3 INTERIOR DRY METHOD (TAPE AND TAPE)
 - A. Cut glazing tape to length and set against permanent stops, projecting 1/16 inch above sight line.
 - B. Place setting blocks at 1/4 points with edge block no more than 6 inches from corners.
 - C. Rest glazing on setting blocks and push against tape for full contact at perimeter of pane or unit.
 - D. Place glazing tape on free perimeter of glazing in same manner described above.
 - E. Install removable stop without displacement of tape. Exert pressure on tape for full continuous contact.
 - F. Knife trim protruding tape.
- 3.4 EXTERIOR WET/DRY METHOD
 - A. Cut glazing tape to length and set against permanent stops, 3/16 inch below sight line. Seal corners by butting tape and dabbing with sealant.
 - B. Apply heel bead of sealant along intersection of permanent stop with frame ensuring full perimeter seal between glass and frame to complete the continuity of the air and vapor seal.
 - C. Place setting blocks at 1/4 points with edge block no more than 6 inches from corner.
 - D. Rest glazing on setting blocks and push against tape and heel bead of seanant with sufficient pressure to attain full contact at perimeter of pane or glass unit.
 - E. Install removable stops, with spacer strips inserted between glazing and applied stops, 1/4 inch below sight line.
 - F. Fill gap between glazing stop with sealant to depth equal to bite of grame on glazing, but not more than 3/8 inch below sight line.
 - G. Apply cap bead of sealant along void between the stop and the glazing, to uniform line, flush with sight line. Tool or wipe sealant surface smooth.

3.5 CLEANING

- A. Clean work under provisions of Division 1 General Requirements.
- B. Remove glazing materials from finish surfaces.
- C. Remove labels after work is complete.
- 3.6 PROTECTION OF FINISHED WORK
 - A. Protect finished Work under provisions of Division 1 General Requirements.
 - B. After installation, mark pane with an 'X' by using removable plastic tape or paste.

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Gypsum Board.
- B. Cementitious tile backer board Shower areas only.
- C. Quiet Rock.
- D. Taped and sanded joint treatment.
- E. Aluminum reveals.
- F. Accessories.

1.2 RELATED SECTIONS

- A. Section 061000 Rough Carpentry.
- B. Section 081120 Standard Steel Frames.
- C. Section 099000 Painting: Surface finish.
- D. Division 15 Mechanical.
- E. Division 16 Electrical.

1.3 REFERENCES

- A. ASTM C36 Gypsum Wallboard.
- B. ASTM C79 Gypsum Sheathing Board.
- C. ASTM C475 Joint Treatment Materials for Gypsum Wallboard Construction.
- D. ASTM C665 Mineral Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing.
- E. ASTM C840 Application and Finishing of Gypsum Board.
- F. ASTM C1002 Steel Drill Screws for the Application of Gypsum Board.
- G. GA-201 Gypsum Board for Walls and Ceilings.
- H. GA-216 Recommended Specifications for the Application and Finishing of Gypsum Board.
- I. GA-600 Fire-Resistance Design Manual.
- J. UL Fire-Resistance Directory.
- K. ASTM C645 Non-Load (Axial) Bearing Steel Studs, Runners (Track) and rigid furring channels for screw application of gypsum board.

- L. ASTM C754 Installation of framing members to receive screw attached gypsum wallboard, backing board or water-resistant backing board.
- 1.4 SUBMITTALS
 - A. Submit under provisions of Division 1 General Requirements.
 - B. Product Data: Provide data on metal framing, gypsum board, joint and tape.
- 1.5 QUALITY ASSURANCE
 - A. Perform Work in accordance with ASTM C840 and GA-600.
 - B. Maintain one copy of each document on site.

1.6 QUALIFICATIONS

A. Applicator: Company specializing in performing the work of this section with minimum 3 years documented experience.

PART 2 PRODUCTS

- 2.1 MANUFACTURERS GYPSUM BOARD SYSTEM
 - A. Georgia -Pacific Gypsum Products.
 - B. USG Cementitious Backer Board.
 - C. Pabco Gypsum Quiet Rock.
 - D. Substitutions: Under provisions of Division 1 General Requirements.
- 2.2 GYPSUM BOARD MATERIALS
 - A. Standard Gypsum Board: ASTM C36; 5/8" thick, maximum permissible length; ends square cut, tapered edges.
 - B Moisture Rated Gypsum Board: ASTM 630;' 5/8" thick, maximum permissible length; ends square cut, tapered edges.
 - C. Tile Backer Cementitious Backer Board: AST A108.11 and ASTM C1325;
 - 1. USG Durock Brand Cement Board with Edgeguard; 5/8" thick; maximum permissible length; provide with manufacturer's standard edges, or approved equal.
 - 2. For use in shower areas only: Women's T.R. 113 and Men's T.R. 117; see enlarged floor plan for additional information.
 - D. Quiet Rock: ASTM C1396 and STAM C1766:
 - 1. Pabco Gypsum: Quiet Rock EZ-snap 5/8" sound damped gypsum panel; maximum permissible length; tapered edges, or approved equal.
 - 2. For use in Witness Advocate Interview Room 143.

2.3 ACCESSORIES

- A. Acoustical Sealant: Non-hardening, non-skinning, for use in conjunction with gypsum board; recommended by manufacturer.
- B. Corner Beads: Metal.
- C. Reveals: Pittcon STR Series trim reveal; STR-063-063; 5/8" wide x 5/8" deep; aluminum extrusion; painted.
- D. Joint Materials: ASTM C475; reinforcing tape, joint compound, adhesive, and water.
- E. Fasteners: ASTM C1002.

PART 3 EXECUTION

- 3.1 EXAMINATION
 - A. Verify site conditions under provisions of Division 1 General Requirements.
 - B. Verify that site conditions are ready to receive work and opening dimensions are as indicated on shop drawings.
- 3.2 GYPSUM BOARD INSTALLATION
 - A. Install gypsum board in accordance with GA-201, GA-216 and GA-600.
 - B. Erect single layer standard gypsum board in most economical direction, with ends and edges occurring over firm bearing.
 - C. Place control joints consistent with lines of building spaces.
 - D. Place corner beads at external corners. Use longest practical length. Place edge trim where gypsum board abuts dissimilar materials.
 - E. Install cementitious tile backer board in accordance with manufacturer's instructions.
 - F. Install sound dampening gypsum wallboard in accordance with manufacturer's instructions.

3.3 JOINT TREATMENT

- A. Tape, fill, and sand exposed joints, edges, and corners to produce smooth surface ready to receive finishes.
- B. Feather coats onto adjoining surfaces so that camber is maximum 1/32 inch.
- C. Taping, filling, and sanding is not required at surfaces behind adhesive applied ceramic tile..
- 3.4 TOLERANCES
 - A. Maximum Variation of Finished Gypsum Board Surface from True Flatness: 1/8 inch in 10 feet in any direction.
- 3.5 FINISH

SECTION 09260 - GYPSUM BOARD SYSTEMS

- Level 1: Α.
- Above finished ceilings concealed from view. Walls of all storage areas, mechanical spaces, etc. Level 3:
 - All walls, ceilings and soffits of private offices and office areas, corridors, Level 4: conference rooms, toilet rooms, lobbies, work rooms, etc. and public spaces, except as noted.

1PART GENERAL

- 1.1 SECTION INCLUDES
 - A. Porcelain tile floor finish using the thinset application method.
 - B. Ceramic tile wall finish using the thinset application method.
 - C. Porcelain tile floor finish in full mud bed in shower areas.
 - D. Threshold at door openings.

1.2 RELATED SECTIONS

A Section 030000 - Cast-in-Place Concrete: Preparation of floor construction for tile application.

- B. Section 079000 Joint Sealers: Mildew resistant sealant.
- C. Section 092600 Gypsum Board Systems.
- D. Division 15 Plumbing Specialties: Floor drains and plumbing fixtures.

1.3 REFERENCES

A ANSI A108.5 - Installation of Ceramic Tile with Dry-Set Portland Cement Mortar or Latex Portland Cement Mortar.

- B ANSI A108.10 Installation of Grout in Tilework.
- C. ANSI A118.4 Bonding Mortars.
- D. ANSI A118.6 Ceramic Tile Grouts.
- E. ANSI A137.1 Standard Specifications for Ceramic Tile.
- F. TCA (Tile Council of America) Handbook for Ceramic Tile Installation.

1.4 SUBMITTALS

- A. Submit under provisions of Division 1 General Requirements.
- B. Samples: Submit product literature and samples as noted in administrative sections.
- C. Product Data: Provide instructions for using adhesives and grouts.
- D. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

1.5 MAINTENANCE DATA

- 1. Submit under provisions of Division 1 General Requirements.
- 2. Maintenance Data: Include recommended cleaning methods, cleaning materials, stain removal methods, and polishes and waxes.
- 1.6 QUALITY ASSURANCE

SECTION 093060 - CERAMIC TILE

- A. Perform Work in accordance with ANSI A137.1.
- B. Conform to TCA Handbook, ANSI A108.5 and ANSI A108.4.

1.7 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.

B. Installer: Company specializing in performing the work of this section with minimum 3 years documented experience.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, protect and handle products to site under provisions of Division 1 - General Requirements.

B. Protect adhesives from freezing or overheating in accordance with manufacturer's instructions.

1.9 ENVIRONMENTAL REQUIREMENTS

- A. Do not install adhesives in an unventilated environment.
- B Maintain 50 degrees F during installation of mortar materials.

1.10 EXTRA MATERIALS

A. Furnish under provisions of Division 1 - General Requirements.

B. Provide 40 s.f. total, of size, colors and surface finish of tile specified in quantities equal to proportion specified.

2PART PRODUCTS

- 2 TILE MANUFACTURERS
 - 1. Dal-Tile.
 - B. Substitutions: Under provisions of Division 1 General Requirements.

3 CERAMIC TILE MATERIALS

- 1. Porcelain Mosaic Floor Tile: Dal-Tile Keystones; ANSI A137.1, conforming to the following:
 - Water Absorption 1. < 5% 2. Size 2" x 2" x 1/4" 3. Shape square 4. Edae square Surface Finish 5. unglazed 6. Color D200 - Desert Gray Speckle
- 2. Ceramic Modular Wall Tile: Dal-Tile Color Wheel Classic TCA A137.1, conforming to the following:
 - 1. Water Absorption < 20%

SECTION 093060 - CERAMIC TILE

2.	Size	3" x 6"
3.	Shape	rectangle
4.	Edge	square
5.	Internal Corner	coved
6.	External Corner	bullnose
7.	Surface Finish	glazed
8.	Color	0190 - Arctic White

C. Ceramic Mosaic Accent Wall Tile: Dal-Tile Color Wheel Classic; ANSI A137.1, conforming to the following:

1.	Water Absorption	< 20%
2.	Size	3"x 6"
3.	Shape	rectangle
4.	Edge	square
5.	Internal Corner	coved
6.	External Corner	bull nose
7.	Surface Finish	glazed
8.	Color	1469 - Galaxy

- D. Ceramic Mosaic Base Tile: Dal-Tile Color Wheel Classic; ANSI A137.1, conforming to the following:
 - Water Absorption 1.
 - < 20% 6" x 6" 2. Size Shape Cove base (A-3601, SCR-6-3601, SCR-R-3601) 3. Surface Finish 4. glaze 5. Color X114 - Desert Gray

2.3 MORTAR MATERIALS

Mortar Materials: ANSI A118.1 Dry Set, ANSI A118.4 Latex Modified, Portland Α. cement, sand, latex additive, and water.

2.4 **GROUT MATERIALS**

Sanded Grout: ANSI A118.6, and CRD C-621 - 'Hydromet' Portland cement Α. grout with colorfast pigments and high strength aggregates as manufactured by Bostik (tile floors and base). Colors as selected by Architect.

Unsanded Grout: ANSI A118.6 - 'Hydromet' dry tile grout of Portland cement, Β. ground quartz and colorfast pigments and high strength aggregates as manufactured by Bostik or approved equal (tile walls). Colors as selected by Architect.

ACCESSORIES 2.5

Α. Thresholds: Marble type, color to be selected, honed finish, full width of frame opening, beveled both sides.

See Architectural Drawings for information on all Schluter - Kerdi waterproofing B. system components required at ceramic/porcelain tile showers.

2.6 MORTAR MIX AND GROUT MIX

Α. Mix and proportion pre-mix setting bed and grout materials with additives in accordance with manufacturer's instructions, and TCA Handbook.

3PART EXECUTION

1 EXAMINATION

- 1. Verify substrate under provisions of Division 1 General Requirements.
- 2. Verify that surfaces are ready to receive work.

2 PREPARATION

- A. Protect surrounding work from damage or disfiguration.
- B. Vacuum clean surfaces and damp clean, if required.

C. Seal substrate surface cracks with filler. Level existing substrate surfaces to acceptable flatness tolerances.

D. Apply sealer to substrate surfaces in accordance with adhesive manufacturer's instructions.

3 INSTALLATION - THINSET METHOD

A. Install adhesive, tile, thresholds, and grout in accordance with manufacturer's instructions and to TCA Handbook.

- B. Place thresholds edge strips at exposed tile edges and locations indicated.
- C. Cut and fit tile tight to penetrations through tile. Form corners and bases neatly.

D. Place tile joints uniform in width, subject to variance in tolerance allowed in tile size. Make joints watertight, without voids, cracks, excess mortar, or excess grout.

- E. Sound tile after setting. Replace hollow sounding units.
- F. Allow tile to set for a minimum of 48 hours prior to grouting.

G Grout tile joints in accordance with manufacturer's directions and comply with ANSI A108.1. Grouting is not complete until all grout haze and residue are removed from the surface of the tile.

H. Apply sealant to junction of tile and dissimilar materials and junction of dissimilar planes.

- I. Comply with ANSI A108.5 and TCA for appropriate method of installation. Press and beat tile into place to obtain as near 100% coverage as possible.
- J. Install porcelain floor tile in full mud bed in shower.

K. Provide/Install all Schluter - Kerdi waterproofing system components as indicated on Drawings and in accordance with manufacturers instructions.

3.4 CLEANING

- A. Clean work under provisions of Division 1 General Requirements.
- B. Clean tile and grout surfaces.

3.5 PROTECTION OF FINISHED WORK

- A. Protect finished work under provisions of Division 1 General Requirements.
- B. Do not permit traffic over finished floor surface for 4 days after installation.
- C. Protect all floor tile installations with Kraft paper or other heavy coating during construction period to prevent stains or damage.

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Suspended metal grid ceiling system and perimeter trim.
- B. Acoustical tile.

1.2 REFERENCES

- A. ASTM C635 Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings.
- B. ASTM C636 Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels.
- C. ASTM E1264 Classification of Acoustical Ceiling Products.
- D. Ceilings and Interior Systems Contractors Association (CISCA) Acoustical Ceilings: Use and Practice.

1.3 SYSTEM DESCRIPTION

A. Suspension system to rigidly secure acoustical ceiling system including integral mechanical and electrical components with maximum deflection of 1/360.

1.4 SUBMITTALS

- A. Submit under provisions of Division 1 General Requirements.
- B. Product Data: Provide data on metal grid system components and acoustical units.
- C. Samples: Submit two samples full size illustrating material and finish of acoustical units.
- D. Samples: Submit two samples each, of suspension system main runner, cross runner, and edge trim.
- E. Manufacturer's Installation Instructions: Indicate special procedures and perimeter conditions requiring special attention.

1.5 QUALIFICATIONS

- A. Grid Manufacturer: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.
- B. Acoustical Unit Manufacturer: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

1.6 REGULATORY REQUIREMENTS

A. Conform to applicable codes for combustibility requirements for materials.

1.7 ENVIRONMENTAL REQUIREMENTS

A. Maintain uniform temperature of minimum 60 degrees F and maximum humidity of 40 percent prior to, during, and after acoustical unit installation.

1.8 SEQUENCING

- A. Sequence work under the provisions of Division 1 General Requirements.
- B. Sequence work to ensure acoustical ceilings are not installed until building is enclosed, sufficient heat is provided, dust generating activities have terminated, and overhead work is completed, tested, and approved.
- C. Install acoustical units after interior wet work is dry.

1.9 EXTRA MATERIALS

- A. Furnish under provisions of Division 1 General Requirements.
- B. Provide two unopened boxes of each tile to Owner.

PART 2 PRODUCTS

- 2.1 MANUFACTURERS SUSPENSION SYSTEM
 - A. Armstrong Contract Interiors.
 - B. Substitutions: Under provisions of Division 1 General Requirements.
- 2.2 SUSPENSION SYSTEM MATERIALS
 - A. Non-fire Rated Grid: ASTM C635, intermediate duty; exposed T; components die cut and interlocking; hot dipped galvanized. Product: Prelude 15/16" T-bar grid suspension system.
 - B. Grid: Prelude 15/16" Grid White.
 - C. Accessories: Stabilizer bars, hold-down clips, splices, edge and moldings required for suspended grid system.
 - D. Support Channels and Hangers: Hot dipped galvanized; size and type to suit application and ceiling system flatness requirement specified.

2.3 MANUFACTURERS - ACOUSTICAL UNITS

- A. Armstrong Contract Interiors.
- B. Substitutions: Under provisions of Division 1 General Requirements.
- 2.4 ACOUSTICAL UNIT MATERIALS
 - A. Acoustical Tile Tile Type 1 Ultima High NRC No. 2083; conforming to the following:
 - 1. Size: 24 x 48 inches

- 2. Thickness: 1 inch.
- 3. Edge Detail: Square Lay In
- 4. Grid: 15/16 inch.
- 5. Color: White.
- 6. NRC/CAC: 0.85/35
- 7. Humidity Resistance: Humiguard Plus
- 8. Factory applied vinyl latex paint.
- 9. Composition: Mineral Fiber
- 10. Fire Performance: Class A
- B Acoustical Tile Tile Type 2 Armstrong Ultima High NCR No. 2080; conforming to the following:
 - 1. Size: 24x24 inches
 - 2. Thickness: 1 inch
 - 3. Edge Detail: Square Lay-In
 - 4. Grid: 15/16 inch
 - 5. Color: White
 - 6. NRC/CAC: 0.85/35
 - 7. Humidity Resistance: Humiguard Plus
 - 8. Factory applied vinyl latex paint
 - 9. Composition: Mineral Fiber
 - 10. Fire Performance: Class A
- C. Acoustical Tile Tile Type 3 Armstrong Angled Tegular Dune No. 1776; conforming to the following:
 - 1. Size: 24 x 48 inches.
 - 2. Thickness: 5/8 inch.
 - 3. Composition: Wet-formed mineral fiber.
 - 4. NRC Range: .50-.60
 - 5. CAC Range: 35
 - 6. Edge Detail: Angled tegular lay-in.
 - 7. Surface Burning Characteristics: Flame spread 25 or under.
 - 8. Grid: 15/16 inch.
 - 9. Color: White.
 - 10. Factory applied vinyl latex paint.
 - 11. Humidity Resistance: Humiguard Plus.
- D. Acoustical Tile Tile Type 4 Armstrong Angled Tegular Dune No. 1774; conforming to the following:
 - 1. Size: 24 x 24 inches.
 - 2. Thickness: 5/8 inch.
 - 3. Composition: Wet-formed mineral fiber.
 - 4. NRC Range: .50-.60
 - 5. CAC Range: 35
 - 6. Edge Detail: Angled tegular lay-in.
 - 7. Surface Burning Characteristics: Flame spread 25 or under.
 - 8. Grid: 15/16 inch.
 - 9. Color: White.
 - 10. Factory applied vinyl latex paint.
 - 11. Humidity Resistance: Humiguard Plus.

2.5 ACCESSORIES

A. Touch-up Paint: Type and color to match acoustical and grid units.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify site conditions under provisions of Division 1 General Requirements.
- B. Verify that layout of hangers will not interfere with other work.

3.2 INSTALLATION - LAY-IN GRID SUSPENSION SYSTEM

- A. Install suspension system in accordance with ASTM C636 and manufacturer's instructions and as supplemented in this section.
- B. Install system capable of supporting imposed loads to a deflection of 1/360 maximum.
- C. Locate system on room axis according to reflected ceiling plan.
- D. Install after major above ceiling work is complete. Coordinate the location of hangers with other work.
- E. Hang suspension system independent of walls, columns, ducts, pipes and conduit. Where carrying members are spliced, avoid visible displacement of face plane of adjacent members.
- F. Where ducts or other equipment prevent the regular spacing of hangers, reinforce the nearest affected hangers and related carrying channels to span the extra distance.
- G. Do not support components on main runners or cross runners if weight causes total dead load to exceed deflection capability.
- H. Do not eccentrically load system or produce rotation of runners.
- I. Install edge molding at intersection of ceiling and vertical surfaces, using longest practical lengths. Miter corners. Provide edge moldings at junctions with other interruptions.

3.3 INSTALLATION - ACOUSTICAL UNITS

- A. Install acoustical units in accordance with manufacturer's instructions.
- B. Fit acoustical units in place, free from damaged edges or other defects detrimental to appearance and function.
- C. Lay directional patterned units one way with pattern parallel to room axis. Fit border trim neatly against abutting surfaces.
- D. Install units after above ceiling work is complete.
- E. Install acoustical units level, in uniform plane, and free from twist, warp and dents.
- F. Cut tile to fit irregular grid and perimeter edge trim. Field rabbet tile edge. Double cut and field paint exposed edges of tegular units.

3.4 ERECTION TOLERANCES

- A. Maximum Variation from Flat and Level Surface: 1/8 inch in 10 feet.
- B. Maximum Variation from Plumb of Grid Members Caused by Eccentric Loads: 2 degrees.

PART 1 GENERAL

- 1.1 SECTION INCLUDES
 - A. Resilient tile flooring SDT and LVT.
 - B. Rubber tile.
 - C. Resilient base.
 - D. Accessories.

1.2 RELATED SECTIONS

- A. Section 033000 Concrete.
- B. Section 043000 Unit Masonry.
- C. Section 096880 Carpet.

1.3 REFERENCES

- A. ASTM E648 Critical Radiant Flux Class 1.
- B. ASTM E 662 Smoke 450 or less.
- C. ASTM F1066 Vinyl Composition Floor Tile.
- D. FS-SS-W-40 Wall Base: Rubber and vinyl plastic.

1.4 SUBMITTALS

- A. Submit under provisions of Division 1 General Requirements.
- B. Product Data: Provide data on specified products, describing physical and performance characteristics; sizes, patterns and colors available.
- C. Samples: Submit two samples, 2 x 2 inch in size illustrating color and pattern for each floor material for each color specified.
- D. Submit two inch long samples of base material for each color specified.
- E. Manufacturer's Installation Instructions: Indicate special procedures and perimeter conditions requiring special attention.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, protect and handle products to site under provisions of Division 1 - General Requirements.

1.6 ENVIRONMENTAL REQUIREMENTS

- A. Store materials for three days prior to installation in area of installation to achieve temperature stability.
- B. Maintain ambient temperature required by adhesive manufacturer three days prior to, during, and 24 hours after installation of materials.

1.7 MAINTENANCE DATA

- A. Submit under provisions of Division 1 General Requirements.
- B. Maintenance Data: Include maintenance procedures, recommended maintenance materials, and suggested schedule for cleaning, stripping, and re-waxing.

1.8 EXTRA MATERIALS

- A. Furnish under provisions of Division 1 General Requirements.
- B. Provide 20 sq ft of flooring and 20 lineal feet of base of each material specified.

PART 2 PRODUCTS

- 2.1 MANUFACTURERS
 - A. SDT: Armstrong.
 - B. LVT: Patcraft.
 - C. Rubber Tile: Mannington.
 - D. Vinyl Base: Mannington.
 - E. Substitutions: Under provisions of Division 1 General Requirements.

2.2 MATERIALS – STATIC DISSIPATIVE TILE (SDT)

- A. Vinyl Composition Tile: ASTM F1066:
 - 1. Size: 12 x 12 inch
 - 2. Thickness: 1/8 inch
 - 3. Design: Non-directional
 - 4. Manufacturer: Armstrong Excelon SDT
 - 5. Color: As selected by Architect
 - 6. Pattern: Solid/Basketweave.

2.3 LUXURY VINYL TILE

- A. Luxury Vinyl Tile: ASTM E648:
 - 1. Size: 7" x 48"
 - 2. Thickness: 5 mm
 - 3. Design: Non-directional
 - 4. Manufacturer: Patcraft Crossover LL
 - 5. Finish: Textured Wood Grain.
 - 6. Wear Layer: 20 mil.

SECTION 096500 - RESILIENT FLOORING

- 7. Color: To be selected (Full color range. Assume 2 colors)
- 8. Pattern Ashlar

2.4 RUBBER TILE

- A. Rubber Tile: ASTM F3041:
 - 1. Size: 24"x24"; interlocking
 - 2. Thickness: 3/8 inch
 - 3. Design: Non-directional
 - 4. Manufacturer: Mannington Reset
 - 5. Color: As selected by Architect
 - 6. Pattern: Ashlar (offset brick pattern)

2.5 MATERIALS - BASE

- A. Base: Standard vinyl wall base, coved:
 - 1. Height: 4 inch
 - 2. Thickness: 1/8 inch thick
 - 3. Length: Roll (120 feet)
 - 4. Manufacturer: Mannington
 - 5. Color: as selected by Architect (Assume 3 colors).

2.6 ACCESSORIES

- A. Subfloor Filler: White premix latex; type recommended by adhesive material manufacturer.
- B. Primers and Adhesives: Waterproof; types recommended by flooring manufacturer for static dissipative tile (S-202 SDT Adhesive)
- C. Sealer and Wax: Types recommended by flooring manufacturer for static dissipative tile (S-392 Static Dissipative Polish)
- D. Transition Strips: SDT/Carpet adapter, rubber tile/carpet adapter or approved equal. Colors as selected by Architect.
- E. Provide Armstrong S-202 Static Dissipative Tile Adhesive with 2 inch wide by 24 inch long copper ground strips for under the tile.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify concrete floors are dry to a maximum moisture content of 7 percent, and exhibit negative alkalinity, carbonization, or dusting.
- B. Verify floor and lower wall surfaces are free of substances that may impair adhesion of new adhesive and finish materials.

3.2 PREPARATION

- A. Remove sub-floor ridges and bumps. Fill minor or local low spots, cracks, joints, holes, a and other defects with sub-floor filler to achieve smooth, flat, hard surface.
- B. Prohibit traffic until filler is cured.

- C. Vacuum clean substrate.
- D. Apply primer to required surfaces.

3.3 INSTALLATION - TILE FLOORING

- A. Install in accordance with manufacturer's instructions.
- B. Spread only enough adhesive to permit installation of materials before initial set.
- C. Set flooring in place, press with heavy roller to attain full adhesion.
- D. Install VCT to basket weave pattern. Allow minimum ½ full tile width at room or area perimeter.
- E. Lay flooring with joints and seams parallel to building lines to produce symmetrical tile.
- F. Terminate flooring at centerline of door openings where adjacent floor finish is dissimilar.
- G. Scribe flooring to walls, columns, cabinets, floor outlets, and other appurtenances to produce tight joints.
- H. Install LVT plank in accordance with manufacturer's instructions and in patterns selected or specified.
- I. Install static dissipative tile, adhesive and grounding strips in accordance with manufacturer's instructions and in patterns selected or specified.
- J. Install interlocking rubber tile in accordance with manufacturer's instructions and in patterns selected or specified.

3.5 INSTALLATION - BASE

- A. Fit joints tight and vertical. Maintain maximum measurement between joints.
- B. Miter internal corners. At external corners, 'V' cut back of base strip to 2/3 of its thickness and fold. At exposed ends, use premolded units.
- C. Install base on solid backing. Bond tight to wall and floor surfaces.
- D. Scribe and fit to door frames and other interruptions.

3.6 CLEANING

- A. Clean work under provisions of Division 1 General Requirements.
- B. Remove access adhesive from floor, base, and wall surfaces without damage.
- C. Clean, seal, and wax floor and base surfaces in accordance with manufacturer's instructions.
- 3.7 PROTECTION OF FINISHED WORK
 - A. Protect finished Work under provisions of Division 1 General Requirements.

SECTION 096500 - RESILIENT FLOORING

B. Prohibit traffic on floor finish for 48 hours after installation.

3.9 SCHEDULE

A. See Finish Schedule for locations.

PART 1 GENERAL

1.1 SUMMARY

- A. This Section includes:
 - 1. High-performance resinous flooring systems.

1.2 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Installer Certificates for Qualification: Signed by manufacturer stating that installers comply with specified requirements.
- C. Material Certificates: For each resinous flooring component, from manufacturer.
- D. Maintenance Data: For maintenance manuals.
- E. Samples: Submit two 6" X 6" samples of each resinous flooring system applied to a rigid backing. Provide sample which is a true representation of proposed field applied finish. Provide sample color and texture for approval from Owner in writing or approved by General Contractor prior to installation.
- F. Product Schedule: For resinous flooring.

1.3 QUALITY ASSURANCE

- A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of flooring systems required for this Project.
 - 1. Engage an installer who is approved in writing by resinous flooring manufacturer as qualified to apply resinous flooring systems indicated.
 - 2. Installer Letter of Qualification: Installer to provide letter stating that they have been in business for at least 5 years and listing 5 projects in the last 2 years of similar scope. For each project provide: project name, location, date of installation, contact information, size of project, and manufacturer of materials with system information.
- B. Source Limitations: Obtain primary resinous flooring materials, including primers, resins, hardening agents, grouting coats, and topcoats, from single source from single manufacturer. Provide secondary materials, including patching and fill material, joint sealant, and repair materials, of type and from source recommended by manufacturer of primary materials.
- C. Pre-installation Conference: Conduct conference at Project site before work and mockups begin.
- D. Mockups: Apply mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution. Do not cover up mockup area.
 - 1. Apply full-thickness mockups on 16 square foot floor area selected by Architect.
 - 2. Finish surfaces for verification of products, color, texture, and sheen.

- 3. Simulate finished lighting conditions for Architect's review of mockups.
- 4. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.
- 5. Mockup shall demonstrate desired slip resistance for review and approval by Owner's representative in writing.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials in original packages and containers, with seals unbroken, bearing manufacturer's labels indicating brand name and directions for storage and mixing with other components.
 - 1. Maintain containers in clean condition, free of foreign materials and residue.
 - 2. Remove rags and waste from storage areas daily.

1.5 PROJECT CONDITIONS

- A. Environmental Limitations: Comply with resinous flooring manufacturer's written instructions for substrate temperature, ambient temperature, moisture, ventilation, and other conditions affecting resinous flooring application.
- B. Lighting: Provide permanent lighting or, if permanent lighting is not in place, simulate permanent lighting conditions during resinous flooring application.
- C. Close spaces to traffic during resinous flooring application and for not less than 24 hours after application unless manufacturer recommends a longer period.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by:
 - 1. The Sherwin Williams Company, Cleveland, OH. <u>swflooring@sherwin.com</u>.
 - 2. Basis of Design Product: Resufloor Topcoat TX. (with 80/120 mesh sand)
 - 3. Substitutions must be approved in writing 10 days prior to bid date.
 - a. Cove base shall be done prior to floor coating. Epoxy Cove base system; 4 inches high with feathered edge.
 - b. 1st Coat: Primer epoxy Resuprimer 3579 applied at 200-250 sq ft / gal
 - c. 2nd Coat: Fill Coat, Resufloor 3746 epoxy applied at 140-150 sq ft / gal
 - d. 3rd Coat: Broadcast 80/120 Mesh Sand to rejection.
 - e. 4th Coast: Seal Coat Pigmented, Resutile 4687 / gal applied at 250 sq ft / gal
 - f. Total system thickness: 12-30 mils as required.

2.2 MATERIALS

- A. VOC Content of Resinous Flooring: Provide resinous flooring systems, for use inside the weatherproofing system, that comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D.
 - 1. Resinous Flooring: 100 g/L.

2.3 HIGH-PERFORMANCE RESINOUS FLOORING

- A. Resinous Flooring: Abrasion-, impact- and chemical-resistant, high-performance, resinbased, monolithic floor surfacing designed to produce a seamless floor.
- B. System Characteristics:
 - 1. Color and Pattern: As indicated from manufacturers listed above.
 - 2. Slip Resistance: Provide slip resistant finish.

PART 3 EXECUTION

3.1 PREPARATION

- A. Inspection: Prior to commencing Work, thoroughly examine all underlying and adjoining work, surfaces and conditions upon which Work is in any way dependent for perfect results. Report all conditions which affect Work. No "waiver of responsibility" for incomplete, inadequate or defective underlaying and adjoining work, surfaces and conditions will be considered, unless notice of such unsatisfactory conditions has been filed and agreed to in writing before Work begins. Commencement of Work constitutes acceptance of surfaces.
- B. Surface Preparation: Remove all surface contamination, loose or weakly adherent particles, laitance, grease, oil, curing compounds, paint, dust and debris by blast track method or approved mechanical means (acid etch not allowed). If surface is questionable try a test patch. Create a minimum surface profile for the system specified in accordance with the methods described in ICRI No. 03732 to achieve profile CSP 1-3 as follows:

1.	Thin film, to 10 mils	CSP-1 to CSP-3
2.	Thin and medium films, 10 to 40 mils	CSP-3 to CSP-5
3.	Self-leveling mortars, to 3/16"	CSP-4 to CSP-6
4.	Mortars and laminates, to 1/4" or more	CSP-5 to CSP-10

- C. Verify that concrete substrates are dry and moisture-vapor emissions are within acceptable levels according to manufacturer's written instructions.
 - 1. Moisture Testing: Perform tests indicated below.
 - a. Calcium Chloride Test: Perform anhydrous calcium chloride test per ASTM F 1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. in 24

- hours. Perform tests so that each test area does not exceed 1000 sq. ft. and perform 3 tests for the first 1000 sq. ft. and one additional test for every additional 1000 sq ft.
- In-Situ Probe Test: Perform relative-humidity test using in-situ probes per ASTM F 2170. Proceed with installation only after substrates have a maximum 75 percent relative-humidity-level measurement.

3.2 ENVIRONMENTAL CONDITIONS

A. All applicators and all other personnel in the area of the RF installation shall take all required and necessary safety precautions. All manufacturers' installation instructions shall be implicitly instructions shall be implicitly followed.

- B. Repair damaged and deteriorated concrete according to resinous flooring manufacturer's written instructions.
- C. Alkalinity and Adhesion Testing: Verify that concrete substrates have pH within acceptable range. Perform tests recommended by manufacturer. Proceed with application only after substrates pass testing.
- D. Resinous Materials: Mix components and prepare materials according to resinous flooring manufacturer's written instructions.
- E. Use patching and fill material to fill holes and depressions in substrates according to manufacturer's written instructions.

F. Treat control joints and other nonmoving substrate cracks to prevent cracks from reflecting through resinous flooring according to manufacturer's written instructions.

3.3 APPLICATIONS

A. Install resinous floor over properly prepared concrete surface in strict accordance with the manufacturer's directions.

- 1. Install the primer and/or base coats over thoroughly cleaned and prepared concrete.
- 2. Install topcoat over flooring after excess aggregate has been removed.

3. Maintain a slab temperature of 60°F to 80°F for 24 hours minimum before applying floor topping, or as instructed by manufacturer.

B. Apply components of resinous flooring system according to manufacturer's written instructions to produce a uniform, monolithic wearing surface of thickness indicated.

1. Coordinate application of components to provide optimum adhesion of resinous flooring system to substrate, and optimum intercoat adhesion.

2. Cure resinous flooring components according to manufacturer's written instructions. Prevent contamination during application and curing processes.

3. At substrate expansion and isolation joints, comply with resinous flooring manufacturer's written instructions.

- C. Sealant: Saw cut resinous floor topping at expansion joints in concrete slab. Fill sawcuts with sealant prior to final seal coat application. Follow manufacturer's written recommendations.
- D. Apply primer over prepared substrate at manufacturer's recommended spreading rate.
- E. Slip Resistant Finish: Provide grit for slip resistance.
- F. Apply topcoats in number indicated for flooring system and at spreading rates recommended in writing by manufacturer.
- 3.4 COMPLETED WORK
 - A. Cleaning: Upon completion of the Work, clean up and remove from the premises surplus materials, tools, appliances, empty cans, cartons and rubbish resulting from the Work. Clean off all spattering and drippings, and all resulting stains.
 - B. Protection: Protect Work in accordance with manufacturer's directions from damage and wear during the remainder of the construction period. Use protective methods and materials, including temporary covering, recommended in writing by resinous flooring manufacturer.
 - C. Contractor shall insure that coating is protected from any traffic until it is fully cured to the satisfaction of the coating manufacturer.

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Carpet tile placed with glue-down method.
- B. Walk off tile placed with glue-down method.
- C. Accessories.

1.2 RELATED SECTIONS

- A. Section 033000 Cast-in-Place Concrete.
- B. Section 060010 Carpentry.
- C. Section 093060 Ceramic Tile: Transition/Edge Protection.
- D. Section 096500 Resilient Flooring: resilient tile flooring; base and accessories.

1.3 REFERENCES

- A. ASTM D2859 Test Method for Flammability of Finished Textile Floor Covering Materials.
- B. ASTM E84 Surface Burning Characteristics of Building Materials.
- C. ASTM E648 Critical Radiant Flux of Floor Covering Systems Using a Radiant Heat Energy Source.
- D. NFPA 253 Test for Critical Radiant Flux of Floor Covering Systems.

1.4 SUBMITTALS

- A. Submit under provisions of Division 1 General Requirements
- B. Product Data: Provide data on specified products, describing physical and performance characteristics; sizes, patterns, colors available, and method of installation.
- C. Samples: Submit two samples 6 x 6 inch in size illustrating color and pattern for each carpet material specified.
- D. Manufacturer's Installation Instructions: Indicate special procedures, and perimeter conditions requiring special attention.

1.5 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing specified carpet with minimum three years documented experience.
- B. Installer: Company specializing in installing carpet with minimum three years documented experience and approved by manufacturer.

1.6 REGULATORY REQUIREMENTS

- A. Conform to applicable codes for flame/smoke rating requirements in accordance with ASTM E84.
- B. Conform to ASTM D2859 for surface flammability ignition test.

1.7 ENVIRONMENTAL REQUIREMENTS

- A. Store materials for 3 days prior to installation in area of installation to achieve temperature stability.
- B. Maintain minimum 70 degrees F ambient temperature 3 days prior to, during and 24 hours after installation.

1.8 MAINTENANCE DATA

- A. Submit under provisions of Division 1 General Requirements.
- B. Maintenance Data: Include maintenance procedures, recommended maintenance materials, and suggested schedule for cleaning.
- 1.9 EXTRA MATERIAL
 - A. Furnish under provisions of Division 1 General Requirements.
 - B. Provide a total of 90 sq ft of carpeting of main type, color, and pattern specified.

PART 2 PRODUCTS

- 2.1 ACCEPTABLE MANUFACTURERS CARPETING / WALK-OFF CARPET
 - A. J & J Flooring Carpet Tile.
 - B. Mannington Commercial Walk-Off Carpet Tile.
 - C. Substitutions: Under provisions of Division 1 General Requirements.

2.2 MATERIALS - CARPET TILE

- A. Carpet Tile: J&J Flooring Kinetex Textile Composite Flooring; Put A Cork In It; 24"x24"; wear layer/face fiber of abrasion and ravel resistant knitted fabric thermally fused to cushioned backing of polyester felt. Colors to be selected (assume 2 colors).
- B. Installation Method Brick.
- 2.3 MATERIALS WALK-OFF CARPET TILE
 - Mannington Ruffian II; 24" x 24" modular carpet tile, Infinity modular backing; 32 oz/sq/yd; post production type 6, 6 nylon plus scraper fiber; color as selected by Architect. (Assume 1 color).

B. Installation Method: Monolithic.

2.4 ACCESSORIES

- A. Sub-Floor Filler: White premix latex; type recommended by adhesive material manufacturer.
- B. Adhesive: Recommended by entrance mat manufacturer.
- C. Transition Strip: Carpet to SDT/LVT/Rubber Tile; color as selected by Architect.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that surfaces are smooth and flat with maximum variation of 1/4 inch in 10 ft, and are ready to receive work.

3.2 PREPARATION

- A. Remove sub-floor ridges and bumps. Fill minor or local low spots, cracks, joints, holes, and other defects with sub-floor filler.
- B. Apply, trowel, and float filler to achieve smooth, flat, hard surface. Prohibit traffic until filler is cured.
- C. Vacuum clean substrate.

3.3 INSTALLATION

- A. Install carpet tile and adhesive in accordance with manufacturers' instructions.
- B. Verify carpet tile match before cutting to ensure minimal variation between dye lots.
- C. Double cut carpet tile, to allow intended seam and pattern match. Make cuts straight, true, and unfrayed. Edge seam carpet at public areas.
- D. Lay carpet tile tight and flat on subfloor, well fastened at edges, with a uniform appearance. Provide monolithic color, pattern, and texture match within any one area.
- E. Do not change run of pile in any room where carpet tile is continuous through a wall opening into another room. Locate change of color or pattern between rooms under door centerline.
- F. Cut and fit carpet tile around interruptions.
- G. Fit carpet tile tight to intersection with vertical surfaces without gaps.
- H. Install carpet tile and walk-off tile in patterns specified/indicated.
- I. Provide carpet tile and walk-off tile in areas indicated on Finish Schedule.

3.4 CLEANING

- A. Clean work under provisions of Division 1 General Requirements.
- B. Remove excess adhesive without damage, from floor, base, and wall surfaces.
- C. Clean and vacuum carpet surfaces.

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Surface preparation and field application of paints and coatings.

1.2 RELATED SECTIONS

- A. Section 025110 Hot Mix Asphalt Paving.
- B. Section 043000 Unit Masonry System.
- C. Section 062000 Finish Carpentry.
- D. Section 081110 Standard Steel Doors.
- E. Section 081120 Standard Steel Frames.
- F. Section 092600 Gypsum Board Systems.

1.3 REFERENCES

A. ASTM D16 - Definitions of Terms Relating to Paint, Varnish, Lacquer, and Related Products.

1.4 DEFINITIONS

A. Conform to ASTM D16 for interpretation of terms used in this Section.

1.5 SUBMITTALS

- A. Product Data: Provide data on all finishing products and special coatings.
- B. Samples: Submit samples illustrating range of colors and textures available for each surface finishing product scheduled.
- C. Manufacturer's Instructions: Indicate special surface preparation procedures and substrate conditions requiring special attention.
- D. Manufacturer's Safety Data Sheet (MSDS) for each product used.

1.6 QUALITY ASSURANCE

- A. Single Source
 - 1. Provide primers and other undercoat paints produced by same manufacturer as finish coats for each application.
 - 2. Use only thinners approved by paint manufacturer, and use only with recommended limits.
- B. Coordination of Work
 - 1. Review other sections of these Specifications in which prime paints are to be provided, to ensure compatibility of total coatings system.
 - Upon request from other trades, furnish information or characteristics of

2.

proposed finish materials, to ensure that compatible prime coats are used.

- C. Manufacturer: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.
- D. Applicator: Company specializing in performing the work of this section with minimum years documented experience and where applicable, approved by manufacturer.

1.7 REGULATORY REQUIREMENTS

A. Conform to applicable codes, standards and specifications referenced in this section.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, protect and handle products to site.
- B. Deliver products to site in sealed and labeled containers; inspect to verify acceptability.
- C. Container label to 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. Store paint materials at minimum ambient temperature of 45 degrees F and a maximum of 90 degrees F, in ventilated area, and as required by manufacturer's instructions.

1.9 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.
- C. Minimum Application Temperatures for Latex Paints: 45 degrees F for interiors; 50 degrees F for exterior; unless required otherwise by manufacturer's instructions.
- D. Minimum Application Temperature for Varnish Finishes: 65 degrees F for interior or exterior, unless required otherwise by manufacturer's instructions.
- E. Provide lighting level of 80 ft candles measured mid-height at substrate surface.

1.10 EXTRA MATERIALS

- A. Provide 1 unopened gallon of each color, type, and surface texture to Owner.
- B. Label each container with color, type, texture, and room locations, in addition to the manufacturer's label.

PART 2 PRODUCTS

- 2.1 MANUFACTURERS
 - A. Sherwin Williams.

- B. MAB.
- C. Benjamin Moore.
- D. Finnaren & Haley.

2.2 MATERIALS

- A. Coatings: Ready mixed, except field catalyzed coatings. Process pigments to a soft paste consistency, capable of being readily and uniformly dispersed to a homogeneous coating; good flow and brushing properties; capable of drying or curing free of streaks or sags.
- B. Accessory Materials: Linseed oil, shellac, turpentine, paint thinners and other materials not specifically indicated but required to achieve the finishes specified, of commercial quality.

2.3 FINISHES

A. Refer to schedule at end of section for surface finish schedule.

PART 3 EXECUTION

- 3.1 EXAMINATION
 - A. Verify site conditions.
 - B. Verify that surfaces and substrate conditions 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. Test shop applied primer for compatibility with subsequent cover materials.
 - E. Measure moisture content of surfaces using an electronic moisture meter. Do not apply finishes unless moisture content of surfaces are below the following maximums:
 - 1. Gypsum Wallboard: 12 percent.
 - 2. Interior Wood: 15 percent, measured in accordance with ASTM D2016.

3.2 PREPARATION

- A. Remove electrical plates, hardware, light fixture trim, escutcheons, and fittings prior to preparing surfaces or finishing.
- B. Correct defects and clean surfaces which affect work of this section.
- C. Seal with shellac and seal marks which may bleed through surface finishes.
- D. Impervious Surfaces: Remove mildew by scrubbing with solution of tri-sodium phosphate and bleach. Rinse with clean water and allow surface to dry.
- E. Gypsum Board Surfaces: Fill minor defects with filler compound. Spot prime defects after repair.
- F. Galvanized Surfaces: Remove surface contamination and oils and wash with solvent. Apply coat of etching primer.
- G. Uncoated Steel and Iron Surfaces: Remove grease, mill scale, weld splatter, dirt, and rust. Where heavy coatings of scale are evident, remove by power tool 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.
- H. Shop Primed Steel Surfaces: Sand and scrape to remove loose primer and rust.
 Feather edges to make touch-up patches inconspicuous. Clean surfaces with solvent.
 Prime bare steel surfaces.
- I. Clean and prepare all surfaces in accordance with manufacturer's written specifications.

3.3 APPLICATION

- A. Apply products in accordance with manufacturer's instructions.
- B. Do not apply finishes to surfaces that are not dry.
- C. Apply each coat to uniform finish.
- D. Apply each coat of paint slightly darker than preceding coat unless otherwise approved.
- E. Sand wood and metal lightly between coats to achieve required finish.
- F. Vacuum clean surfaces free of loose particles. Use tack cloth just prior to applying next coat.
- G. Allow applied coat to dry before next coat is applied.
- H. Where clear finishes are required, tint fillers to match wood. Work fillers into the grain before set. Wipe excess from surface.
- I. Prime concealed surfaces of interior woodwork scheduled to receive stain or varnish finish with gloss varnish reduced 25 percent with mineral spirits.
- J. Prime concealed surfaces of interior and exterior woodwork with primer paint.

3.4 CLEANING

A. Clean work.

B. Collect waste material which may constitute a fire hazard, place in closed metal containers and remove daily from site.

3.5 SCHEDULE - INTERIOR SURFACES

- A. Steel Unprimed:
 - 1. One coat of primer: Sherwin Williams: Pro Industrial Procryl Primer, B66-310.
 - 2. Two coats of flat finish: Sherwin Williams: Waterborne Acrylic Dry Fall B42 Series; flat; color to be selected.

- B. Steel Primed:
 - 1. One coat of primer: Sherwin Williams: Pro Industrial Procryl Primer, B66-310.
 - 2. Two coats of flat finish: Sherwin Williams: Waterborne Acrylic Dry Fall B42 Series; flat; color to be selected.
- C. Gypsum Board (Assume 4 colors):
 - 1. One coat of latex primer, Sherwin Williams: Pro Mar 200 Zero Voc Interior Latex Primer.
 - 2. Two coats of flat finish, Sherwin Williams: Promar 200 Zero VOC Interior Latex Flat.
- D. CMU (Assume 2 colors):
 - 1. One coat primer/void filler: Sherwin Williams Loxon Acrylic Block Surfacer.
 - 2. Two coats Pro Industrial Waterbased Catalyzed Epoxy Eg-shel.
- E. Steel Galvanized:
 - Two coats of flat finish: Sherwin Williams: Waterborne Acrylic Dry Fall B42 Series; flat; color to be selected. NOTE: No primer required at galvanized surfaces.

3.6 SCHEDULE - EXTERIOR SURFACES

- A. Steel Uprimed:
 - 1. One coat of primer: Sherwin Williams: Kembond HS Universal Primer, B50 Z.
 - 2. Two coats of gloss finish: Sherwin Williams: Pro Industrial Urethane Alkyd, B54-150.
- B. Steel Shop Primed:
 - 1. Touch-up with Sherwin Williams: Kembond HS Universal Primer, B50 Z.
 - 2. Two coats gloss finish: Sherwin Williams: Pro Industrial Urethane Alkyd, B54-150.
- C. Bituminous Concrete:
 - 1. One coat zone marking latex traffic paint (Vinyl acetate/acrylic latex) applied with spray or traffic line marker. (Provide tint for handicap markings.) Sherwin Williams: Hotline Fast Dry Latex Traffic Marking Paint, TM2152/2153.
- D. Steel Galvanized
 - 1. One coat of primer:
 - Sherwin Williams Macropoxy 646 Fast Cure Epoxy
 - 2. Two coats of High Solids Polyurethane 250 semigloss.

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

- 1. Factory built, surfaced metal markerboards and tack boards.
- 2. Trim, chalk rail, and accessories.

1.2 REFERENCES

- A. American Hardboard Association: AHA A135.4 Basic Hardboard.
- B. American Society for Testing and Materials:
 - 1. ASTM A424 Steel Sheets for Porcelain Enameling.
 - 2. ASTM B221 Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes, and Tubes.
 - 3. ASTM C208 Insulation Board (Cellulose Fiber) Structural and Decorative.
 - 4. ASTM E84 Test Method for Surface Burning Characteristics of Building Materials.
- C. Porcelain Enamel Institute: PEI Performance Specifications for Porcelain Enamel Chalkboards.

1.3 SUBMITTALS

- A. Submit under provisions of Division 1 General Requirements: Submittals
- B. Product Data: Provide data on marker boards, tack boards, tack board surface covering bulletin boards, trim and accessories.
- C. Samples: Submit two samples 6 x 6 inch in size illustrating materials and finish, color and texture of marker board, trim and tack board surfacing.

1.4 OPERATION AND MAINTENANCE DATA

A. Maintenance Data: Include data on regular cleaning and stain removal.

1.5 REGULATORY REQUIREMENTS

A. Conform to applicable code for flame/smoke rating for fabric covered tack boards in accordance with ASTM E84.

1.6 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.

1.7 FIELD MEASUREMENTS

A. Verify that field measurements are as indicated.

1.8 WARRANTY

A. Warranty: Include coverage of marker board surface from discoloration due to cleaning, crazing or cracking and staining.

PART 2 PRODUCTS

- 2.1 MANUFACTURERS MARKER BOARDS AND STANDARD TACKBOARDS
 - A. Claridge Products and Equipment, Inc .(Basis of Design).
 - B. Nelson Adams Corporation.
 - C. Polysivion Corp./Steelcase.
 - D. Or Approved Equal.

2.2 TACK BOARD/ MARKERBOARD

- A. Claridge; Series #5 or approved equal of the size and type as depicted on the drawings with the following features:
 - 1. Trim: 5/8" extruded aluminum etched and anodized in a clear satin finish.
 - 2. Markerboard: LCS 11 on 7/16" MDF with moisture barrier backing.
 - 3. Vinyl fabric on cork on 7/16" Duracore.
 - 4. Mitered corners.
 - 5. Hanger clips.
 - 6. Heavy-duty 3-1/4" aluminum chalk rail with end closures.
 - 7. 1" joint strips as applicable.

2.5 FINISHES

- A. Porcelain Enamel: Glass fibered enamel, baked to vitreous surfaces; White.
- B. Bulletin Board Surface: Fabric type vinyl. Color to be selected.
- C. Aluminum Frame Tack board, Chalk rail and Accessories: Mill finish natural aluminum anodized to satin finish.
- 2.6 ACCESSORIES
 - A. Cleaning Instruction Plate: Provide instructions for cleaning on a metal plate fastened to perimeter frame near chalk rail.

PART 3 EXECUTION

- 3.1 EXAMINATION
 - A. Verify site conditions under provisions of Division 1 General Requirements.
 - B. Verify flat wall surface for frameless adhesive applied type.
 - C. Verify locations and mounting heights with Owner.

3.2 INSTALLATION

- A. Install markerboards and bulletin boards in accordance with manufacturer's instructions.
- B. Secure units level and plumb.

3.5 CLEANING

- A. Clean work under provisions of Division 1 General Requirements.
- B. Clean surfaces in accordance with manufacturer's instructions.
- C. Remove temporary protective cover at date of Substantial Completion.

3.6 SCHEDULE

- A. See drawings (floor plans and interior elevations) for quantities, sizes, and locations.
- B. Plans indicate board lengths x 4'-0" High unless otherwise noted.

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Solid plastic polymer toilet stalls and doors, floor mounted, head rail braced.
 - 2. Hardware, etc.

1.2 REFERENCES

- A. American National Standards Institute: ANSI A117.1 Safety Standards for the Handicapped.
- B. American Society for Testing and Materials: ASTM A167 Stainless and Heat Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.
- C. FS RR-P-1352 Partitions, Toilet, Complete.

1.3 SUBMITTALS

- A. Shop Drawings: Indicate partition plan, elevation views, dimensions, details of wall and floor supports, door swings, etc.
- B. Product Data: Provide data on panel construction, hardware, and accessories.
- C. Manufacturer's Installation Instructions: Indicate special procedures, perimeter conditions requiring special attention.
- D. Provide color chart for use of the Architect.

1.4 FIELD MEASUREMENTS

A. Verify that field measurements are as indicated as on shop drawings.

PART 2 PRODUCTS

- 2.1 ACCEPTABLE MANUFACTURERS
 - A. Scranton Products (Hiny Hiders).
 - B. Or Approved Equal.

2.2 MATERIALS

- B. Panels shall be solid polymer resin nominal 1" thick by 55" high of required depth with uniformly machined radius edges. Panels shall be anchored to front pilasters with continuous panel height heavy duty plastic wall brackets. Panels shall be mounted 14" above finished floor.
- B. Doors shall be nominal 1" thick by 55" high. Doors shall be of the same design and construction as specified for panels. Doors shall be mounted 14" above finished floor.

- C. Pilasters shall be minimum 1" thick x 82" high and of the same design and construction as specified for panels and doors. Pilasters shall be mounted to the floor within a one piece plastic shoe and to the walls with continuous panel height plastic wall brackets. Head rail shall be extruded heavy aluminum type 6463-T5 alloy weighing no less than .75 pounds per linear foot of "Anti-Grip" design to cap top of pilasters.
- D. All hardware and fasteners required for a complete installation shall be furnished and be of tamper-proof type. Doors shall be hung on manufacturer's standard integral door hinge system.
- E. Coat Hook/Wall Bumper shall be heavy chrome with rubber bumper.
- F. Latch shall be slide bolt type with emergency access feature which shall not require lifting of the door. Door pull shall be chrome plated "U" shaped pull. Latch and pull shall be mounted 36" AFF.

2.3 FINISHING

- C. Materials shall be homogeneous polymer resin with uniform color throughout and special mar-resistant finish, in manufacturer's standard colors.
- B. Colors: To be selected by Architect from Classic Color Collection or Mosaic Color Collection.

PART 3 EXECUTION

- 3.1 EXAMINATION
 - D. Verify correct location of built-in framing, anchorage, and bracing.

3.2 INSTALLATION

- E. Install partitions secure, rigid, plumb, and level in accordance with manufacturer's instructions.
- F. Maintain 3/8 to 1/2 inch space between wall and panels and between wall and end pilasters.
- G. Attach panel brackets securely to walls using anchor devices.
- H. Provide adjustment for floor variations with screw jack through stainless steel saddles integral with pilaster.
- E. Replace damaged or scratched materials with new materials.

3.3 ERECTION TOLERANCES

- I. Maximum Variation From True Position: 1/4 inch.
- J. Maximum Variation From Plumb: 1/8 inch.

3.4 ADJUSTMENTS

K. Adjust and align hardware to uniform clearance at vertical edge of doors, not exceeding 3/16 inch.

- L. Adjust hinges to position doors in full closed position when unlatched.
- M. Adjust adjacent components for consistency of line or plane.

PART 1 GENERAL

1.1 SUMMARY

A. This section includes a ground-set aluminum flagpoles.

1.2 RELATED SECTIONS

- A. Section 033000 Cast-in-Place Concrete for concrete footings for flagpole.
- B Section 079000 Joint Sealants for elastomeric sealant filling the top of the foundation tube.

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 nylon or cotton flags of maximum standard size suitable for use with flagpole or flag size indicated, whichever is more stringent.
 - 2. Basic Wind Speed: 110 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. Structural Calculations: For flagpoles indicated to comply with design loads, include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
- D. 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 flagpole 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 FLAGPOLES

A. Manufacturers:

- 1. Acme Lingo Inc.
- 2. Concord Industries
- 3. Or approved equal.
- B. 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.
- C. Exposed Height: (2) at 25 feet and (1) at 30 feet.
- D. Aluminum Flagpoles: Provide entasis-tapered flagpoles fabricated from seamless extruded tubing complying with ASTM B 241/, Alloy 6063-T6, with a minimum wall thickness of 3/16 inch. Heat treated after fabrication to comply with ASTM B 597.
- E. Foundation Tube: Galvanized corrugated-steel foundation tube, 16GA. minimum nominal wall thickness. Provide with 3/16" steel bottom plate and support plate; welded to sleeve, 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 flash collar of same material and finish as flagpole.

2.2 FITTINGS

- A. Finial Ball: Manufacturer's standard flush-seam ball sized as indicated or if not indicated, to match flagpole butt diameter.
 - 1. 6 inch diameter at ball, 14 ga. Finish to match pole.
- B. Internal Halyard, Winch System or approved equal: Manually operated winch with control stop device and removable handle, stainless steel cable halyard and concealed revolving truck assembly with plastic-coated counterweight and sling. Provide flush access door secured with cylinder lock. Finish truck assembly to match flagpole.
- C. Halyard Flag Snaps: Provide two stainless-steel swivel snap hooks per halyard or approved equal.
 - 1. Provide with vinyl covers.
- D. Plastic Halyard Flag Clips: Made from injection molded, UV stabilized, acetal resin (Delrin) or approved equal. Clips attach to flag and have two eyes for inserting both runs of halyards. Provide two flag clips per halyard.

2.3 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: Multicomponent 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.

2.4 FINISHES

- A. Metal Finishes, General: Comply with NAAMM's "Metal Finished Manual for Architectural and Metal Products" for recommendations for applying and designation finished.
- B. Aluminum: Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finished.

PART 3 – EXECUTION

3.1 PREPARATION

- A. Prepare uncoated metal flagpoles that are set in foundation tubes by painting belowgrade 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 on civil drawings 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.

1GENERAL

- 1 SUMMARY
 - A. Section includes interior signs:
 - 1. Braille signs for offices with room name, number and insert channel.
 - 2. Braille signs for all other rooms with room name and number.
 - 3. Braille signs for restroom and locker room identification.
 - 4. Cast Aluminum Exterior Building Letters.
 - B. Related Sections:
 - 1. Section 092600 Gypsum Board Systems.

2 SUBMITTALS

A. Under provisions of Division 1 - General Requirements: Submittals.

B. Shop Drawings: Indicate sign styles, lettering font, foreground and background colors, locations and overall dimensions of each sign type.

C. Samples: Submit two signs, 6 x 6 inch in size illustrating type, style, letter font and method of attachment.

D. Manufacturer's Installation Instructions: Submit installation template and attachment devices.

E. Colors: Provide sample chips of standard color options.

3 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.

4 DELIVERY, STORAGE, AND HANDLING

- A. Package signs, labeled in name groups.
- B. Store adhesive attachment tape at ambient room temperatures.

5 ENVIRONMENTAL REQUIREMENTS

A. Do not install signs when ambient temperature is lower than recommended by manufacturer.

B. Maintain this minimum temperature during and after installation of signs.

1.6 STANDARDS

A. Signage shall consist of room number and function to meet the requirements of the Americans with Disabilities Act - 1990 (ADA).

2PRODUCTS

1 INTERIOR SIGNS

- A. Manufacturers:
 - 1. AGS Access Sign Systems Access Signature Interior Sign System.
 - 2. I Sign Case Aluminum Exterior Building Letters.
 - 3. Or approved equal.

2.2 GRAPHIC PROCESS

A. All interior signs shall be carved type.

1. Tactile characters shall be raised the required 1/32 inches from sign face. Glue on letters or etched backgrounds are not acceptable.

2. All text shall be accompanied by Grade 2 braille. Braille shall be separated ½" from the corresponding raised characters or symbols. Grade 2 braille translation to be provided by signage manufacturer.

3. All letters, numbers and/or symbols shall contrast with their background, either light characters on a dark background or dark characters on a light background. Characters and background shall have a non-glare finish.

B. Sign material shall be melamine plastic laminate, approximately 1/8" thick with contrasting core color. The melamine shall be non-static, fire-retardant and self-extinguishing. The plastic laminate is to be impervious to most acids, alkalies, alcohol, solvents, abrasives and boiling water.

- C. Size of letters and numbers shall be as follows:
 - 1. Room numbers shall be 1"or as recommended by sign manufacturer.
 - 2. Lettering for room names shall be 1" or as recommended by sign manufacturer.
 - 3. Symbol size shall be 4".
 - 4. Standard Grade 2 braille shall be $\frac{1}{2}$ " below copy.
 - 5. Font to be selected.
- D. Copy Position: Left justified.
- E. Selections may be changed and are for bidding purposes only. All colors to be selected.

2.3 SIGN SIZE

A. General Support room function signs; 8"x8"; sign model no. AX323 with room number, room name and grade 2 Braille.

B. Offices; sign model no. AX322 with room number, room name, occupant ID holder and Grade 2 Braille. Assume 8 for bidding purposes.

C. Restrooms; 8"x6"; sign model no. AX530 with a 4" accessibility or gender symbol and the verbal description placed directly below followed by Grade 2 Braille. Assume 6 for bidding purposes.

- D. Locker Rooms; 9"x6"; sign model no. AX540 with a 4" gender symbol and the verbal description placed directly below followed by Grade 2 Braille. Assume 2 for bidding purposes.
- E. Corners: square.

2.4 ACCESSORIES

A. Vinyl Tape Adhesive: Double sided tape, permanent adhesive and silicone adhesive as required.

- 2. BUILDING LETTERS
 - A. Material:
 - 1. 24" high, cast aluminum.
 - 2. **Futura Medium** (FOR BIDDING PURPOSES).
 - 3. Baked enamel finish.
 - 4. Text: "NEW JERSEY STATE POLICE" (two locations).

PART 3 EXECUTION

3.1 INTERIOR SIGN INSTALLATION

A. Install signs in accordance with manufacturer's instructions after doors and wall surfaces are finished, in locations as directed by Architect/Owner.

B. Locate centerline of signs 5 feet above finished floor.

C. Position sign 2 inches minimum from strike side of door; on door surface or adjacent wall, level.

3.2 BUILDING LETTERS

- A. Letters to be flush, stud mounted.
- B. Install where shown on Drawings. Verify with Architect.

PART 1 GENERAL

- 1.1 SECTION INCLUDES
 - A. Fire extinguishers.
 - B. Cabinets.
- 1.2 RELATED SECTIONS
 - A. Section 061140 Wood Blocking and Curbing: Wood blocking and shims.

1.3 REFERENCES

- A. ANSI/NFPA 10 Portable Fire Extinguishers.
- B. ANSI/UL 711 Rating and Fire Testing of Fire Extinguishers.
- C. UL 626 2 1/2 Gallon Stored Pressure, Water Type Fire Extinguishers.

1.4 SUBMITTALS

- A. Submit under provisions of Section 01300.
- B. Product Data: Provide extinguisher operational features, color and finish.
- C. Manufacturer's Installation Instructions: Indicate special criteria and wall opening coordination requirements.
- D. Manufacturer's Certificate: Certify that Products meet or exceed specified requirements.
- 1.5 OPERATION AND MAINTENANCE DATA
 - A. Maintenance Data: Include test, refill or recharge schedules and re-certification requirements.
- 1.6 REGULATORY REQUIREMENTS
 - A. Conform to applicable code ANSI/NFPA 10 for requirements for extinguishers.
- 1.7 ENVIRONMENTAL REQUIREMENTS
 - A. Do not install extinguishers when ambient temperature may cause freezing of extinguisher ingredients.

PART 2 PRODUCTS

- 2.1 MANUFACTURERS
 - J.L. Industries: Product Dry chemical extinguisher; Cosmic 10E with Cosmopolitan 1037 F10 semi-recessed cabinet; stainless steel trim and door; #4 finish; 2-1/2" rolled edge; Type FE-1.

B. Substitutions: Under provisions of Division 1.

2.2 EXTINGUISHERS

A. Dry Chemical Type: UL 299, Cast steel tank, with pressure gage; Class A, B, C, Size 10 lbs.

2.3 CABINETS

- A. Configuration: Semi-recessed type, exterior nominal frame dimensions of 13 inch wide x 26 inch high x 3-5/8 inch deep.
- B. Type: Returned to wall surface, with 2-1/2 inch projection.
- C. Door Glazing: Plastic, clear, 1/4" thick acrylic.
- D. Cabinet Mounting Hardware: Appropriate to cabinet.

PART 3 EXECUTION

- 3.1 EXAMINATION
 - A. Verify rough openings for cabinets are correctly sized and located.

3.2 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Install cabinets plumb and level in wall openings, 30 inches from finished floor to inside bottom of cabinet.
- C. Secure rigidly in place.
- D. Place extinguishers in cabinets and on wall brackets.

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Toilet and washroom accessories.
- B. Grab bars.
- C. Attachment hardware

1.2 RELATED SECTIONS

- A. Section 061000 Rough Carpentry.
- B Section 064100 Custom Casework.

1.3 REFERENCES

- A. ANSI A117.1 Safety Standards for the Handicapped.
- B. ASTM A123 Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
- C. ASTM A167 Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.
- D. ASTM A269 Seamless and Welded Austenitic Stainless Steel Tubing for General Service.
- E. ASTM A366 Steel, Carbon, Cold-Rolled Sheet, Commercial Quality.
- F. ASTM B456 Electrodeposited Coatings of Copper Plus Nickel Plus Chromium and Nickel Plus Chromium.

1.4 SUBMITTALS

- A. Submit under provisions of Division 1 General Requirements.
- B. Product Data: Provide data on accessories describing size, finish, details of function, attachment methods.
- C. Manufacturer's Installation Instructions: Indicate special procedures and perimeter conditions requiring special attention.

1.5 REGULATORY REQUIREMENTS

A. Conform to ANSI A117.1 code for access for the handicapped.

1.6 FIELD MEASUREMENTS

A. Verify that field measurements are as indicated on product data and instructed by the manufacturer.

1.7 COORDINATION

- A. Coordinate work under provisions of Division 1 General Requirements.
- B. Coordinate the work with the placement of internal wall reinforcement and reinforcement of toilet partitions to receive anchor attachments.

PART 2 PRODUCTS

- 2.1 MANUFACTURERS
 - A. Bobrick Accessories.
 - B. Koalakare Baby Changing Stations.
 - C. Substitutions: Under provisions of Division 1 General Requirements.

2.2 MATERIALS

- A. Sheet Steel: ASTM A366.
- B. Stainless Steel Sheet: ASTM A167, Type 304.
- C. Tubing: ASTM A269, stainless steel.
- D. Adhesive: Two component epoxy type, waterproof.
- E. Fasteners, Screws, and Bolts: Hot dip galvanized, tamper-proof.
- F. Expansion Shields: Fiber, lead, or rubber as recommended by accessory manufacturer for component and substrate.

2.3 FABRICATION

- A. Weld and grind joints of fabricated components, smooth.
- B. Form exposed surfaces from single sheet of stock, free of joints. Form surfaces flat without distortion. Maintain surfaces without scratches or dents.
- C. Fabricate grab bars of tubing, free of visible joints, return to wall with end attachment flanges. Form bar with minimum 1/2 inches clear of wall surface. Knurl grip surfaces.
- D. Shop assemble components and package complete with anchors and fittings.
- E. Provide steel anchor plates, adapters, and anchor components for installation.

2.4 KEYING

- A. Supply 3 keys for each accessory to Owner.
- B. Master key all accessories.

2.5 FINISHES

- A. Galvanizing: ASTM A123 to 1.25 oz/sq yd. Galvanize ferrous metal and fastening devices.
- B. Shop Primed Ferrous Metals: Pretreat and clean, spray apply one coat primer and bake.
- C. Chrome/Nickel Plating: ASTM B456, Type SC 2 satin finish.
- D. Stainless Steel: No. 4 satin luster finish.
- E. Back paint components where contact is made with building finishes to prevent electrolysis.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify site conditions under provisions of Division 1 General Requirements.
- B. Verify that site conditions are ready to receive work and dimensions are as indicated on shop drawings and instructed by the manufacturer.
- C. Verify exact location of accessories for installation.
- D. Contractor to verify all quantities prior to ordering.

3.2 PREPARATION

- A. Deliver inserts and rough-in frames to site for timely installation.
- B. Provide templates and rough-in measurements as required.

3.3 INSTALLATION

- A. Install accessories in accordance with manufacturers' instructions and ANSI A117.1.
- B. Install plumb and level, securely and rigidly anchored to substrate.
- C. Install Basic Guard in accordance with manufacturer's instructions. Cut to fit 30" wide sink space.
- 3.4 SCHEDULE
 - A. See Drawings for Accessory Schedule.

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Clutch operated shades.
 - 2. Two different fabrics with varying degrees of openness may be selected.

1.2 SUBMITTALS FOR REVIEW

- A. Submit under provisions of Division 1 Submittals: Procedures for submittals.
- B. Shop Drawings: Indicate opening sizes, tolerances required, method of attachment, clearances, and operation.
- C. Product Data: Provide data indicating physical and dimensional characteristics, operating features and finishes.
- D. Samples: Submit two samples, 6" x 6" long illustrating materials, finish and color.
- E. Manufacturer's Installation Instructions: Indicate special procedures, perimeter conditions requiring special attention.

1.3 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three years experience.
- B. Anti-Microbial characteristics: 'NoGrowth' per ASTM G 21 results for fungi ATCC9642, ATCC 9644, ATCC 9645.
- C. Mock-Up: Provide mock-up of one roller shade assembly of each type specified for evaluation of mounting, appearance and accessories.

1.4 PROJECT CONDITIONS

A. Take field measurements to determine sizes required.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Mecho Shade Systems Inc. Mecho shade 5 Eco Sheer 6850.
- B. Or approved equal.
- 2.2 SHADE COMPONENTS
 - A. Shade Fabric: Fire resistant, 100% polyester, openness factor of approximately 0%-1%, 8.8 oz./sq. yd; shade to extend from window head to stool; width to be mullion to mullion with hemmed edges and ½" gap.
 - B. Operation/Manual: Bead chain/clutch operator, high carbon steel and molded fiberglass reinforced polyester. Bead chain to be provided in lengths to suit location.

- C. Mounting: Jamb of window frame or head/soffit mounted with brackets or as required by manufacturer.
- D. Shade Orientation: Regular roll, shadecloth falls at window side of roller.
- E. Configuration:
 - 1. Single unit for windows up to 84 inches wide.
 - 2. Multiple units for windows over 84 inches wide; units to align with mullions.
- F. Housing Size: 3" x 3" maximum with fascia.
- G. Accessories:
 - 1. Single Fascia: One-piece extruded aluminum sized to meet application; finish to be selected.
 - 2. End caps. Sized to meet application.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that openings are ready to receive the work.
- B. Ensure structural supports are correctly placed.

3.2 INSTALLATION

- A. Install shades in accordance with manufacturer's instructions.
- B. Secure in place with fasteners.

3.3 INSTALLATION TOLERANCES

A. Maximum Offset from Level: 1/8 inch.

3.4 ADJUSTING

- A. Division 1 Contract Closeout: Adjusting installed work.
- B. Adjust blinds for smooth operation.
- 3.5 CLEANING
 - A. Submit under provisions of Division 1 Contract Closeout: Cleaning installed work.
- 3.6 SCHEDULE
 - A. For use at the following window types:1. Type A

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Piping materials and installation instructions common to most piping systems.
 - 2. Transition fittings.
 - 3. Dielectric fittings.
 - 4. Mechanical sleeve seals.
 - 5. Sleeves.
 - 6. Escutcheons.
 - 7. Grout.
 - 8. Equipment installation requirements common to equipment sections.
 - 9. Painting and finishing.
 - 10. Concrete bases.
 - 11. Supports and anchorages.

1.3 DEFINITIONS

- A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe chases, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.
- B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.
- C. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.
- D. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and in chases.
- E. Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.
- F. The following are industry abbreviations for plastic materials:
 - 1. ABS: Acrylonitrile-butadiene-styrene plastic.
 - 2. CPVC: Chlorinated polyvinyl chloride plastic.
 - 3. PE: Polyethylene plastic.
 - 4. PVC: Polyvinyl chloride plastic.
- G. The following are industry abbreviations for rubber materials:
 - 1. EPDM: Ethylene-propylene-diene terpolymer rubber.
 - 2. NBR: Acrylonitrile-butadiene rubber.

1.4 SUBMITTALS

- A. Product Data: For the following:
 - 1. Transition fittings.
 - 2. Dielectric fittings.
 - 3. Mechanical sleeve seals.
 - 4. Escutcheons.
- B. Welding certificates.

1.5 QUALITY ASSURANCE

- A. Steel Support Welding: Qualify processes and operators according to AWS D1.1, "Structural Welding Code--Steel."
- B. Steel Pipe Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."
 - 1. Comply with provisions in ASME B31 Series, "Code for Pressure Piping."
 - 2. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.
- C. Electrical Characteristics for Plumbing Equipment: Equipment of higher electrical characteristics may be furnished provided such proposed equipment is approved in writing and connecting electrical services, circuit breakers, and conduit sizes are appropriately modified. If minimum energy ratings or efficiencies are specified, equipment shall comply with requirements.
- D. The plumbing system shall comply with "The Reduction of Lead in Drinking Water Act (P.L. 111-380) which amends the Safe Drinking Water Act (42 USC 300g-6).
- E. The plumbing system shall comply with the current adopted plumbing code for this project site.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture.
- B. Store plastic pipes protected from direct sunlight. Support to prevent sagging and bending.

1.7 COORDINATION

- A. Arrange for pipe spaces, chases, slots, and openings in building structure during progress of construction, to allow for plumbing installations.
- B. Coordinate installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components as they are constructed.

C. Coordinate requirements for access panels and doors for plumbing items requiring access that are concealed behind finished surfaces. Access panels and doors are specified in Division 08 Section "Access Doors and Frames."

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for product selection:
 - 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the manufacturers specified.
- 2.2 PIPE, TUBE, AND FITTINGS
 - A. Refer to individual Division 22 piping Sections for pipe, tube, and fitting materials and joining methods.
 - B. Pipe Threads: ASME B1.20.1 for factory-threaded pipe and pipe fittings.

2.3 JOINING MATERIALS

- A. Refer to individual Division 22 piping Sections for special joining materials not listed below.
- B. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.
 - 1. ASME B16.21, nonmetallic, flat, asbestos-free, 1/8-inch maximum thickness unless thickness or specific material is indicated.
 - a. Full-Face Type: For flat-face, Class 125, cast-iron and cast-bronze flanges.
 - b. Narrow-Face Type: For raised-face, Class 250, cast-iron and steel flanges.
 - 2. AWWA C110, rubber, flat face, 1/8 inch thick, unless otherwise indicated; and fullface or ring type, unless otherwise indicated.
- C. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.
- D. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.
- E. Brazing Filler Metals: AWS A5.8, BCuP Series, copper-phosphorus alloys for generalduty brazing, unless otherwise indicated; and AWS A5.8, BAg1, silver alloy for refrigerant piping, unless otherwise indicated.
- F. Welding Filler Metals: Comply with AWS D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.
- G. Solvent Cements for Joining Plastic Piping:
 - 1. ABS Piping: ASTM D 2235.

- 2. CPVC Piping: ASTM F 493.
- 3. PVC Piping: ASTM D 2564. Include primer according to ASTM F 656.
- 4. PVC to ABS Piping Transition: ASTM D 3138.

2.4 TRANSITION FITTINGS

- A. AWWA Transition Couplings: Same size as, and with pressure rating at least equal to and with ends compatible with, piping to be joined.
 - 1. Available Manufacturers:
 - a. Cascade Waterworks Mfg. Co.
 - b. Dresser Industries, Inc.; DMD Div.
 - c. Ford Meter Box Company, Incorporated (The); Pipe Products Div.
 - d. JCM Industries.
 - e. Smith-Blair, Inc.
 - f. Viking Johnson.
 - 2. Underground Piping NPS 1-1/2 and Smaller: Manufactured fitting or coupling.
 - 3. Underground Piping NPS 2 and Larger: AWWA C219, metal sleeve-type coupling.
 - 4. Aboveground Pressure Piping: Pipe fitting.
- B. Plastic-to-Metal Transition Fittings: CPVC and PVC one-piece fitting with manufacturer's Schedule 80 equivalent dimensions; one end with threaded brass insert, and one solvent-cement-joint end.
 - 1. Available Manufacturers:
 - a. Eslon Thermoplastics.
- C. Plastic-to-Metal Transition Adaptors: One-piece fitting with manufacturer's SDR 11 equivalent dimensions; one end with threaded brass insert, and one solvent-cement-joint end.
 - 1. Available Manufacturers:
 - a. Thompson Plastics, Inc.
- D. Plastic-to-Metal Transition Unions: MSS SP-107, CPVC and PVC four-part union. Include brass end, solvent-cement-joint end, rubber O-ring, and union nut.
 - 1. Available Manufacturers:
 - a. NIBCO INC.
 - b. NIBCO, Inc.; Chemtrol Div.
- E. Flexible Transition Couplings for Underground Nonpressure Drainage Piping: ASTM C 1173 with elastomeric sleeve, ends same size as piping to be joined, and corrosion-resistant metal band on each end.
 - 1. Available Manufacturers:
 - a. Cascade Waterworks Mfg. Co.
 - b. Fernco, Inc.

- c. Mission Rubber Company.
- d. Plastic Oddities, Inc.

2.5 DIELECTRIC FITTINGS

- A. Description: Combination fitting of copper alloy and ferrous materials with threaded, solder-joint, plain, or weld-neck end connections that match piping system materials.
- B. Insulating Material: Suitable for system fluid, pressure, and temperature.
- C. Dielectric Unions: Factory-fabricated, union assembly, for 250-psig minimum working pressure at 180 deg F.
 - 1. Available Manufacturers:
 - a. Capitol Manufacturing Co.
 - b. Central Plastics Company.
 - c. Eclipse, Inc.
 - d. Epco Sales, Inc.
 - e. Hart Industries, International, Inc.
 - f. Watts Industries, Inc.; Water Products Div.
 - g. Zurn Industries, Inc.; Wilkins Div.
- D. Dielectric Flanges: Factory-fabricated, companion-flange assembly, for 150- or 300-psig minimum working pressure as required to suit system pressures.
 - 1. Available Manufacturers:
 - a. Capitol Manufacturing Co.
 - b. Central Plastics Company.
 - c. Epco Sales, Inc.
 - d. Watts Industries, Inc.; Water Products Div.
- E. Dielectric-Flange Kits: Companion-flange assembly for field assembly. Include flanges, full-face- or ring-type neoprene or phenolic gasket, phenolic or polyethylene bolt sleeves, phenolic washers, and steel backing washers.
 - 1. Available Manufacturers:
 - a. Advance Products & Systems, Inc.
 - b. Calpico, Inc.
 - c. Central Plastics Company.
 - d. Pipeline Seal and Insulator, Inc.
 - 2. Separate companion flanges and steel bolts and nuts shall have 150- or 300-psig minimum working pressure where required to suit system pressures.
- F. Dielectric Couplings: Galvanized-steel coupling with inert and noncorrosive, thermoplastic lining; threaded ends; and 300-psig minimum working pressure at 225 deg F.
 - 1. Available Manufacturers:
 - a. Calpico, Inc.

- b. Lochinvar Corp.
- G. Dielectric Nipples: Electroplated steel nipple with inert and noncorrosive, thermoplastic lining; plain, threaded, or grooved ends; and 300-psig minimum working pressure at 225 deg F.
 - 1. Available Manufacturers:
 - a. Perfection Corp.
 - b. Precision Plumbing Products, Inc.
 - c. Sioux Chief Manufacturing Co., Inc.
 - d. Victaulic Co. of America.

2.6 MECHANICAL SLEEVE SEALS

- A. Description: Modular sealing element unit, designed for field assembly, to fill annular space between pipe and sleeve.
 - 1. Available Manufacturers:
 - a. Advance Products & Systems, Inc.
 - b. Calpico, Inc.
 - c. Metraflex Co.
 - d. Pipeline Seal and Insulator, Inc.
 - 2. Sealing Elements: EPDM or NBR interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
 - 3. Pressure Plates: Stainless steel. Include two for each sealing element.
 - 4. Connecting Bolts and Nuts: Stainless steel of length required to secure pressure plates to sealing elements. Include one for each sealing element.

2.7 SLEEVES

- A. Galvanized-Steel Sheet: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.
- B. Steel Pipe: ASTM A 53, Type E, Grade B, Schedule 40, galvanized, plain ends.
- C. Cast Iron: Cast or fabricated "wall pipe" equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.
- D. Stack Sleeve Fittings: Manufactured, cast-iron sleeve with integral clamping flange. Include clamping ring and bolts and nuts for membrane flashing.
 - 1. Underdeck Clamp: Clamping ring with set screws.

2.8 ESCUTCHEONS

- A. Description: Manufactured wall and ceiling escutcheons and floor plates, with an ID to closely fit around pipe, tube, and insulation of insulated piping and an OD that completely covers opening.
- B. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with polished chromeplated finish.

- C. One-Piece, Cast-Brass Type: With set screw.
 - 1. Finish: Polished chrome-plated.
- D. Split-Casting, Cast-Brass Type: With concealed hinge and set screw.
 - 1. Finish: Polished chrome-plated.
- E. One-Piece, Stamped-Steel Type: With set screw and chrome-plated finish.
- F. Split-Plate, Stamped-Steel Type: With concealed hinge, set screw, and chrome-plated finish.
- G. One-Piece, Floor-Plate Type: Cast-iron floor plate.
- H. Split-Casting, Floor-Plate Type: Cast brass with concealed hinge and set screw.

2.9 GROUT

- A. Description: ASTM C 1107, Grade B, nonshrink and nonmetallic, dry hydraulic-cement grout.
 - 1. Characteristics: Post-hardening, volume-adjusting, nonstaining, noncorrosive, nongaseous, and recommended for interior and exterior applications.
 - 2. Design Mix: 5000-psi, 28-day compressive strength.
 - 3. Packaging: Premixed and factory packaged.

PART 3 - EXECUTION

3.1 PIPING SYSTEMS - COMMON REQUIREMENTS

- A. Install piping according to the following requirements and Division 22 Sections specifying piping systems.
- B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.
- C. Install piping in concealed locations, unless otherwise indicated and except in equipment rooms and service areas.
- D. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- F. Install piping to permit valve servicing.
- G. Install piping at indicated slopes.
- H. Install piping free of sags and bends.

- I. Install fittings for changes in direction and branch connections.
- J. Install piping to allow application of insulation.
- K. Select system components with pressure rating equal to or greater than system operating pressure.
- L. Install escutcheons for penetrations of walls, ceilings, and floors according to the following:
 - 1. New Piping:
 - a. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep-pattern type.
 - b. Chrome-Plated Piping: One-piece, cast-brass type with polished chromeplated finish.
 - c. Insulated Piping: One-piece, stamped-steel type, polished chrome-plated finish with spring clips.
 - d. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, cast-brass type with polished chrome-plated finish.
 - e. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece, castbrass type with polished chrome-plated finish and set screw.
 - f. Bare Piping in Unfinished Service Spaces: One-piece, cast-brass type with rough-brass finish and set screw.
 - g. Bare Piping in Equipment Rooms: One-piece, cast-brass type with set screw.
 - h. Bare Piping at Floor Penetrations in Equipment Rooms: One-piece, floorplate type.
- M. Sleeves are not required for core-drilled holes in walls only but are required in floors.
- N. Install sleeves for pipes passing through concrete and masonry walls and concrete floor and roof slabs.
- O. Install sleeves for pipes passing through concrete and masonry walls, gypsum-board partitions, and concrete floor and roof slabs.
 - 1. Cut sleeves to length for mounting flush with both surfaces.
 - a. Exception: Extend sleeves installed in floors 2 inches above finished floor level. Extend cast-iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified.
 - 2. Install sleeves in new walls and slabs as new walls and slabs are constructed.
 - 3. Install sleeves that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation. Use the following sleeve materials:
 - a. Steel Pipe Sleeves: For pipes smaller than NPS 6.
 - b. Steel Sheet Sleeves: For pipes NPS 6 and larger, penetrating gypsumboard partitions.
 - c. Stack Sleeve Fittings: For pipes penetrating floors with membrane waterproofing. Secure flashing between clamping flanges. Install section of cast-iron soil pipe to extend sleeve to 2 inches above finished floor level. Refer to Division 07 Section "Sheet Metal Flashing and Trim" for flashing.

- 1) Seal space outside of sleeve fittings with grout.
- 4. Except for underground wall penetrations, seal annular space between sleeve and pipe or pipe insulation, using joint sealants appropriate for size, depth, and location of joint. Refer to Division 07 Section "Joint Sealants" for materials and installation.
- P. Aboveground, Exterior-Wall Pipe Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.
 - 1. Install steel pipe for sleeves smaller than 6 inches in diameter.
 - 2. Install cast-iron "wall pipes" for sleeves 6 inches and larger in diameter.
 - 3. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.
- Q. Underground, Exterior-Wall Pipe Penetrations: Install cast-iron "wall pipes" for sleeves. Seal pipe penetrations using mechanical sleeve seals. Select sleeve size to allow for 1inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.
 - 1. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.
- R. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Refer to Division 07 Section "Penetration Firestopping" for materials.
- S. Verify final equipment locations for roughing-in.
- T. Refer to equipment specifications in other Sections of these Specifications for roughing-in requirements.

3.2 PIPING JOINT CONSTRUCTION

- A. Join pipe and fittings according to the following requirements and Division 22 Sections specifying piping systems.
- B. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
- C. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
- D. Soldered Joints: Apply ASTM B 813, water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook," using lead-free solder alloy complying with ASTM B 32.
- E. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter, using copper-phosphorus brazing filler metal complying with AWS A5.8.

- F. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
 - 1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
 - 2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.
- G. Welded Joints: Construct joints according to AWS D10.12, using qualified processes and welding operators according to Part 1 "Quality Assurance" Article.
- H. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.
- I. Plastic Piping Solvent-Cement Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:
 - 1. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.
 - 2. CPVC Piping: Join according to ASTM D 2846/D 2846M Appendix.
 - 3. PVC Pressure Piping: Join schedule number ASTM D 1785, PVC pipe and PVC socket fittings according to ASTM D 2672. Join other-than-schedule-number PVC pipe and socket fittings according to ASTM D 2855.
 - 4. PVC Nonpressure Piping: Join according to ASTM D 2855.

3.3 PIPING CONNECTIONS

- A. Make connections according to the following, unless otherwise indicated:
 - 1. Install unions, in piping NPS 2 and smaller, adjacent to each valve and at final connection to each piece of equipment.
 - 2. Install flanges, in piping NPS 2-1/2 and larger, adjacent to flanged valves and at final connection to each piece of equipment.
 - 3. Dry Piping Systems: Install dielectric unions and flanges to connect piping materials of dissimilar metals.
 - 4. Wet Piping Systems: Install dielectric coupling and nipple fittings to connect piping materials of dissimilar metals.

3.4 EQUIPMENT INSTALLATION - COMMON REQUIREMENTS

- A. Install equipment to allow maximum possible headroom unless specific mounting heights are not indicated.
- B. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.
- C. Install plumbing equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference to other installations. Extend grease fittings to accessible locations.
- D. Install equipment to allow right of way for piping installed at required slope.

3.5 PAINTING

- A. Painting of plumbing systems, equipment, and components is specified in Division 09 Sections "Interior Painting" and "Exterior Painting."
- B. Damage and Touchup: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.

3.6 CONCRETE BASES

- A. Concrete Bases: Anchor equipment to concrete base according to equipment manufacturer's written instructions and according to seismic codes at Project.
 - 1. Construct concrete bases of dimensions indicated, but not less than 4 inches larger in both directions than supported unit.
 - 2. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of the base.
 - 3. Install epoxy-coated anchor bolts for supported equipment that extend through concrete base, and anchor into structural concrete floor.
 - 4. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - 5. Install anchor bolts to elevations required for proper attachment to supported equipment.
 - 6. Install anchor bolts according to anchor-bolt manufacturer's written instructions.
 - 7. Use 3000-psi, 28-day compressive-strength concrete and reinforcement as specified in Division 03 Section "Miscellaneous Cast-in-Place Concrete."

3.7 ERECTION OF METAL SUPPORTS AND ANCHORAGES

- A. Refer to Division 05 Section "Metal Fabrications" for structural steel.
- B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor plumbing materials and equipment.
- C. Field Welding: Comply with AWS D1.1.

3.8 GROUTING

- A. Mix and install grout for plumbing equipment base bearing surfaces, pump and other equipment base plates, and anchors.
- B. Clean surfaces that will come into contact with grout.
- C. Provide forms as required for placement of grout.
- D. Avoid air entrapment during placement of grout.
- E. Place grout, completely filling equipment bases.
- F. Place grout on concrete bases and provide smooth bearing surface for equipment.
- G. Place grout around anchors.

H. Cure placed grout.

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. Thermometers.
 - 2. Gages.
 - 3. Test plugs.

1.3 DEFINITIONS

- A. CR: Chlorosulfonated polyethylene synthetic rubber.
- B. EPDM: Ethylene-propylene-diene terpolymer rubber.

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated; include performance curves.
- B. Shop Drawings: Schedule for thermometers and gages indicating manufacturer's number, scale range, and location for each.
- C. Product Certificates: For each type of thermometer and gage, signed by product manufacturer.

PART 2 - PRODUCTS

- 2.1 METAL-CASE, LIQUID-IN-GLASS THERMOMETERS
 - 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. Palmer Wahl Instruments Inc.
 - 2. Trerice, H. O. Co.
 - 3. Weiss Instruments, Inc.
 - 4. Weksler Instruments Operating Unit; Dresser Industries; Instrument Div.
 - B. Case: Chrome-plated brass, 7 inches long.
 - C. Tube: Red or blue reading, organic-liquid filled, with magnifying lens.
 - D. Tube Background: Satin-faced, nonreflective aluminum with permanently etched scale markings.
 - E. Window: Glass.

- F. Connector: Adjustable type, 180 degrees in vertical plane, 360 degrees in horizontal plane, with locking device.
- G. Stem: Copper-plated steel, aluminum, or brass for thermowell installation and of length to suit installation.
- H. Accuracy: Plus or minus 1 percent of range or plus or minus 1 scale division to maximum of 1.5 percent of range.

2.2 BIMETALLIC-ACTUATED DIAL THERMOMETERS

- 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. Tel-Tru Manufacturing Company.
 - 2. Trerice, H. O. Co.
 - 3. Weiss Instruments, Inc.
- B. Description: Direct-mounting, bimetallic-actuated dial thermometers complying with ASME B40.3.
- C. Case: Liquid-filled type, stainless steel with 5-inch diameter.
- D. Element: Bimetal coil.
- E. Dial: Satin-faced, nonreflective aluminum with permanently etched scale markings.
- F. Pointer: Black metal.
- G. Window: Glass.
- H. Ring: Stainless steel.
- I. Connector: Adjustable angle type.
- J. Stem: Metal, for thermowell installation and of length to suit installation.
- K. Accuracy: Plus or minus 1 percent of range or plus or minus 1 scale division to maximum of 1.5 percent of range.

2.3 THERMOWELLS

- 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. Tel-Tru Manufacturing Company.
 - 2. Trerice, H. O. Co.
 - 3. Weiss Instruments, Inc.
- B. Manufacturers: Same as manufacturer of thermometer being used.

C. Description: Pressure-tight, socket-type metal fitting made for insertion into piping and of type, diameter, and length required to hold thermometer.

2.4 PRESSURE GAGES

- 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. Palmer Wahl Instruments Inc.
 - 2. Trerice, H. O. Co.
 - 3. Weiss Instruments, Inc.
- B. Direct-Mounting, Dial-Type Pressure Gages: Indicating-dial type complying with ASME B40.100.
 - 1. Case: Liquid-filled type, drawn steel or cast aluminum 4-inch diameter.
 - 2. Pressure-Element Assembly: Bourdon tube, unless otherwise indicated.
 - 3. Pressure Connection: Brass, NPS 1/4, bottom-outlet type unless back-outlet type is indicated.
 - 4. Movement: Mechanical, with link to pressure element and connection to pointer.
 - 5. Dial: Satin-faced, nonreflective aluminum with permanently etched scale markings.
 - 6. Pointer: Black metal.
 - 7. Window: Glass.
 - 8. Ring: Stainless steel.
 - 9. Accuracy: Grade A, plus or minus 1 percent of middle half scale.
 - 10. Vacuum-Pressure Range: 30-in. Hg of vacuum to 15 psig of pressure.
 - 11. Range for Fluids under Pressure: Two times operating pressure.
- C. Pressure-Gage Fittings:
 - 1. Valves: NPS 1/4 brass or stainless-steel needle type.
 - 2. Snubbers: ASME B40.5, NPS 1/4 brass bushing with corrosion-resistant, porousmetal disc of material suitable for system fluid and working pressure.

2.5 TEST PLUGS

- 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. Sisco Manufacturing Co.
 - 2. Trerice, H. O. Co.
 - 3. Watts Industries, Inc.; Water Products Div.
- B. Description: Corrosion-resistant brass or stainless-steel body with core inserts and gasketed and threaded cap, with extended stem for units to be installed in insulated piping.
- C. Minimum Pressure and Temperature Rating: 500 psig at 200 deg F.
- D. Core Inserts: One or two self-sealing rubber valves.
- 1. Insert material for water service at 20 to 200 deg F shall be CR.
- 2. Insert material for water service at minus 30 to plus 275 deg F shall be EPDM.

PART 3 - EXECUTION

3.1 THERMOMETER APPLICATIONS

- A. Install liquid-in-glass bimetallic-actuated dial thermometers in the outlet of each domestic, hot-water storage tank.
- B. Install liquid-filled-case-type, bimetallic-actuated dial thermometers at suction and discharge of each pump.
- C. Provide the following temperature ranges for thermometers:
 - 1. Domestic Hot Water: 30 to 240 deg F, with 2-degree scale divisions.
 - 2. Domestic Cold Water: 0 to 100 deg F, with 2-degree scale divisions.

3.2 GAGE APPLICATIONS

- A. Install liquid-filled-case-type pressure gages for discharge of each pressure-reducing valve.
- B. Install liquid-filled-case-type pressure gages at suction and discharge of each pump.

3.3 INSTALLATIONS

- A. Install direct-mounting thermometers and adjust vertical and tilted positions.
- B. Install thermowells with socket extending to center of pipe and in vertical position in piping tees where thermometers are indicated.
- C. Install direct-mounting pressure gages in piping tees with pressure gage located on pipe at most readable position.
- D. Install needle-valve and snubber fitting in piping for each pressure gage.
- E. Install test plugs in tees in piping.
- F. Install permanent indicators on walls or brackets in accessible and readable positions.
- G. Install connection fittings for attachment to portable indicators in accessible locations.
- H. Install thermometers and gages adjacent to machines and equipment to allow service and maintenance for thermometers, gages, machines, and equipment.
- I. Adjust faces of thermometers and gages to proper angle for best visibility.

END OF SECTION

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. Brass ball valves.
 - 2. Bronze ball valves.
 - 3. Bronze lift check valves.
 - 4. Bronze swing check valves.
 - 5. Lubricated plug valves.
- B. Related Sections:
 - 1. Division 22 plumbing piping Sections for specialty valves applicable to those Sections only.
 - 2. Division 22 Section "Identification for Plumbing Piping and Equipment" for valve tags and schedules.

1.3 DEFINITIONS

- A. CWP: Cold working pressure.
- B. EPDM: Ethylene propylene copolymer rubber.
- C. NBR: Acrylonitrile-butadiene, Buna-N, or nitrile rubber.
- D. NRS: Nonrising stem.
- E. OS&Y: Outside screw and yoke.
- F. RS: Rising stem.
- G. SWP: Steam working pressure.

1.4 SUBMITTALS

A. Product Data: For each type of valve indicated.

1.5 QUALITY ASSURANCE

- A. Source Limitations for Valves: Obtain each type of valve from single source from single manufacturer.
- B. ASME Compliance:
 - 1. ASME B16.10 and ASME B16.34 for ferrous valve dimensions and design criteria.
 - 2. ASME B31.1 for power piping valves.
 - 3. ASME B31.9 for building services piping valves.

C. NSF Compliance: NSF 61 for valve materials for potable-water service.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Prepare valves for shipping as follows:
 - 1. Protect internal parts against rust and corrosion.
 - 2. Protect threads, flange faces, and weld ends.
 - 3. Set ball and plug valves open to minimize exposure of functional surfaces.
 - 4. Block check valves in either closed or open position.
- B. Use the following precautions during storage:
 - 1. Maintain valve end protection.
 - 2. Store valves indoors and maintain at higher than ambient dew point temperature. If outdoor storage is necessary, store valves off the ground in watertight enclosures.
- C. Use sling to handle large valves; rig sling to avoid damage to exposed parts. Do not use handwheels or stems as lifting or rigging points.

PART 2 - PRODUCTS

- 2.1 GENERAL REQUIREMENTS FOR VALVES
 - A. Refer to valve schedule articles for applications of valves.
 - B. Valve Pressure and Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.
 - C. Valve Sizes: Same as upstream piping unless otherwise indicated.
 - D. Valve Actuator Types:
 - 1. Gear Actuator: For quarter-turn valves NPS 8 and larger.
 - 2. Handwheel: For valves other than quarter-turn types.
 - 3. Handlever: For quarter-turn valves NPS 6 and smaller except plug valves.
 - 4. Wrench: For plug valves with square heads. Furnish Owner with 1 wrench for every 10 plug valves, for each size square plug-valve head.
 - E. Valves in Insulated Piping: With 2-inch stem extensions and the following features:
 - 1. Gate Valves: With rising stem.
 - 2. Ball Valves: With extended operating handle of non-thermal-conductive material, and protective sleeve that allows operation of valve without breaking the vapor seal or disturbing insulation.
 - F. Valve-End Connections:
 - 1. Flanged: With flanges according to ASME B16.1 for iron valves.
 - 2. Grooved: With grooves according to AWWA C606.
 - 3. Solder Joint: With sockets according to ASME B16.18.
 - 4. Threaded: With threads according to ASME B1.20.1.

G. Valve Bypass and Drain Connections: MSS SP-45.

2.2 BRASS BALL VALVES

- A. Two-Piece, Full-Port, Brass Ball Valves with Stainless-Steel Trim:
 - 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. Crane Co.; Crane Valve Group; Crane Valves.
 - b. Crane Co.; Crane Valve Group; Jenkins Valves.
 - c. Hammond Valve.
 - d. Milwaukee Valve Company.
 - 2. Description:
 - a. Standard: MSS SP-110.
 - b. SWP Rating: 150 psig.
 - c. CWP Rating: 600 psig.
 - d. Body Design: Two piece.
 - e. Body Material: Forged brass.
 - f. Ends: Threaded.
 - g. Seats: PTFE or TFE.
 - h. Stem: Stainless steel.
 - i. Ball: Stainless steel, vented.
 - j. Port: Full.
- B. Three-Piece, Full-Port, Brass Ball Valves with Stainless-Steel Trim:
 - 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. Jomar International, LTD.
 - b. Kitz Corporation.
 - c. Marwin Valve; a division of Richards Industries.
 - d. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
 - 2. Description:
 - a. Standard: MSS SP-110.
 - b. SWP Rating: 150 psig.
 - c. CWP Rating: 600 psig.
 - d. Body Design: Three piece.
 - e. Body Material: Forged brass.
 - f. Ends: Threaded.
 - g. Seats: PTFE or TFE.
 - h. Stem: Stainless steel.
 - i. Ball: Stainless steel, vented.
 - j. Port: Full.

2.3 BRONZE BALL VALVES

- A. Two-Piece, Full-Port, Bronze Ball Valves with Stainless-Steel Trim:
 - 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. Conbraco Industries, Inc.; Apollo Valves.
 - b. Crane Co.; Crane Valve Group; Crane Valves.
 - c. Hammond Valve.
 - d. Milwaukee Valve Company.
 - e. NIBCO INC.
 - f. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
 - 2. Description:
 - a. Standard: MSS SP-110.
 - b. SWP Rating: 150 psig (1035 kPa).
 - c. CWP Rating: 600 psig (4140 kPa).
 - d. Body Design: Two piece.
 - e. Body Material: Bronze.
 - f. Ends: Threaded.
 - g. Seats: PTFE or TFE.
 - h. Stem: Stainless steel.
 - i. Ball: Stainless steel, vented.
 - j. Port: Full.
- B. Three-Piece, Full-Port, Bronze Ball Valves with Stainless-Steel Trim:
 - 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. Conbraco Industries, Inc.; Apollo Valves.
 - b. Hammond Valve.
 - c. Milwaukee Valve Company.
 - d. NIBCO INC.
 - 2. Description:
 - a. Standard: MSS SP-110.
 - b. SWP Rating: 150 psig.
 - c. CWP Rating: 600 psig.
 - d. Body Design: Three piece.
 - e. Body Material: Bronze.
 - f. Ends: Threaded.
 - g. Seats: PTFE or TFE.
 - h. Stem: Stainless steel.
 - i. Ball: Stainless steel, vented.
 - j. Port: Full.

2.4 BRONZE LIFT CHECK VALVES

- A. Class 125, Lift Check Valves with Bronze Disc:
 - 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. Crane Co.; Crane Valve Group; Crane Valves.
 - b. Crane Co.; Crane Valve Group; Jenkins Valves.
 - c. Crane Co.; Crane Valve Group; Stockham Division.
 - 2. Description:
 - a. Standard: MSS SP-80, Type 1.
 - b. CWP Rating: 200 psig.
 - c. Body Design: Vertical flow.
 - d. Body Material: ASTM B 61 or ASTM B 62, bronze.
 - e. Ends: Threaded.
 - f. Disc: Bronze.
- B. Class 125, Lift Check Valves with Nonmetallic Disc:
 - 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. Hammond Valve.
 - b. Milwaukee Valve Company.
 - c. NIBCO INC.
 - d. Red-White Valve Corporation.
 - e. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
 - 2. Description:
 - a. Standard: MSS SP-80, Type 2.
 - b. CWP Rating: 200 psig.
 - c. Body Design: Vertical flow.
 - d. Body Material: ASTM B 61 or ASTM B 62, bronze.
 - e. Ends: Threaded.
 - f. Disc: NBR, PTFE, or TFE.

2.5 BRONZE SWING CHECK VALVES

- A. Class 125, Bronze Swing Check Valves with Bronze Disc:
 - 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. Crane Co.; Crane Valve Group; Crane Valves.
 - b. Crane Co.; Crane Valve Group; Jenkins Valves.
 - c. Crane Co.; Crane Valve Group; Stockham Division.
 - d. Hammond Valve.

- e. Milwaukee Valve Company.
- f. NIBCO INC.
- g. Red-White Valve Corporation.
- h. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
- 2. Description:
 - a. Standard: MSS SP-80, Type 3.
 - b. CWP Rating: 200 psig.
 - c. Body Design: Horizontal flow.
 - d. Body Material: ASTM B 62, bronze.
 - e. Ends: Threaded.
 - f. Disc: Bronze.
- B. Class 125, Bronze Swing Check Valves with Nonmetallic Disc:
 - 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. Crane Co.; Crane Valve Group; Crane Valves.
 - b. Crane Co.; Crane Valve Group; Jenkins Valves.
 - c. Crane Co.; Crane Valve Group; Stockham Division.
 - d. Hammond Valve.
 - e. Milwaukee Valve Company.
 - f. NIBCO INC.
 - g. Red-White Valve Corporation.
 - h. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
 - 2. Description:
 - a. Standard: MSS SP-80, Type 4.
 - b. CWP Rating: 200 psig.
 - c. Body Design: Horizontal flow.
 - d. Body Material: ASTM B 62, bronze.
 - e. Ends: Threaded.
 - f. Disc: PTFE or TFE.
- C. Class 150, Bronze Swing Check Valves with Bronze Disc:
 - 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. Crane Co.; Crane Valve Group; Crane Valves.
 - b. Crane Co.; Crane Valve Group; Jenkins Valves.
 - c. Crane Co.; Crane Valve Group; Stockham Division.
 - d. Milwaukee Valve Company.
 - e. NIBCO INC.
 - f. Red-White Valve Corporation.
 - 2. Description:
 - a. Standard: MSS SP-80, Type 3.

- b. CWP Rating: 300 psig.
- c. Body Design: Horizontal flow.
- d. Body Material: ASTM B 62, bronze.
- e. Ends: Threaded.
- f. Disc: Bronze.
- D. Class 150, Bronze Swing Check Valves with Nonmetallic Disc:
 - 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. Crane Co.; Crane Valve Group; Crane Valves.
 - b. Crane Co.; Crane Valve Group; Jenkins Valves.
 - c. Hammond Valve.
 - d. Milwaukee Valve Company.
 - e. NIBCO INC.
 - f. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
 - 2. Description:
 - a. Standard: MSS SP-80, Type 4.
 - b. CWP Rating: 300 psig.
 - c. Body Design: Horizontal flow.
 - d. Body Material: ASTM B 62, bronze.
 - e. Ends: Threaded.
 - f. Disc: PTFE or TFE.

2.6 LUBRICATED PLUG VALVES

- A. Class 125, Cylindrical, Lubricated Plug Valves with Threaded Ends:
 - 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. Homestead Valve; a division of Olson Technologies, Inc.
 - b. Milliken Valve Company.
 - c. R & M Energy Systems; a unit of Robbins & Myers, Inc.
 - 2. Description:
 - a. Standard: MSS SP-78, Type IV.
 - b. CWP Rating: 200 psig
 - c. Body Material: ASTM A 48/A 48M or ASTM A 126, cast iron with lubrication-sealing system.
 - d. Pattern: Regular or short Venturi.
 - e. Plug: Bronze with sealant groove.
- B. Class 125, Cylindrical, Lubricated Plug Valves with Flanged Ends:
 - 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. Homestead Valve; a division of Olson Technologies, Inc.
- b. Milliken Valve Company.
- c. R & M Energy Systems; a unit of Robbins & Myers, Inc.
- 2. Description:
 - a. Standard: MSS SP-78, Type IV.
 - b. CWP Rating: 200 psig.
 - c. Body Material: ASTM A 48/A 48M or ASTM A 126, cast iron with lubrication-sealing system.
 - d. Pattern: Regular or short Venturi.
 - e. Plug: Bronze with sealant groove.
- C. Class 250, Cylindrical, Lubricated Plug Valves with Threaded Ends:
 - 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. Homestead Valve; a division of Olson Technologies, Inc.
 - b. Milliken Valve Company.
 - c. R & M Energy Systems; a unit of Robbins & Myers, Inc.
 - 2. Description:
 - a. Standard: MSS SP-78, Type IV.
 - b. CWP Rating: 400 psig (2760 kPa).
 - c. Body Material: ASTM A 48/A 48M or ASTM A 126, cast iron with lubrication-sealing system.
 - d. Pattern: Regular or short Venturi.
 - e. Plug: Bronze with sealant groove.
- D. Class 250, Cylindrical, Lubricated Plug Valves with Flanged Ends:
 - 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. Homestead Valve; a division of Olson Technologies, Inc.
 - b. Milliken Valve Company.
 - c. R & M Energy Systems; a unit of Robbins & Myers, Inc.
 - 2. Description:
 - a. Standard: MSS SP-78, Type IV.
 - b. CWP Rating: 400 psig.
 - c. Body Material: ASTM A 48/A 48M or ASTM A 126, Grade 40 cast iron with lubrication-sealing system.
 - d. Pattern: Regular or short Venturi.
 - e. Plug: Bronze with sealant groove.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine valve interior for cleanliness, freedom from foreign matter, and corrosion. Remove special packing materials, such as blocks, used to prevent disc movement during shipping and handling.
- B. Operate valves in positions from fully open to fully closed. Examine guides and seats made accessible by such operations.
- C. Examine threads on valve and mating pipe for form and cleanliness.
- D. Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material. Verify that gasket is of proper size, that its material composition is suitable for service, and that it is free from defects and damage.
- E. Do not attempt to repair defective valves; replace with new valves.

3.2 VALVE INSTALLATION

- A. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.
- B. Locate valves for easy access and provide separate support where necessary.
- C. Install valves in horizontal piping with stem at or above center of pipe.
- D. Install valves in position to allow full stem movement.
- E. Install check valves for proper direction of flow and as follows:
 - 1. Swing Check Valves: In horizontal position with hinge pin level.
 - 2. Center-Guided and Plate-Type Check Valves: In horizontal or vertical position, between flanges.
 - 3. Lift Check Valves: With stem upright and plumb.

3.3 ADJUSTING

A. Adjust or replace valve packing after piping systems have been tested and put into service but before final adjusting and balancing. Replace valves if persistent leaking occurs.

3.4 GENERAL REQUIREMENTS FOR VALVE APPLICATIONS

- A. If valve applications are not indicated, use the following:
 - 1. Shutoff Service: Ball, gate, or plug valves.
 - 2. Throttling Service: Globe valves.
 - 3. Pump-Discharge Check Valves:
 - a. NPS 2 and Smaller: Bronze swing check valves with bronze or nonmetallic disc.

- B. If valves with specified SWP classes or CWP ratings are not available, the same types of valves with higher SWP classes or CWP ratings may be substituted.
- C. Select valves with the following end connections:
 - 1. For Copper Tubing, NPS 2 and Smaller: Threaded ends except where solder-joint valve-end option is indicated in valve schedules below.
 - 2. For Copper Tubing, NPS 2-1/2 to NPS 4: Flanged ends except where threaded valve-end option is indicated in valve schedules below.
 - 3. For Copper Tubing, NPS 5 and Larger: Flanged ends.
 - 4. For Steel Piping, NPS 2 and Smaller: Threaded ends.
 - 5. For Steel Piping, NPS 2-1/2 to NPS 4: Flanged ends except where threaded valve-end option is indicated in valve schedules below.
 - 6. For Steel Piping, NPS 5 and Larger: Flanged ends.

3.5 DOMESTIC, HOT- AND COLD-WATER VALVE SCHEDULE

- A. Pipe NPS 3 and Smaller:
 - 1. Bronze Valves: May be provided with solder-joint ends instead of threaded ends.
 - 2. Ball Valves: Two piece, full port, bronze with stainless-steel trim.
 - 3. Bronze Swing Check Valves: Class 150, bronze or nonmetallic disc.

END OF SECTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following hangers and supports for plumbing system piping and equipment:
 - 1. Steel pipe hangers and supports.
 - 2. Trapeze pipe hangers.
 - 3. Metal framing systems.
 - 4. Thermal-hanger shield inserts.
 - 5. Fastener systems.
 - 6. Pipe Stands
 - 7. Pipe positioning systems.
 - 8. Equipment supports.

1.3 DEFINITIONS

- A. MSS: Manufacturers Standardization Society for The Valve and Fittings Industry Inc.
- B. Terminology: As defined in MSS SP-90, "Guidelines on Terminology for Pipe Hangers and Supports."

1.4 PERFORMANCE REQUIREMENTS

- A. Design supports for multiple pipes, including pipe stands, capable of supporting combined weight of supported systems, system contents, and test water.
- B. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.
- C. Design seismic-restraint hangers and supports for piping and equipment and obtain approval from authorities having jurisdiction.

1.5 SUBMITTALS

- A. Product Data: For the following:
 - 1. Steel pipe hangers and supports.
 - 2. Thermal-hanger shield inserts.
 - 3. Powder-actuated fastener systems.
 - 4. Pipe positioning systems.
- B. Shop Drawings Signed and sealed by a qualified professional engineer. Show fabrication and installation details and include calculations for the following:
 - 1. Trapeze pipe hangers. Include Product Data for components.
 - 2. Metal framing systems. Include Product Data for components.
 - 3. Equipment supports.

C. Welding certificates.

1.6 QUALITY ASSURANCE

- A. Welding: Qualify procedures and personnel according to AWS D1.1, "Structural Welding Code--Steel." AWS D1.4, "Structural Welding Code--Reinforcing Steel." and ASME Boiler and Pressure Vessel Code: Section IX.
- B. Welding: Qualify procedures and personnel according to the following:
 - 1. AWS D1.1, "Structural Welding Code--Steel."
 - 2. AWS D1.2, "Structural Welding Code--Aluminum."
 - 3. AWS D1.4, "Structural Welding Code--Reinforcing Steel."
 - 4. ASME Boiler and Pressure Vessel Code: Section IX.

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.
- 2.2 STEEL PIPE HANGERS AND SUPPORTS
 - A. Description: MSS SP-58, Types 1 through 58, factory-fabricated components. Refer to Part 3 "Hanger and Support Applications" Article for where to use specific hanger and support types.
 - B. Available Manufacturers:
 - 1. B-Line Systems, Inc.; a division of Cooper Industries.
 - 2. Empire Industries, Inc.
 - 3. ERICO/Michigan Hanger Co.
 - 4. Globe Pipe Hanger Products, Inc.
 - 5. Anvil Corp.
 - 6. GS Metals Corp.
 - 7. National Pipe Hanger Corporation.
 - 8. PHD Manufacturing, Inc.
 - 9. PHS Industries, Inc.
 - 10. Piping Technology & Products, Inc.
 - C. Galvanized, Metallic Coatings: Pregalvanized or hot dipped.
 - D. Nonmetallic Coatings: Plastic coating, jacket, or liner.
 - E. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion for support of bearing surface of piping.

2.3 TRAPEZE PIPE HANGERS

A. Description: MSS SP-69, Type 59, shop- or field-fabricated pipe-support assembly made from structural-steel shapes with MSS SP-58 hanger rods, nuts, saddles, and U-bolts

2.4 METAL FRAMING SYSTEMS

- A. Description: MFMA-3, shop- or field-fabricated pipe-support assembly made of steel channels and other components.
- B. Available Manufacturers:
 - 1. B-Line Systems, Inc.; a division of Cooper Industries.
 - 2. ERICO/Michigan Hanger Co.; ERISTRUT Div.
 - 3. GS Metals Corp.
 - 4. Power-Strut Div.; Tyco International, Ltd.
 - 5. Unistrut Corp.; Tyco International, Ltd.
- C. Coatings: Manufacturer's standard finish unless bare metal surfaces are indicated.
- D. Nonmetallic Coatings: Plastic coating, jacket, or liner.

2.5 THERMAL-HANGER SHIELD INSERTS

- A. Description: 100-psig- minimum, compressive-strength insulation insert encased in sheet metal shield.
- B. Available Manufacturers:
 - 1. Carpenter & Paterson, Inc.
 - 2. ERICO/Michigan Hanger Co.
 - 3. PHS Industries, Inc.
 - 4. Pipe Shields, Inc.
 - 5. Rilco Manufacturing Company, Inc.
- C. Insulation-Insert Material for Cold Piping: Water-repellent treated, ASTM C 533, Type I calcium silicate or ASTM C 552, Type II cellular glass with vapor barrier.
- D. Insulation-Insert Material for Hot Piping: Water-repellent treated, ASTM C 533, Type I calcium silicate or ASTM C 552, Type II cellular glass.
- E. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.
- F. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.
- G. Insert Length: Extend 2 inches beyond sheet metal shield for piping operating below ambient air temperature.

2.6 FASTENER SYSTEMS

A. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

- 1. Available Manufacturers:
 - a. Hilti, Inc.
 - b. ITW Ramset/Red Head.
 - c. Masterset Fastening Systems, Inc.
 - d. MKT Fastening, LLČ.
 - e. Powers Fasteners.
- B. Mechanical-Expansion Anchors: Insert-wedge-type stainless steel, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.
 - 1. Available Manufacturers:
 - a. B-Line Systems, Inc.; a division of Cooper Industries.
 - b. Empire Industries, Inc.
 - c. Hilti, Inc.
 - d. ITW Ramset/Red Head.
 - e. MKT Fastening, LLC.
 - f. Powers Fasteners.

2.7 PIPE STAND FABRICATION

- A. Pipe Stands, General: Shop or field-fabricated assemblies made of manufactured corrosion-resistant components to support roof-mounted piping.
- B. Compact Pipe Stand: One-piece plastic unit with integral-rod-roller, pipe clamps, or Vshaped cradle to support pipe, for roof installation without membrane penetration.
 - 1. Available Manufacturers:
 - a. ERICO/Michigan Hanger Co.
 - b. MIRO Industries.
- C. Low-Type, Single-Pipe Stand: One-piece stainless-steel base unit with plastic roller, for roof installation without membrane penetration.
 - 1. Available Manufacturers:
 - a. MIRO Industries.

2.8 PIPE POSITIONING SYSTEMS

- A. Description: IAPMO PS 42, system of metal brackets, clips, and straps for positioning piping in pipe spaces for plumbing fixtures for commercial applications.
- B. Available Manufacturers:
 - 1. C & S Mfg. Corp.
 - 2. HOLDRITE Corp.; Hubbard Enterprises.
 - 3. Samco Stamping, Inc.

2.9 EQUIPMENT SUPPORTS

A. Description: Welded, shop- or field-fabricated equipment support made from structuralsteel shapes.

2.10 MISCELLANEOUS MATERIALS

- A. Structural Steel: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.
- B. Grout: ASTM C 1107, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout; suitable for interior and exterior applications.
 - 1. Properties: Nonstaining, noncorrosive, and nongaseous.
 - 2. Design Mix: 5000-psi, 28-day compressive strength.

PART 3 - EXECUTION

3.1 HANGER AND SUPPORT APPLICATIONS

- A. Specific hanger and support requirements are specified in Sections specifying piping systems and equipment.
- B. Comply with MSS SP-69 for pipe hanger selections and applications that are not specified in piping system Sections.
- C. Use hangers and supports with galvanized, metallic coatings for piping and equipment that will not have field-applied finish.
- D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.
- E. Use padded hangers for piping that is subject to scratching.
- F. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
 - 1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated stationary pipes, NPS 1/2 to NPS 30.
 - 2. Yoke-Type Pipe Clamps (MSS Type 2): For suspension of 120 to 450 deg F pipes, NPS 4 to NPS 16, requiring up to 4 inches (100 mm) of insulation.
 - 3. Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension of pipes, NPS 3/4 to NPS 24, requiring clamp flexibility and up to 4 inches of insulation.
 - 4. Steel Pipe Clamps (MSS Type 4): For suspension of cold and hot pipes, NPS 1/2 to NPS 24, if little or no insulation is required.
 - 5. Pipe Hangers (MSS Type 5): For suspension of pipes, NPS 1/2 to NPS 4, to allow off-center closure for hanger installation before pipe erection.
 - 6. Adjustable, Swivel Split- or Solid-Ring Hangers (MSS Type 6): For suspension of noninsulated stationary pipes, NPS 3/4 to NPS 8.
 - 7. Adjustable, Steel Band Hangers (MSS Type 7): For suspension of noninsulated stationary pipes, NPS 1/2 to NPS 8.
 - 8. Adjustable Band Hangers (MSS Type 9): For suspension of noninsulated stationary pipes, NPS 1/2 to NPS 8.

- 9. Adjustable, Swivel-Ring Band Hangers (MSS Type 10): For suspension of noninsulated stationary pipes, NPS 1/2 to NPS 2.
- 10. Split Pipe-Ring with or without Turnbuckle-Adjustment Hangers (MSS Type 11): For suspension of noninsulated stationary pipes, NPS 3/8 to NPS 8.
- 11. Extension Hinged or 2-Bolt Split Pipe Clamps (MSS Type 12): For suspension of noninsulated stationary pipes, NPS 3/8 to NPS 3.
- 12. U-Bolts (MSS Type 24): For support of heavy pipes, NPS 1/2 to NPS 30.
- 13. Clips (MSS Type 26): For support of insulated pipes not subject to expansion or contraction.
- 14. Pipe Saddle Supports (MSS Type 36): For support of pipes, NPS 4 to NPS 36, with steel pipe base stanchion support and cast-iron floor flange.
- 15. Pipe Stanchion Saddles (MSS Type 37): For support of pipes, NPS 4 to NPS 36, with steel pipe base stanchion support and cast-iron floor flange and with U-bolt to retain pipe.
- 16. Adjustable, Pipe Saddle Supports (MSS Type 38): For stanchion-type support for pipes, NPS 2-1/2 to NPS 36, if vertical adjustment is required, with steel pipe base stanchion support and cast-iron floor flange.
- 17. Single Pipe Rolls (MSS Type 41): For suspension of pipes, NPS 1 to NPS 30, from 2 rods if longitudinal movement caused by expansion and contraction might occur.
- 18. Adjustable Roller Hangers (MSS Type 43): For suspension of pipes, NPS 2-1/2 to NPS 20, from single rod if horizontal movement caused by expansion and contraction might occur.
- 19. Complete Pipe Rolls (MSS Type 44): For support of pipes, NPS 2 to NPS 42, if longitudinal movement caused by expansion and contraction might occur but vertical adjustment is not necessary.
- 20. Pipe Roll and Plate Units (MSS Type 45): For support of pipes, NPS 2 to NPS 24, if small horizontal movement caused by expansion and contraction might occur and vertical adjustment is not necessary.
- 21. Adjustable Pipe Roll and Base Units (MSS Type 46): For support of pipes, NPS 2 to NPS 30, if vertical and lateral adjustment during installation might be required in addition to expansion and contraction.
- G. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
 - 1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers, NPS 3/4 to NPS 20.
 - 2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers, NPS 3/4 to NPS 20, if longer ends are required for riser clamps.
- H. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
 - 1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches for heavy loads.
 - 2. Steel Clevises (MSS Type 14): For 120 to 450 deg F piping installations.
 - 3. Swivel Turnbuckles (MSS Type 15): For use with MSS Type 11, split pipe rings.
 - 4. Malleable-Iron Sockets (MSS Type 16): For attaching hanger rods to various types of building attachments.
 - 5. Steel Weldless Eye Nuts (MSS Type 17): For 120 to 450 deg F piping installations.
- I. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

- 1. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
- 2. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with barjoist construction to attach to top flange of structural shape.
- 3. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
- 4. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
- 5. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
- 6. C-Clamps (MSS Type 23): For structural shapes.
- 7. Top-Beam Clamps (MSS Type 25): For top of beams if hanger rod is required tangent to flange edge.
- 8. Side-Beam Clamps (MSS Type 27): For bottom of steel I-beams.
- 9. Steel-Beam Clamps with Eye Nuts (MSS Type 28): For attaching to bottom of steel I-beams for heavy loads.
- 10. Linked-Steel Clamps with Eye Nuts (MSS Type 29): For attaching to bottom of steel I-beams for heavy loads, with link extensions.
- 11. Malleable Beam Clamps with Extension Pieces (MSS Type 30): For attaching to structural steel.
- 12. Welded-Steel Brackets: For support of pipes from below, or for suspending from above by using clip and rod. Use one of the following for indicated loads:
 - a. Light (MSS Type 31): 750 lb.
 - b. Medium (MSS Type 32): 1500 lb.
 - c. Heavy (MSS Type 33): 3000 lb
 - d. de-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
- 13. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.
- 14. Horizontal Travelers (MSS Type 58): For supporting piping systems subject to linear horizontal movement where headroom is limited.
- J. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
 - 1. Steel Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.
 - 2. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.
 - 3. Thermal-Hanger Shield Inserts: For supporting insulated pipe.
- K. Spring Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
 - 1. Restraint-Control Devices (MSS Type 47): Where indicated to control piping movement.
 - 2. Spring Cushions (MSS Type 48): For light loads if vertical movement does not exceed 1-1/4 inches (32 mm).
 - 3. Spring-Cushion Roll Hangers (MSS Type 49): For equipping Type 41 roll hanger with springs.
 - 4. Spring Sway Braces (MSS Type 50): To retard sway, shock, vibration, or thermal expansion in piping systems.

- 5. Variable-Spring Hangers (MSS Type 51): Preset to indicated load and limit variability factor to 25 percent to absorb expansion and contraction of piping system from hanger.
- 6. Variable-Spring Base Supports (MSS Type 52): Preset to indicated load and limit variability factor to 25 percent to absorb expansion and contraction of piping system from base support.
- 7. Variable-Spring Trapeze Hangers (MSS Type 53): Preset to indicated load and limit variability factor to 25 percent to absorb expansion and contraction of piping system from trapeze support.
- 8. Constant Supports: For critical piping stress and if necessary to avoid transfer of stress from one support to another support, critical terminal, or connected equipment. Include auxiliary stops for erection, hydrostatic test, and load-adjustment capability. These supports include the following types:
 - a. Horizontal (MSS Type 54): Mounted horizontally.
 - b. Vertical (MSS Type 55): Mounted vertically.
 - c. Trapeze (MSS Type 56): Two vertical-type supports and one trapeze member.
- L. Comply with MSS SP-69 for trapeze pipe hanger selections and applications that are not specified in piping system Sections.
- M. Comply with MFMA-102 for metal framing system selections and applications that are not specified in piping system Sections.
- N. Use powder-actuated fasteners or mechanical-expansion anchors instead of building attachments where required in concrete construction.
- O. Use pipe positioning systems in pipe spaces behind plumbing fixtures to support supply and waste piping for plumbing fixtures.

3.2 HANGER AND SUPPORT INSTALLATION

- A. Steel Pipe Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from building structure.
- B. Trapeze Pipe Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Arrange for grouping of parallel runs of horizontal piping and support together on field-fabricated trapeze pipe hangers.
 - 1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified above for individual pipe hangers.
 - 2. Field fabricate from ASTM A 36/A 36M, steel shapes selected for loads being supported. Weld steel according to AWS D1.1.
- C. Metal Framing System Installation: Arrange for grouping of parallel runs of piping and support together on field-assembled metal framing systems.
- D. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.
- E. Fastener System Installation:

- 1. Install powder-actuated fasteners for use in lightweight concrete or concrete slabs less than 4 inches thick in concrete after concrete is placed and completely cured. Use operators that are licensed by powder-actuated tool manufacturer. Install fasteners according to powder-actuated tool manufacturer's operating manual.
- 2. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.
- F. Pipe Stand Installation:
 - 1. Pipe Stand Type: Assemble components and mount on smooth roof surface. Do not penetrate roof membrane.
- G. Pipe Positioning System Installation: Install support devices to make rigid supply and waste piping connections to each plumbing fixture. Refer to Division 22 Section "Plumbing Fixtures" for plumbing fixtures.
- H. Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers, and other accessories.
- I. Equipment Support Installation: Fabricate from welded-structural-steel shapes.
- J. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.
- K. Install lateral bracing with pipe hangers and supports to prevent swaying.
- L. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, NPS 2-1/2 and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.
- M. Load Distribution: Install hangers and supports so piping live and dead loads and stresses from movement will not be transmitted to connected equipment.
- N. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and so maximum pipe deflections allowed by ASME B31.9 (for building services piping) are not exceeded.
- O. Insulated Piping: Comply with the following:
 - 1. Attach clamps and spacers to piping.
 - a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.
 - b. Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.
 - c. Do not exceed pipe stress limits according to ASME B31.9 for building services piping.
 - 2. Install MSS SP-58, Type 39, protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.

- a. Option: Thermal-hanger shield inserts may be used. Include steel weightdistribution plate for pipe NPS 4 and larger if pipe is installed on rollers.
- 3. Install MSS SP-58, Type 40, protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.
 - a. Option: Thermal-hanger shield inserts may be used. Include steel weightdistribution plate for pipe NPS 4 and larger if pipe is installed on rollers.
- 4. Shield Dimensions for Pipe: Not less than the following:
 - a. NPS 1/4 to NPS 3-1/2: 12 inches long and 0.048 inch thick.
 - b. NPS 4: 12 inches long and 0.06 inch thick.
 - c. NPS 5 and NPS 6: 18 inches long and 0.06 inch thick.
 - d. NPS 8 to NPS 14: 24 inches long and 0.075 inch thick.
 - e. NPS 16 to NPS 24: 24 inches long and 0.105 inch thick.
- 5. Insert Material: Length at least as long as protective shield.
- 6. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

3.3 EQUIPMENT SUPPORTS

- A. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor.
- B. Grouting: Place grout under supports for equipment and make smooth bearing surface.
- C. Provide lateral bracing, to prevent swaying, for equipment supports.

3.4 METAL FABRICATIONS

- A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers and equipment supports.
- B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.
- C. Field Welding: Comply with AWS D1.1 procedures for shielded metal arc welding, appearance and quality of welds, and methods used in correcting welding work, and with the following:
 - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - 2. Obtain fusion without undercut or overlap.
 - 3. Remove welding flux immediately.
 - 4. Finish welds at exposed connections so no roughness shows after finishing and contours of welded surfaces match adjacent contours.

3.5 ADJUSTING

A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.

B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches.

3.6 PAINTING

- A. Touch Up: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.
 - 1. Apply paint by brush or spray to provide minimum dry film thickness of 2.0 mils.
- B. Touch Up: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal are specified in Division 09 painting Sections.
- C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END OF SECTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Equipment labels.
 - 2. Warning signs and labels.
 - 3. Pipe labels.
 - 4. Valve tags.
 - 5. Warning tags.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Samples: For color, letter style, and graphic representation required for each identification material and device.
- C. Equipment Label Schedule: Include a listing of all equipment to be labeled with the proposed content for each label.
- D. Valve numbering scheme.
- E. Valve Schedules: For each piping system to include in maintenance manuals.

1.4 COORDINATION

- A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.
- B. Coordinate installation of identifying devices with locations of access panels and doors.
- C. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2 - PRODUCTS

2.1 EQUIPMENT LABELS

- A. Metal Labels for Equipment:
 - 1. Material and Thickness: Brass, 0.032-inch minimum thickness, and having predrilled or stamped holes for attachment hardware.
 - 2. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
 - 3. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.

- 4. Fasteners: Stainless-steel rivets.
- 5. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
- B. Label Content: Include equipment's Drawing designation or unique equipment number, Drawing numbers where equipment is indicated (plans, details, and schedules), plus the Specification Section number and title where equipment is specified.
- C. Equipment Label Schedule: For each item of equipment to be labeled, on 8-1/2-by-11inch (A4) bond paper. Tabulate equipment identification number and identify Drawing numbers where equipment is indicated (plans, details, and schedules), plus the Specification Section number and title where equipment is specified. Equipment schedule shall be included in operation and maintenance data.

2.2 WARNING SIGNS AND LABELS

- A. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch thick, and having predrilled holes for attachment hardware.
- B. Letter Color: Black.
- C. Background Color: White.
- D. Maximum Temperature: Able to withstand temperatures up to 160 deg F.
- E. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
- F. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
- G. Fasteners: Stainless-steel rivets.
- H. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
- I. Label Content: Include caution and warning information, plus emergency notification instructions.

2.3 PIPE LABELS

- A. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction.
- B. Pretensioned Pipe Labels: Precoiled, semirigid plastic formed to cover full circumference of pipe and to attach to pipe without fasteners or adhesive.
- C. Self-Adhesive Pipe Labels: Printed plastic with contact-type, permanent-adhesive backing.
- D. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings, pipe size, and an arrow indicating flow direction.

- 1. Flow-Direction Arrows: Integral with piping system service lettering to accommodate both directions, or as separate unit on each pipe label to indicate flow direction.
- 2. Lettering Size: At least 1-1/2 inches high.

2.4 VALVE TAGS

- A. Valve Tags: Stamped or engraved with 1/4-inch letters for piping system abbreviation and 1/2-inch numbers.
 - 1. Tag Material: Brass, 0.032-inch minimum thickness, and having predrilled or stamped holes for attachment hardware.
 - 2. Fasteners: Brass S-hook.
- B. Valve Schedules: For each piping system, on 8-1/2-by-11-inch (A4) bond paper. Tabulate valve number, piping system, system abbreviation (as shown on valve tag), location of valve (room or space), normal-operating position (open, closed, or modulating), and variations for identification. Mark valves for emergency shutoff and similar special uses.
 - 1. Valve-tag schedule shall be included in operation and maintenance data.

2.5 WARNING TAGS

- A. Warning Tags: Preprinted or partially preprinted, accident-prevention tags, of plasticized card stock with matte finish suitable for writing.
 - 1. Size: 3 by 5-1/4 inches minimum.
 - 2. Fasteners: Brass grommet and wire.
 - 3. Nomenclature: Large-size primary caption such as "DANGER," "CAUTION," or "DO NOT OPERATE."
 - 4. Color: Yellow background with black lettering.

PART 3 - EXECUTION

- 3.1 PREPARATION
 - A. Clean piping and equipment surfaces of substances that could impair bond of identification devices, including dirt, oil, grease, release agents, and incompatible primers, paints, and encapsulants.
- 3.2 EQUIPMENT LABEL INSTALLATION
 - A. Install or permanently fasten labels on each major item of mechanical equipment.
 - B. Locate equipment labels where accessible and visible.

3.3 PIPE LABEL INSTALLATION

A. Piping Color-Coding: Painting of piping is specified in Division 09 Section "Interior Painting."

- B. Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:
 - 1. Near each valve and control device.
 - 2. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.
 - 3. Near penetrations through walls, floors, ceilings, and inaccessible enclosures.
 - 4. At access doors, manholes, and similar access points that permit view of concealed piping.
 - 5. Near major equipment items and other points of origination and termination.
 - 6. Spaced at maximum intervals of 20 feet along each run. Reduce intervals to 10 feet in areas of congested piping and equipment.
- C. Pipe Label Color Schedule:
 - 1. Domestic Water Piping:
 - a. Background Color: Green.
 - b. Letter Color: White.
 - 2. Sanitary Waste and Vent Piping:
 - a. Background Color: Orange.
 - b. Letter Color: Black.
 - 3. Storm Drainage Piping:
 - a. Background Color: White.
 - b. Letter Color: Black.
 - 4. Natural Gas Piping:
 - a. Background Color: Yellow.
 - b. Letter Color: Black.

3.4 VALVE-TAG INSTALLATION

- A. Install tags on valves and control devices in piping systems, except check valves; valves within factory-fabricated equipment units; shutoff valves; faucets; convenience and lawn-watering hose connections; and similar roughing-in connections of end-use fixtures and units. List tagged valves in a valve schedule.
- B. Valve-Tag Application Schedule: Tag valves according to size, shape, and color scheme and with captions similar to those indicated in the following subparagraphs:
 - 1. Valve-Tag Size and Shape:
 - a. Cold Water: 1-1/2 inches, round.
 - b. Hot Water: 1-1/2 inches, round.
 - 2. Valve-Tag Color:
 - a. Cold Water: Natural.

- b. Hot Water: Natural.
- 3. Letter Color:
 - a. Cold Water: Black.
 - b. Hot Water: Black.

3.5 WARNING-TAG INSTALLATION

A. Write required message on, and attach warning tags to, equipment and other items where required.

END OF SECTION

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. Insulation Materials:
 - a. Flexible elastomeric.
 - b. Mineral fiber.
 - 2. Adhesives.
 - 3. Mastics.
 - 4. Sealants.
 - 5. Factory-applied jackets.
 - 6. Tapes.
 - 7. Securements.
 - 8. Corner angles.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated. Include thermal conductivity, thickness, and jackets.
- B. Shop Drawings:
 - 1. Detail application of protective shields, saddles, and inserts at hangers for each type of insulation and hanger.
 - 2. Detail insulation application at elbows, fittings, flanges, valves, and specialties for each type of insulation.
 - 3. Detail removable insulation at piping specialties, equipment connections, and access panels.
 - 4. Detail application at control devices.
 - 5. Detail field application for each equipment type.
- C. Qualification Data: For qualified Installer.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program certified by the Department of Labor, Bureau of Apprenticeship and Training.
- B. Fire-Test-Response Characteristics: Insulation and related materials shall have fire-testresponse characteristics indicated, as determined by testing identical products per ASTM E 84, by a testing and inspecting agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing and inspecting agency.

- 1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smokedeveloped index of 50 or less.
- 2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smokedeveloped index of 150 or less.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Packaging: Insulation material containers shall be marked by manufacturer with appropriate ASTM standard designation, type and grade, and maximum use temperature.

1.6 COORDINATION

- A. Coordinate size and location of supports, hangers, and insulation shields specified in Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment."
- B. Coordinate clearance requirements with piping Installer for piping insulation application and equipment Installer for equipment insulation application. Before preparing piping Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.

1.7 SCHEDULING

A. Schedule insulation application after pressure testing systems. Insulation application may begin on segments that have satisfactory test results.

PART 2 - PRODUCTS

- 2.1 INSULATION MATERIALS
 - A. Comply with requirements in Part 3 schedule articles for where insulating materials shall be applied.
 - B. Products shall not contain asbestos, lead, mercury, or mercury compounds.
 - C. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.
 - D. Flexible Elastomeric: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type I for tubular materials and Type II for sheet materials.
 - 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. Aeroflex USA Inc.; Aerocel.
 - b. Armacell LLC; AP Armaflex.
 - c. RBX Corporation; Insul-Sheet 1800 and Insul-Tube 180.
 - E. Mineral-Fiber, Preformed Pipe Insulation:
 - 1. Products: Available products that may be incorporated into the Work shall be one of the following:
 - a. Johns Manville; Micro-Lok HP.
 - b. Knauf Insulation; 1000 Pipe Insulation ASJ+.

- c. Owens Corning; SSL II with ASJ MAX Fiberglas Pipe Insulation.
- Type I, 850 deg F (454 deg C) Materials: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 547, Type I, Grade A, with factoryapplied ASJ-SSL. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

2.2 ADHESIVES

- A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated, unless otherwise indicated.
- B. Flexible Elastomeric and Polyolefin Adhesive: Comply with MIL-A-24179A, Type II, Class I.
 - 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. Aeroflex USA Inc.; Aeroseal.
 - b. Armacell LCC; 520 Adhesive.
 - c. Foster Products Corporation, H. B. Fuller Company; 85-75.
 - d. RBX Corporation; Rubatex Contact Adhesive.
 - 2. For indoor applications, use adhesive that has a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- C. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.
 - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Childers Products, Division of ITW; CP-82.
 - b. Foster Products Corporation, H. B. Fuller Company; 85-20.
 - c. ITW TACC, Division of Illinois Tool Works; S-90/80.
 - d. Marathon Industries, Inc.; 225.
 - e. Mon-Eco Industries, Inc.; 22-25.
 - 2. For indoor applications, use adhesive that has a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- D. ASJ Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.
 - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Childers Products, Division of ITW; CP-82.
 - b. Foster Products Corporation, H. B. Fuller Company; 85-20.
 - c. ITW TACC, Division of Illinois Tool Works; S-90/80.
 - d. Marathon Industries, Inc.; 225.
 - e. Mon-Eco Industries, Inc.; 22-25.
 - 2. For indoor applications, use adhesive that has a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

- E. PVC Jacket Adhesive: Compatible with PVC jacket.
 - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Dow Chemical Company (The); 739, Dow Silicone.
 - b. Johns-Manville; Zeston Perma-Weld, CEEL-TITE Solvent Welding Adhesive.
 - c. P.I.C. Plastics, Inc.; Welding Adhesive.
 - d. Speedline Corporation; Speedline Vinyl Adhesive.
 - 2. For indoor applications, use adhesive that has a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- F. ASJ Flashing Sealants:
 - 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. Childers Products, Division of ITW; CP-76.
 - 2. Materials shall be compatible with insulation materials, jackets, and substrates.
 - 3. Fire- and water-resistant, flexible, elastomeric sealant.
 - 4. Service Temperature Range: Minus 40 to plus 250 deg F.
 - 5. Color: White.
 - 6. For indoor applications, use sealants that have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.3 FACTORY-APPLIED JACKETS

- A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:
 - 1. ASJ-SSL: ASJ with self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip; complying with ASTM C 1136, Type I.

2.4 TAPES

- A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136.
 - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0835.
 - b. Compac Corp.; 104 and 105.
 - c. Ideal Tape Co., Inc., an American Biltrite Company; 428 AWF ASJ.
 - d. Venture Tape; 1540 CW Plus, 1542 CW Plus, and 1542 CW Plus/SQ.
 - 2. Width: 3 inches.
 - 3. Thickness: 11.5 mils.
 - 4. Adhesion: 90 ounces force/inch in width.
 - 5. Elongation: 2 percent.
 - 6. Tensile Strength: 40 lbf/inch in width.

- 7. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.
- B. PVC Tape: White vapor-retarder tape matching field-applied PVC jacket with acrylic adhesive. Suitable for indoor and outdoor applications.
 - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0555.
 - b. Compac Corp.; 130.
 - c. Ideal Tape Co., Inc., an American Biltrite Company; 370 White PVC tape.
 - d. Venture Tape; 1506 CW NS.
 - 2. Width: 2 inches.
 - 3. Thickness: 6 mils.
 - 4. Adhesion: 64 ounces force/inch in width.
 - 5. Elongation: 500 percent.
 - 6. Tensile Strength: 18 lbf/inch in width.

2.5 CORNER ANGLES

A. PVC Corner Angles: 30 mil thick, minimum 1 by 1 inch, PVC according to ASTM D 1784, Class 16354-C. White to match adjacent surface.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions for compliance with requirements for installation and other conditions affecting performance of insulation application.
 - 1. Verify that systems and equipment to be insulated have been tested and are free of defects.
 - 2. Verify that surfaces to be insulated are clean and dry.
 - 3. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.
- B. Surface Preparation: Clean and prepare surfaces to be insulated. Before insulating, apply a corrosion coating to insulated surfaces as follows:
 - 1. Carbon Steel: Coat carbon steel operating at a service temperature between 32 and 300 deg F with an epoxy coating. Consult coating manufacturer for appropriate coating materials and application methods for operating temperature range.

3.3 GENERAL INSTALLATION REQUIREMENTS

A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of equipment and piping including fittings, valves, and specialties.

- B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each pipe system as specified in insulation system schedules.
- C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.
- D. Install insulation with longitudinal seams at bottom of horizontal runs.
- E. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.
- F. Keep insulation materials dry during application and finishing.
- G. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.
- H. Install insulation with least number of joints practical.
- I. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.
 - 1. Install insulation continuously through hangers and around anchor attachments.
 - 2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
 - 3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
 - 4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.
- J. Install insulation with factory-applied jackets as follows:
 - 1. Draw jacket tight and smooth.
 - 2. Cover circumferential joints with 3-inch- wide strips, of same material as insulation jacket.
 - 3. Overlap jacket longitudinal seams at least 1-1/2 inches. Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap.
 - a. For below ambient services, apply vapor-barrier mastic over staples.
 - 4. Cover joints and seams with tape as recommended by insulation material manufacturer to maintain vapor seal.
 - 5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to pipe flanges and fittings.
- K. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.

- L. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.
- M. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere and seal patches similar to butt joints.
- N. For above ambient services, do not install insulation to the following:
 - 1. Vibration-control devices.
 - 2. Testing agency labels and stamps.
 - 3. Nameplates and data plates.
 - 4. Manholes.
 - 5. Handholes.
 - 6. Cleanouts.

3.4 PENETRATIONS

- A. Insulation Installation at Roof Penetrations: Install insulation continuously through roof penetrations.
 - 1. Seal penetrations with flashing sealant.
 - 2. For applications requiring only indoor insulation, terminate insulation above roof surface and seal with joint sealant.
- B. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.
- C. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions.
 - 1. Comply with requirements in Division 07 Section "Penetration Firestopping" firestopping and fire-resistive joint sealers.
- D. Insulation Installation at Floor Penetrations:
 - 1. Pipe: Install insulation continuously through floor penetrations.
 - 2. Seal penetrations through fire-rated assemblies. Comply with requirements in Division 07 Section "Penetration Firestopping."

3.5 GENERAL PIPE INSULATION INSTALLATION

- A. Requirements in this article generally apply to all insulation materials except where more specific requirements are specified in various pipe insulation material installation articles.
- B. Insulation Installation on Fittings, Valves, Strainers, Flanges, and Unions:
 - 1. Install insulation over fittings, valves, strainers, flanges, unions, and other specialties with continuous thermal and vapor-retarder integrity, unless otherwise indicated.
 - 2. Insulate pipe elbows using preformed fitting insulation or mitered fittings made from same material and density as adjacent pipe insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams,

voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.

- 3. Insulate tee fittings with preformed fitting insulation or sectional pipe insulation of same material and thickness as used for adjacent pipe. Cut sectional pipe insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.
- 4. Insulate valves using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.
- 5. Insulate strainers using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Fill joints, seams, and irregular surfaces with insulating cement. Insulate strainers so strainer basket flange or plug can be easily removed and replaced without damaging the insulation and jacket. Provide a removable reusable insulation cover. For below ambient services, provide a design that maintains vapor barrier.
- 6. Insulate flanges and unions using a section of oversized preformed pipe insulation. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker.
- 7. For services not specified to receive a field-applied jacket except for flexible elastomeric, install fitted PVC cover over elbows, tees, strainers, valves, flanges, and unions. Terminate ends with PVC end caps. Tape PVC covers to adjoining insulation facing using PVC tape.
- 8. Label the outside insulation jacket of each union with the word "UNION." Match size and color of pipe labels.
- C. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes, vessels, and equipment. Shape insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.

3.6 FLEXIBLE ELASTOMERIC INSULATION INSTALLATION

- A. Seal longitudinal seams and end joints with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
- B. Insulation Installation on Pipe Flanges:
 - 1. Install pipe insulation to outer diameter of pipe flange.
 - 2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
 - 3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of sheet insulation of same thickness as pipe insulation.
 - 4. Secure insulation to flanges and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
- C. Insulation Installation on Pipe Fittings and Elbows:

- 1. Install mitered sections of pipe insulation.
- 2. Secure insulation materials and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
- D. Insulation Installation on Valves and Pipe Specialties:
 - 1. Install preformed valve covers manufactured of same material as pipe insulation when available.
 - 2. When preformed valve covers are not available, install cut sections of pipe and sheet insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
 - 3. Install insulation to flanges as specified for flange insulation application.
 - 4. Secure insulation to valves and specialties and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

3.7 MINERAL-FIBER INSULATION INSTALLATION

- A. Insulation Installation on Pipe Flanges:
 - 1. Install preformed pipe insulation to outer diameter of pipe flange.
 - 2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
 - 3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with mineral-fiber blanket insulation.
 - 4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch, and seal joints with flashing sealant.
- B. Insulation Installation on Pipe Fittings and Elbows:
 - 1. Install preformed sections of same material as straight segments of pipe insulation when available.
 - 2. When preformed insulation elbows and fittings are not available, install mitered sections of pipe insulation, to a thickness equal to adjoining pipe insulation. Secure insulation materials with wire or bands.
- C. Insulation Installation on Valves and Pipe Specialties:
 - 1. Install preformed sections of same material as straight segments of pipe insulation when available.
 - 2. When preformed sections are not available, install mitered sections of pipe insulation to valve body.
 - 3. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
 - 4. Install insulation to flanges as specified for flange insulation application.

3.8 PIPING INSULATION SCHEDULE, GENERAL

- A. Acceptable preformed pipe and tubular insulation materials and thicknesses are identified for each piping system and pipe size range. If more than one material is listed for a piping system, selection from materials listed is Contractor's option.
- B. Items Not Insulated: Unless otherwise indicated, do not install insulation on the following:
- 1. Drainage piping located in crawl spaces.
- 2. Underground piping.
- 3. Chrome-plated pipes and fittings unless there is a potential for personnel injury.

3.9 INDOOR PIPING INSULATION SCHEDULE

- A. Domestic Cold Water:
 - 1. Insulation shall be one of the following:
 - a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.
- B. Domestic Hot and Recirculated Hot Water:
 - 1. Insulation shall be one of the following:
 - a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.
- C. Stormwater and Overflow:
 - 1. Insulation shall be one of the following:
 - a. Flexible Elastomeric: 1 inch thick.
 - b. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.
- D. Roof Drain and Overflow Drain Bodies:
 - 1. Insulation shall be one of the following:
 - a. Flexible Elastomeric: 1 inch thick.
 - b. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.
- E. Condensate and Equipment Drain Water below 60 Deg F (16 Deg C):
 - 1. Insulation shall be one of the following:
 - a. Flexible Elastomeric: 1 inch thick.
 - b. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.
- F. Floor Drains, Traps, and Sanitary Drain Piping within 10 Feet of Drain Receiving Condensate and Equipment Drain Water below 60 Deg F (16 Deg C):
 - 1. Insulation shall be one of the following:
 - a. Flexible Elastomeric: 1 inch thick.
 - b. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.

END OF SECTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Under-building slab and aboveground domestic water pipes, tubes, fittings, and specialties inside the building.
 - 2. Specialty valves.
 - 3. Flexible connectors.
 - 4. Escutcheons.
 - 5. Sleeves and sleeve seals.
 - 6. Wall penetration systems.

1.3 SUBMITTALS

- A. Product Data: For the following products:
 - 1. Specialty valves.
 - 2. Transition fittings.
 - 3. Dielectric fittings.
 - 4. Flexible connectors.
 - 5. Backflow preventers and vacuum breakers.
 - 6. Escutcheons.
 - 7. Sleeves and sleeve seals.
 - 8. Water penetration systems.
- B. Water Samples: Specified in "Cleaning" Article.
- C. Coordination Drawings: For piping in equipment rooms and other congested areas, drawn to scale, on which the following items are shown and coordinated with each other, using input from Installers of the items involved:
 - 1. Domestic water piping.
 - 2. Sanitary Vent Piping
 - 3. HVAC ductwork.
- D. Field quality-control reports.

1.4 QUALITY ASSURANCE

- A. Piping materials shall bear label, stamp, or other markings of specified testing agency.
- B. Comply with NSF 61 for potable domestic water piping and components.
- 1.5 PROJECT CONDITIONS
 - A. Interruption of Existing Water Service: Do not interrupt water service to facilities occupied by Owner or others unless permitted under the following conditions and then

only after arranging to provide temporary water service according to requirements indicated:

- 1. Notify Architect Owner no fewer than two days in advance of proposed interruption of water service.
- 2. Do not proceed with interruption of water service without Architect's and Owner's written permission.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

A. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.

2.2 COPPER TUBE AND FITTINGS

- A. Hard Copper Tube: ASTM B 88, Type L (ASTM B 88M, Type B) water tube, drawn temper.
 - 1. Cast-Copper Solder-Joint Fittings: ASME B16.18, pressure fittings.
 - 2. Wrought-Copper Solder-Joint Fittings: ASME B16.22, wrought-copper pressure fittings.
 - 3. Bronze Flanges: ASME B16.24, Class 150, with solder-joint ends.
 - 4. Copper Unions: MSS SP-123, cast-copper-alloy, hexagonal-stock body, with balland-socket, metal-to-metal seating surfaces, and solder-joint or threaded ends.
- B. Soft Copper Tube: ASTM B 88, Type K (ASTM B 88M, Type A) water tube, annealed temper.
 - 1. Copper Solder-Joint Fittings: ASME B16.22, wrought-copper pressure fittings.

2.3 DUCTILE-IRON PIPE AND FITTINGS

- A. Mechanical-Joint, Ductile-Iron Pipe: AWWA C151, with mechanical-joint bell and plain spigot end unless grooved or flanged ends are indicated.
 - 1. Standard-Pattern, Mechanical-Joint Fittings: AWWA C110, ductile or gray iron.
 - a. Glands, Gaskets, and Bolts: AWWA C111, ductile- or gray-iron glands, rubber gaskets, and steel bolts.
- B. Plain-End, Ductile-Iron Pipe: AWWA C151.
 - 1. Grooved-Joint, Ductile-Iron-Pipe Appurtenances:
 - 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) Anvil International.
 - 2) Shurjoint Piping Products.
 - 3) Star Pipe Products.

- 4) Victaulic Company.
- b. Grooved-End, Ductile-Iron Fittings: ASTM A 47/A 47M, malleable-iron castings or ASTM A 536, ductile-iron castings with dimensions matching pipe.
- c. Grooved-End, Ductile-Iron-Pipe Couplings: AWWA C606 for ductile-ironpipe dimensions. Include ferrous housing sections, EPDM-rubber gaskets suitable for hot and cold water, and bolts and nuts.

2.4 PIPING JOINING MATERIALS

- A. Pipe-Flange Gasket Materials: AWWA C110, rubber, flat face, 1/8 inch thick or ASME B16.21, nonmetallic and asbestos free, unless otherwise indicated; full-face or ring type unless otherwise indicated.
- B. Metal, Pipe-Flange Bolts and Nuts: ASME B18.2.1, carbon steel unless otherwise indicated.
- C. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.
- D. Brazing Filler Metals: AWS A5.8/A5.8M, BCuP Series, copper-phosphorus alloys for general-duty brazing unless otherwise indicated.

2.5 SPECIALTY VALVES

- A. Comply with requirements in Division 22 Section "General-Duty Valves for Plumbing Piping" for general-duty metal valves.
- B. Comply with requirements in Division 22 Section "Domestic Water Piping Specialties" for balancing valves, drain valves, backflow preventers, and vacuum breakers.

2.6 TRANSITION FITTINGS

- A. General Requirements:
 - 1. Same size as pipes to be joined.
 - 2. Pressure rating at least equal to pipes to be joined.
 - 3. End connections compatible with pipes to be joined.
- B. Fitting-Type Transition Couplings: Manufactured piping coupling or specified piping system fitting.
- C. Sleeve-Type Transition Coupling: AWWA C219.
 - 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. Cascade Waterworks Manufacturing.
 - b. Dresser, Inc.; Dresser Piping Specialties.
 - c. Ford Meter Box Company, Inc. (The).
 - d. JCM Industries.
 - e. Romac Industries, Inc.

- f. Smith-Blair, Inc; a Sensus company.
- g. Viking Johnson; c/o Mueller Co.
- D. Plastic-to-Metal Transition Fittings:
 - 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. Charlotte Pipe and Foundry Company.
 - b. Harvel Plastics, Inc.
 - c. Spears Manufacturing Company.
 - 2. Description: CPVC one-piece fitting with manufacturer's Schedule 80 equivalent dimensions; one end with threaded brass insert and one solvent-cement-socket or threaded end.
- E. Plastic-to-Metal Transition Unions:
 - 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. Colonial Engineering, Inc.
 - b. NIBCO INC.
 - c. Spears Manufacturing Company.
 - 2. Description: CPVC four-part union. Include brass threaded end, solvent-cementjoint or threaded plastic end, rubber O-ring, and union nut.

2.7 DIELECTRIC FITTINGS

- A. General Requirements: Assembly of copper alloy and ferrous materials or ferrous material body with separating nonconductive insulating material suitable for system fluid, pressure, and temperature.
- B. Dielectric Unions:
 - 1. 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. Capitol Manufacturing Company.
 - b. Central Plastics Company.
 - c. EPCO Sales, Inc.
 - d. Hart Industries International, Inc.
 - e. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
 - f. Zurn Plumbing Products Group; Wilkins Water Control Products.
 - 2. Description:
 - a. Pressure Rating: 150 psig at 180 deg F.
 - b. End Connections: Solder-joint copper alloy and threaded ferrous.

- C. Dielectric Flanges:
 - 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. Capitol Manufacturing Company.
 - b. Central Plastics Company.
 - c. EPCO Sales, Inc.
 - d. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
 - 2. Description:
 - a. Factory-fabricated, bolted, companion-flange assembly.
 - b. Pressure Rating: 150 psig.
 - c. End Connections: Solder-joint copper alloy and threaded ferrous; threaded solder-joint copper alloy and threaded ferrous.

2.8 FLEXIBLE CONNECTORS

- 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. Flex-Hose Co., Inc.
 - 2. Flexicraft Industries.
 - 3. Mercer Rubber Co.
 - 4. Metraflex, Inc.
 - 5. Proco Products, Inc.
 - 6. Unaflex, Inc.
- B. Bronze-Hose Flexible Connectors: Corrugated-bronze tubing with bronze wire-braid covering and ends brazed to inner tubing.
 - 1. Working-Pressure Rating: Minimum 200 psig.
 - 2. End Connections NPS 2 and Smaller: Threaded copper pipe or plain-end copper tube.
 - 3. End Connections NPS 2-1/2 and Larger: Flanged copper alloy.
- C. Stainless-Steel-Hose Flexible Connectors: Corrugated-stainless-steel tubing with stainless-steel wire-braid covering and ends welded to inner tubing.
 - 1. Working-Pressure Rating: Minimum 200 psig.
 - 2. End Connections NPS 2 and Smaller: Threaded steel-pipe nipple.
 - 3. End Connections NPS 2-1/2 and Larger: Flanged steel nipple.

2.9 ESCUTCHEONS

- A. General: Manufactured ceiling, floor, and wall escutcheons and floor plates.
- B. One Piece, Cast Brass: Polished, chrome-plated finish with setscrews.
- C. One Piece, Deep Pattern: Deep-drawn, box-shaped brass with chrome-plated finish.

- D. One Piece, Stamped Steel: Chrome-plated finish with setscrew.
- E. Split Casting, Cast Brass: Polished, chrome-plated finish with concealed hinge and setscrew.
- F. Split Plate, Stamped Steel: Chrome-plated finish with concealed hinge, setscrew.
- G. One-Piece Floor Plates: Cast-iron flange.
- H. Split-Casting Floor Plates: Cast brass with concealed hinge.

2.10 SLEEVES

- A. Cast-Iron Wall Pipes: Fabricated of cast iron and equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop unless otherwise indicated.
- B. Galvanized-Steel-Sheet Sleeves: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.
- C. Galvanized-Steel-Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, zinc-coated, with plain ends.
- D. Stack Sleeve Fittings: Manufactured, cast-iron sleeve with integral clamping flange. Include clamping ring and bolts and nuts for membrane flashing.
 - 1. Underdeck Clamp: Clamping ring with setscrews.

2.11 SLEEVE SEALS

- 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. Advance Products & Systems, Inc.
 - 2. Calpico, Inc.
 - 3. Metraflex, Inc.
 - 4. Pipeline Seal and Insulator, Inc.
- B. Description: Modular sealing element unit, designed for field assembly, used to fill annular space between pipe and sleeve.
 - 1. Sealing Elements: EPDM-rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
 - 2. Pressure Plates: Stainless steel.
 - 3. Connecting Bolts and Nuts: Stainless steel of length required to secure pressure plates to sealing elements.

2.12 GROUT

- A. Standard: ASTM C 1107, Grade B, post-hardening and volume-adjusting, dry, hydrauliccement grout.
- B. Characteristics: Nonshrink; recommended for interior and exterior applications.

- C. Design Mix: 5000-psi, 28-day compressive strength.
- D. Packaging: Premixed and factory packaged.

PART 3 - EXECUTION

3.1 PIPING INSTALLATION

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of domestic water piping. Indicated locations and arrangements are used to size pipe and calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.
- B. Install copper tubing under building slab according to CDA's "Copper Tube Handbook."
- C. Install ductile-iron piping under building slab with restrained joints according to AWWA C600 and AWWA M41.
- D. Install shutoff valve, hose-end drain valve, strainer, pressure gage, and test tee with valve, inside the building at each domestic water service entrance. Comply with requirements in Division 22 Section "Meters and Gages for Plumbing Piping" for pressure gages and Division 22 Section "Domestic Water Piping Specialties" for drain valves and strainers.
- E. Install shutoff valve immediately upstream of each dielectric fitting.
- F. Install water-pressure-reducing valves downstream from shutoff valves. Comply with requirements in Division 22 Section "Domestic Water Piping Specialties" for pressure-reducing valves.
- G. Install domestic water piping level and plumb.
- H. Install piping concealed from view and protected from physical contact by building occupants unless otherwise indicated and except in equipment rooms and service areas.
- I. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- J. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal, and coordinate with other services occupying that space.
- K. Install piping adjacent to equipment and specialties to allow service and maintenance.
- L. Install piping to permit valve servicing.
- M. Install nipples, unions, special fittings, and valves with pressure ratings the same as or higher than system pressure rating used in applications below unless otherwise indicated.
- N. Install piping free of sags and bends.
- O. Install fittings for changes in direction and branch connections.

- P. Install unions in copper tubing at final connection to each piece of equipment, machine, and specialty.
- Q. Install pressure gages on suction and discharge piping from each plumbing pump. Comply with requirements in Division 22 Section "Meters and Gages for Plumbing Piping" for pressure gages.
- R. Install thermostats in hot-water circulation piping. Comply with requirements in Division 22 Section "Domestic Water Pumps" for thermostats.
- S. Install thermometers on outlet piping from each water heater. Comply with requirements in Division 22 Section "Meters and Gages for Plumbing Piping" for thermometers.

3.2 JOINT CONSTRUCTION

- A. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
- B. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.
- C. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
 - 1. Apply appropriate tape or thread compound to external pipe threads.
 - 2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.
- D. Brazed Joints: Join copper tube and fittings according to CDA's "Copper Tube Handbook," "Brazed Joints" Chapter.
- E. Soldered Joints: Apply ASTM B 813, water-flushable flux to end of tube. Join copper tube and fittings according to ASTM B 828 or CDA's "Copper Tube Handbook."
- F. Ductile-Iron-Piping Grooved Joints: Cut groove end of pipe. Assemble coupling with housing, gasket, lubricant, and bolts. Join ductile-iron pipe and grooved-end fittings according to AWWA C606 for ductile-iron-pipe, cut-grooved joints.
- G. Flanged Joints: Select appropriate asbestos-free, nonmetallic gasket material in size, type, and thickness suitable for domestic water service. Join flanges with gasket and bolts according to ASME B31.9.
- H. Dissimilar-Material Piping Joints: Make joints using adapters compatible with materials of both piping systems.

3.3 VALVE INSTALLATION

- A. General-Duty Valves: Comply with requirements in Division 22 Section "General-Duty Valves for Plumbing Piping" for valve installations.
- B. Install shutoff valve close to water main on each branch and riser serving plumbing fixtures or equipment, on each water supply to equipment, and on each water supply to plumbing fixtures that do not have supply stops. Use ball or gate valves for piping NPS 2 and smaller. Use butterfly or gate valves for piping NPS 2-1/2 and larger.

- C. Install drain valves for equipment at base of each water riser, at low points in horizontal piping, and where required to drain water piping. Drain valves are specified in Division 22 Section "Domestic Water Piping Specialties."
 - 1. Hose-End Drain Valves: At low points in water mains, risers, and branches.
 - 2. Stop-and-Waste Drain Valves: Instead of hose-end drain valves where indicated.
- D. Install calibrated balancing valves in each hot-water circulation return branch and discharge side of each pump and circulator. Set calibrated balancing valves partly open to restrict but not stop flow. Comply with requirements in Division 22 Section "Domestic Water Piping Specialties" for calibrated balancing valves.

3.4 TRANSITION FITTING INSTALLATION

- A. Install transition couplings at joints of dissimilar piping.
- B. Transition Fittings in Underground Domestic Water Piping:
 - 1. NPS 1-1/2 and Smaller: Fitting-type coupling.
 - 2. NPS 2 and Larger: Sleeve-type coupling.
- C. Transition Fittings in Aboveground Domestic Water Piping NPS 2 and Smaller: Plasticto-metal transition unions.

3.5 DIELECTRIC FITTING INSTALLATION

- A. Install dielectric fittings in piping at connections of dissimilar metal piping and tubing.
- B. Dielectric Fittings for NPS 2 and Smaller: Use dielectric couplings couplings or nipples nipples unions.
- C. Dielectric Fittings for NPS 2-1/2 and Larger: Use dielectric flanges.

3.6 FLEXIBLE CONNECTOR INSTALLATION

- A. Install flexible connectors in suction and discharge piping connections to each domestic water pump and in suction and discharge manifold connections to each domestic water booster pump.
- B. Install bronze-hose flexible connectors in copper domestic water tubing.
- C. Install stainless-steel-hose flexible connectors in steel domestic water piping.

3.7 HANGER AND SUPPORT INSTALLATION

- A. Comply with requirements in Division 22 Section "Vibration and Seismic Controls for Plumbing Piping and Equipment" for seismic-restraint devices.
- B. Comply with requirements in Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment" for pipe hanger and support products and installation.
 - 1. Vertical Piping: MSS Type 8 or 42, clamps.
 - 2. Individual, Straight, Horizontal Piping Runs:

- a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.
- b. Longer Than 100 Feet: MSS Type 43, adjustable roller hangers.
- c. Longer Than 100 Feet: If Indicated: MSS Type 49, spring cushion rolls.
- 3. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
- 4. Base of Vertical Piping: MSS Type 52, spring hangers.
- C. Support vertical piping and tubing at base and at each floor.
- D. Rod diameter may be reduced one size for double-rod hangers, to a minimum of 3/8 inch.
- E. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:
 - 1. NPS 3/4 and Smaller: 60 inches with 3/8-inch rod.
 - 2. NPS 1 and NPS 1-1/4: 72 inches with 3/8-inch rod.
 - 3. NPS 1-1/2 and NPS 2: 96 inches with 3/8-inch rod.
 - 4. NPS 2-1/2: 108 inches with 1/2-inch rod.
 - 5. NPS 3 to NPS 5: 10 feet with 1/2-inch rod.
 - 6. NPS 6: 10 feet with 5/8-inch rod.
 - 7. NPS 8: 10 feet with 3/4-inch rod.
- F. Install supports for vertical copper tubing every 10 feet.
- G. Support piping and tubing not listed in this article according to MSS SP-69 and manufacturer's written instructions.

3.8 CONNECTIONS

- A. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install piping adjacent to equipment and machines to allow service and maintenance.
- C. Connect domestic water piping to exterior water-service piping. Use transition fitting to join dissimilar piping materials.
- D. Connect domestic water piping to water-service piping with shutoff valve; extend and connect to the following:
 - 1. Water Heaters: Cold-water inlet and hot-water outlet piping in sizes indicated, but not smaller than sizes of water heater connections.
 - 2. Plumbing Fixtures: Cold- and hot-water supply piping in sizes indicated, but not smaller than required by plumbing code. Comply with requirements on Plumbing Fixture Schedule on drawings for connection sizes.
 - 3. Equipment: Cold- and hot-water supply piping as indicated, but not smaller than equipment connections. Provide shutoff valve and union for each connection. Use flanges instead of unions for NPS 2-1/2 and larger.

3.9 ESCUTCHEON INSTALLATION

- A. Install escutcheons for penetrations of walls, ceilings, and floors.
- B. Escutcheons for New Piping:

- a. Piping with Fitting or Sleeve Protruding from Wall: One piece, deep pattern.
- b. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One piece, cast brass with polished chrome-plated finish.
- c. Bare Piping at Ceiling Penetrations in Finished Spaces: One piece, cast brass with polished chrome-plated finish.
- d. Bare Piping in Unfinished Service Spaces: One piece, cast brass with polished chrome-plated finish cast brass with rough-brass finish.
- e. Bare Piping in Equipment Rooms: One piece, cast brass.
- f. Bare Piping at Floor Penetrations in Equipment Rooms: One-piece floor plate.

3.10 SLEEVE INSTALLATION

- A. General Requirements: Install sleeves for pipes and tubes passing through penetrations in floors, partitions, roofs, and walls.
- B. Sleeves are not required for core-drilled holes.
- C. Cut sleeves to length for mounting flush with both surfaces unless otherwise indicated.
- D. Install sleeves in new partitions, slabs, and walls as they are built.
- E. For interior wall penetrations, seal annular space between sleeve and pipe or pipe insulation using joint sealants appropriate for size, depth, and location of joint. Comply with requirements in Division 07 Section "Joint Sealants" for joint sealants.
- F. For exterior wall penetrations above grade, seal annular space between sleeve and pipe using joint sealants appropriate for size, depth, and location of joint. Comply with requirements in Division 07 Section "Joint Sealants" for joint sealants.
- G. For exterior wall penetrations below grade, seal annular space between sleeve and pipe using sleeve seals specified in this Section.
- H. Seal space outside of sleeves in concrete slabs and walls with grout.
- I. Install sleeves that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation unless otherwise indicated.
- J. Install sleeve materials according to the following applications:
 - 1. Sleeves for Piping Passing through Concrete Floor Slabs: Steel pipe.
 - 2. Sleeves for Piping Passing through Concrete Floor Slabs of Mechanical Equipment Areas or Other Wet Areas: Steel pipe.
 - a. Extend sleeves 2 inches above finished floor level.
 - b. For pipes penetrating floors with membrane waterproofing, extend cast-iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified. Secure flashing between clamping flanges. Install section of cast-iron soil pipe to extend sleeve to 2 inches above finished floor level. Comply with requirements in Division 07 Section "Sheet Metal Flashing and Trim" for flashing.
 - 3. Sleeves for Piping Passing through Gypsum-Board Partitions:

- a. Steel pipe sleeves for pipes smaller than NPS 6.
- b. Galvanized-steel sheet sleeves for pipes NPS 6 and larger.
- c. Exception: Sleeves are not required for water supply tubes and waste pipes for individual plumbing fixtures if escutcheons will cover openings.
- 4. Sleeves for Piping Passing through Concrete Roof Slabs: Steel pipe.
- 5. Sleeves for Piping Passing through Exterior Concrete Walls:
 - a. Steel pipe sleeves for pipes smaller than NPS 6.
 - b. Cast-iron wall pipe sleeves for pipes NPS 6 and larger.
 - c. Install sleeves that are large enough to provide 1-inch annular clear space between sleeve and pipe or pipe insulation when sleeve seals are used.
- 6. Sleeves for Piping Passing through Interior Concrete Walls:
 - a. Steel pipe sleeves for pipes smaller than NPS 6.
 - b. Galvanized-steel sheet sleeves for pipes NPS 6 and larger.
- K. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Comply with requirements in Division 07 Section "Penetration Firestopping" for firestop materials and installations.

3.11 SLEEVE SEAL INSTALLATION

- A. Install sleeve seals in sleeves in exterior concrete walls at water-service piping entries into building.
- B. Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble sleeve seal components and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

3.12 IDENTIFICATION

- A. Identify system components. Comply with requirements in Division 22 Section "Identification for Plumbing Piping and Equipment" for identification materials and installation.
- B. Label pressure piping with system operating pressure.

3.13 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. Piping Inspections:
 - 1. Do not enclose, cover, or put piping into operation until it has been inspected and approved by authorities having jurisdiction.
 - 2. During installation, notify authorities having jurisdiction at least one day before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction:

- a. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.
- b. Final Inspection: Arrange final inspection for authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.
- 3. Reinspection: If authorities having jurisdiction find that piping will not pass tests or inspections, make required corrections and arrange for reinspection.
- 4. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.
- C. Piping Tests:
 - 1. Fill domestic water piping. Check components to determine that they are not air bound and that piping is full of water.
 - 2. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit a separate report for each test, complete with diagram of portion of piping tested.
 - 3. Leave new, altered, extended, or replaced domestic water piping uncovered and unconcealed until it has been tested and approved. Expose work that was covered or concealed before it was tested.
 - 4. Cap and subject piping to static water pressure of 50 psig above operating pressure, without exceeding pressure rating of piping system materials. Isolate test source and allow to stand for four hours. Leaks and loss in test pressure constitute defects that must be repaired.
 - 5. Repair leaks and defects with new materials and retest piping or portion thereof until satisfactory results are obtained.
 - 6. Prepare reports for tests and for corrective action required.
- D. Domestic water piping will be considered defective if it does not pass tests and inspections.
- E. Prepare test and inspection reports.

3.14 ADJUSTING

- A. Perform the following adjustments before operation:
 - 1. Close drain valves, hydrants, and hose bibbs.
 - 2. Open shutoff valves to fully open position.
 - 3. Open throttling valves to proper setting.
 - 4. Adjust balancing valves in hot-water-circulation return piping to provide adequate flow.
 - a. Adjust calibrated balancing valves to flows indicated.
 - 5. Remove plugs used during testing of piping and for temporary sealing of piping during installation.
 - 6. Remove and clean strainer screens. Close drain valves and replace drain plugs.
 - 7. Remove filter cartridges from housings and verify that cartridges are as specified for application where used and are clean and ready for use.
 - 8. Check plumbing specialties and verify proper settings, adjustments, and operation.

3.15 CLEANING

- A. Clean and disinfect potable domestic water piping as follows:
 - 1. Purge new piping and parts of existing piping that have been altered, extended, or repaired before using.
 - 2. Use purging and disinfecting procedures prescribed by authorities having jurisdiction; if methods are not prescribed, use procedures described in either AWWA C651 or AWWA C652 or follow procedures described below:
 - a. Flush piping system with clean, potable water until dirty water does not appear at outlets.
 - b. Fill and isolate system according to either of the following:
 - 1) Fill system or part thereof with water/chlorine solution with at least 50 ppm of chlorine. Isolate with valves and allow to stand for 24 hours.
 - 2) Fill system or part thereof with water/chlorine solution with at least 200 ppm of chlorine. Isolate and allow to stand for three hours.
 - c. Flush system with clean, potable water until no chlorine is in water coming from system after the standing time.
 - d. Submit water samples in sterile bottles to authorities having jurisdiction. Repeat procedures if biological examination shows contamination.
- B. Prepare and submit reports of purging and disinfecting activities.
- C. Clean interior of domestic water piping system. Remove dirt and debris as work progresses.

3.16 PIPING SCHEDULE

- A. Transition and special fittings with pressure ratings at least equal to piping rating may be used in applications below unless otherwise indicated.
- B. Flanges and unions may be used for aboveground piping joints unless otherwise indicated.
- C. Fitting Option: Brazed joints may be used on aboveground copper tubing.
- D. Under-building-slab, domestic water, building service piping, NPS 3 and smaller, shall be the following:
 - 1. Soft copper tube, ASTM B 88, Type K (ASTM B 88M, Type A) wrought-copper solder-joint fittings; and brazed copper pressure-seal fittings; and pressure-sealed joints.
- E. Under-building-slab, domestic water, building-service piping, NPS 4 to NPS 8 and larger, shall be one of the following:
 - 1. Soft copper tube, ASTM B 88, Type K (ASTM B 88M, Type A); wrought-copper solder-joint fittings; and brazed joints.
 - 2. Mechanical-joint, ductile-iron pipe; standard- or compact- pattern mechanical-joint fittings; and mechanical joints.

- F. Under-building-slab, domestic water piping, NPS 2 and smaller, shall be the following:
 - 1. Soft copper tube, ASTM B 88, Type K (ASTM B 88M, Type B) wrought-copper solder-joint fittings; and brazed joints.
- G. Aboveground domestic water piping, shall be the following:
 - 1. Hard copper tube, ASTM B 88, Type L (ASTM B 88M, Type B) wrought- copper solder-joint fittings; and soldered joints.

3.17 VALVE SCHEDULE

- A. Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:
 - 1. Shutoff Duty: Use ball for piping NPS 3 and smaller.
 - 2. Throttling Duty: Use ball valves for piping all piping.
 - 3. Hot-Water Circulation Piping, Balancing Duty: Calibrated balancing valves.
 - 4. Drain Duty: Hose-end drain valves.
- B. Use check valves to maintain correct direction of domestic water flow to and from equipment.

END OF SECTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following domestic water piping specialties:
 - 1. Vacuum breakers.
 - 2. Backflow preventers.
 - 3. Balancing valves.
 - 4. Temperature-actuated water mixing valves.
 - 5. Strainers.
 - 6. Hose bibbs.
 - 7. Wall hydrants.
 - 8. Drain valves.
 - 9. Water hammer arresters.
- B. Related Sections include the following:
 - 1. Division 22 Section "Meters and Gages for Plumbing Piping" for thermometers, pressure gages, and flow meters in domestic water piping.

1.3 PERFORMANCE REQUIREMENTS

A. Minimum Working Pressure for Domestic Water Piping Specialties: 125 psig, unless otherwise indicated.

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: Diagram power, signal, and control wiring.
- C. Field quality-control test reports.
- D. Operation and Maintenance Data: For domestic water piping specialties to include in emergency, operation, and maintenance manuals.

1.5 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- B. NSF Compliance:
 - 1. Comply with NSF 61, "Drinking Water System Components Health Effects; Sections 1 through 9."

PART 2 - PRODUCTS

2.1 VACUUM BREAKERS

- A. Pipe-Applied, Atmospheric-Type Vacuum Breakers:
 - 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. Ames Co.
 - b. Watts Industries, Inc.; Water Products Div.
 - c. Zurn Plumbing Products Group; Wilkins Div.
 - 2. Standard: ASSE 1001.
 - 3. Size: NPS 1/4 to NPS 3, as required to match connected piping.
 - 4. Body: Bronze.
 - 5. Inlet and Outlet Connections: Threaded.
 - 6. Finish: Chrome plated.
- B. Hose-Connection Vacuum Breakers:
 - 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. Watts Industries, Inc.; Water Products Div.
 - b. Woodford Manufacturing Company.
 - c. Zurn Plumbing Products Group; Light Commercial Operation.
 - d. Zurn Plumbing Products Group; Wilkins Div.
 - 2. Standard: ASSE 1011.
 - 3. Body: Bronze, nonremovable, with manual drain.
 - 4. Outlet Connection: Garden-hose threaded complying with ASME B1.20.7.
 - 5. Finish: Chrome or nickel plated.

2.2 BACKFLOW PREVENTERS

- A. Reduced-Pressure-Principle Backflow Preventers:
 - 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. Ames Co.
 - b. Watts Industries, Inc.; Water Products Div.
 - c. Zurn Plumbing Products Group; Wilkins Div.
 - 2. Standard: ASSE 1013.
 - 3. Operation: Continuous-pressure applications.
 - 4. Pressure Loss: 10 psig maximum.
 - 5. Body: Bronze for NPS 2 and smaller; cast iron with interior lining complying with AWWA C550 or that is FDA approved for NPS 2-1/2 and larger.

- 6. End Connections: Threaded for NPS 2 and smaller; flanged for NPS 2-1/2 and larger.
- 7. Configuration: Designed for horizontal, straight through flow.
- 8. Accessories:
 - a. Valves: Ball type with threaded ends on inlet and outlet of NPS 2" and smaller; outside screw and yoke gate-type with flanged ends on inlet and outlet of NPS 2-1/2" and larger.
 - b. Air-Gap Fitting: ASME A112.1.2, matching backflow-preventer connection.

2.3 BALANCING VALVES

- A. Copper-Alloy Calibrated Balancing Valves:
 - 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. Armstrong International, Inc.
 - b. ITT Industries; Bell & Gossett Div.
 - c. NIBCO INC.
 - d. Taco, Inc.
 - e. Watts Industries, Inc.; Water Products Div.
 - 2. Type: Y-pattern globe valve with two readout ports and memory setting indicator.
 - 3. Body: Brass or bronze.
 - 4. Size: Same as connected piping, but not larger than NPS 2 (DN 50).
 - 5. Accessories: Meter hoses, fittings, valves, differential pressure meter, and carrying case.

2.4 TEMPERATURE-ACTUATED WATER MIXING VALVES

- A. Primary, Thermostatic, Water Mixing Valves:
 - 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. Leonard Valve Company.
 - b. Powers; a Watts Industries Co.
 - c. Symmons Industries, Inc.
 - 2. Standard: ASSE 1017.
 - 3. Pressure Rating: 125 psig.
 - 4. Type: Exposed-mounting, thermostatically controlled water mixing valve.
 - 5. Material: Bronze body with corrosion-resistant interior components.
 - 6. Connections: Threaded union inlets and outlet.
 - 7. Accessories: Manual temperature control, check stops on hot- and cold-water supplies, and adjustable, temperature-control handle.
 - 8. Valve Pressure Rating: 125 psig minimum.
 - 9. Tempered-Water Setting: 105 deg F.
 - 10. Pressure Drop at Design Flow Rate: 10 psig.
 - 11. Valve Finish: Rough bronze.
 - 12. Piping Finish: Copper.

- B. Manifold, Thermostatic, Water-Mixing-Valve Assemblies:
 - 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. Leonard Valve Company.
 - b. Powers; a Watts Industries Co.
 - c. Symmons Industries, Inc.
 - 2. Description: Factory-fabricated, exposed-mounting, thermostatically controlled, water-mixing-valve assembly in two or three-valve parallel arrangement.
 - 3. Large-Flow Parallel: Thermostatic water mixing valve and downstream pressure regulator with pressure gages on inlet and outlet.
 - 4. Intermediate-Flow Parallel: Thermostatic water mixing valve and downstream pressure regulator with pressure gages on inlet and outlet.
 - 5. Small-Flow Parallel: Thermostatic water mixing valve.
 - 6. Thermostatic Mixing Valves: Comply with ASSE 1017. Include check stops on hot- and cold-water inlets and shutoff valve on outlet.
 - 7. Water Regulators: Comply with ASSE 1003. Include pressure gage on inlet and outlet.
 - 8. Component Pressure Ratings: 125 psig minimum, unless otherwise indicated.
 - 9. Cabinet: Factory-fabricated, stainless steel, for surface mounting and with hinged, stainless-steel door.
 - 10. Tempered-Water Setting: 105 deg F.
 - 11. Unit Pressure Drop at Design Flow Rate: 10 psig.
 - 12. Thermostatic Mixing Valve and Water Regulator Finish: Rough bronze.
 - 13. Piping Finish: Copper.

2.5 STRAINERS FOR DOMESTIC WATER PIPING

- A. Y-Pattern Strainers:
 - 1. Pressure Rating: 125 psig minimum.
 - 2. Body: Bronze for NPS 2" and smaller; cast iron with interior lining complying with AWWA C550 or FDA-approved, epoxy coating and for NPS 2-1/2" and larger.
 - 3. End Connections: Threaded for NPS 2" and smaller; flanged for NPS 2-1/2" and larger.
 - 4. Screen: Stainless steel with round perforations, unless otherwise indicated.
 - 5. Perforation Size:
 - a. Strainers NPS 2 and Smaller: 0.033 inch.
 - b. Strainers NPS 2-1/2 to NPS 4: 0.062 inch.
 - c. Strainers NPS 5 and Larger: 0.125 inch.
 - 6. Drain: Factory-installed, hose-end drain valve.

2.6 HOSE BIBBS

- A. Hose Bibbs:
 - 1. Standard: ASME A112.18.1 for sediment faucets.
 - 2. Body Material: Bronze.
 - 3. Seat: Bronze, replaceable.

- 4. Supply Connections: NPS 1/2 or NPS 3/4 threaded or solder-joint inlet.
- 5. Outlet Connection: Garden-hose thread complying with ASME B1.20.7.
- 6. Pressure Rating: 125 psig.
- 7. Vacuum Breaker: Integral, nonremovable, drainable, hose-connection vacuum breaker complying with ASSE 1011.
- 8. Finish for Equipment Rooms: Rough bronze.
- 9. Finish for Service Areas: Rough bronze.
- 10. Finish for Finished Rooms: Chrome or nickel plated.
- 11. Operation for Equipment Rooms: Wheel handle or operating key.
- 12. Operation for Service Areas: Operating key.
- 13. Operation for Finished Rooms: Operating key.
- 14. Include operating key with each operating-key hose bibb.
- 15. Include integral wall flange with each chrome- or nickel-plated hose bibb.

2.7 WALL HYDRANTS

- A. Nonfreeze Wall Hydrants:
 - 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. Josam Company.
 - b. Watts Drainage Products Inc.
 - c. Woodford Manufacturing Company.
 - d. Zurn Plumbing Products Group; Light Commercial Operation.
 - e. Zurn Plumbing Products Group; Specification Drainage Operation.
 - 2. Standard: ASME A112.21.3M for concealed-outlet, self-draining wall hydrants.
 - 3. Pressure Rating: 125 psig.
 - 4. Operation: Loose key.
 - 5. Casing and Operating Rod: Of length required to match wall thickness. Include wall clamp.
 - 6. Inlet: NPS 3/4 or NPS 1.
 - 7. Outlet: Concealed, with integral vacuum breaker and garden-hose thread complying with ASME B1.20.7.
 - 8. Box: Deep, flush mounting with cover.
 - 9. Box and Cover Finish: Polished nickel bronze.
 - 10. Outlet: Exposed, with integral vacuum breaker and garden-hose thread complying with ASME B1.20.7.
 - 11. Nozzle and Wall-Plate Finish: Polished nickel bronze.
 - 12. Operating Keys: One with each wall hydrant.

2.8 DRAIN VALVES

- A. Ball-Valve-Type, Hose-End Drain Valves:
 - 1. Standard: MSS SP-110 for standard-port, two-piece ball valves.
 - 2. Pressure Rating: 400-psig minimum CWP.
 - 3. Size: NPS 3/4.
 - 4. Body: Copper alloy.
 - 5. Ball: Chrome-plated brass.
 - 6. Seats and Seals: Replaceable.
 - 7. Handle: Vinyl-covered steel.

- 8. Inlet: Threaded or solder joint.
- 9. Outlet: Threaded, short nipple with garden-hose thread complying with ASME B1.20.7 and cap with brass chain.

2.9 WATER HAMMER ARRESTERS

- A. Water Hammer Arresters:
 - 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. Sioux Chief Manufacturing Company, Inc.
 - b. Watts Drainage Products Inc.
 - c. Zurn Plumbing Products Group; Specification Drainage Operation.
 - 2. Standard: ASSE 1010 or PDI-WH 201.
 - 3. Type: Metal bellows or Copper tube with piston.
 - 4. Size: ASSE 1010, Sizes AA and A through F or PDI-WH 201, Sizes A through F.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Refer to Division 22 Section "Common Work Results for Plumbing" for piping joining materials, joint construction, and basic installation requirements.
- B. Install backflow preventers in each water supply to mechanical equipment and systems and to other equipment and water systems that may be sources of contamination. Comply with authorities having jurisdiction.
 - 1. Locate backflow preventers in same room as connected equipment or system.
 - 2. Install drain for backflow preventers with atmospheric-vent drain connection with air-gap fitting, fixed air-gap fitting, or equivalent positive pipe separation of at least two pipe diameters in drain piping and pipe to floor drain. Locate air-gap device attached to or under backflow preventer. Simple air breaks are not acceptable for this application.
 - 3. Do not install bypass piping around backflow preventers.
- C. Install water regulators with inlet and outlet shutoff valves and bypass with memory-stop balancing valve. Install pressure gages on inlet and outlet.
- D. Install water control valves with inlet and outlet shutoff valves and bypass with globe valve. Install pressure gages on inlet and outlet.
- E. Install balancing valves in locations where they can easily be adjusted.
- F. Install pressure reducing station on incoming water service if pressure is above 80 psig. Set pressure to 80 psig.
- G. Install temperature-actuated water mixing valves with check stops or shutoff valves on inlets and with shutoff valve on outlet.
 - 1. Install thermometers and water regulators if specified.

- H. Install Y-pattern strainers for water on supply side of each control valve, water pressurereducing valve, solenoid valve, and pump.
- I. Install water hammer arresters in water piping according to PDI-WH 201.

3.2 CONNECTIONS

- A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping and specialties.
- B. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."
- C. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

3.3 LABELING AND IDENTIFYING

- A. Equipment Nameplates and Signs: Install engraved plastic-laminate equipment nameplate or sign on or near each of the following:
 - 1. Reduced-pressure-principle backflow preventers.
 - 2. Calibrated balancing valves.
 - 3. Manifold, thermostatic, water-mixing-valve assemblies.
- B. Distinguish among multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations, in addition to identifying unit. Nameplates and signs are specified in Division 22 Section "Identification for Plumbing Piping and Equipment."

3.4 FIELD QUALITY CONTROL

- A. Perform the following tests and prepare test reports:
 - 1. Test each reduced-pressure-principle backflow preventer according to authorities having jurisdiction and the device's reference standard.
- B. Remove and replace malfunctioning domestic water piping specialties and retest as specified above.

3.5 ADJUSTING

- A. Set field-adjustable pressure set points of water pressure-reducing valves.
- B. Set field-adjustable flow set points of balancing valves.
- C. Set field-adjustable temperature set points of temperature-actuated water mixing valves.

END OF SECTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Pipes, tubes, and fittings.
 - 2. Piping specialties.
 - 3. Piping and tubing joining materials.
 - 4. Valves.
 - 5. Mechanical sleeve seals.

1.3 DEFINITIONS

- A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct shafts, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.
- B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.
- C. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.

1.4 PERFORMANCE REQUIREMENTS

- A. Minimum Operating-Pressure Ratings:
 - 1. Piping and Valves: 100 psig minimum unless otherwise indicated.
- B. Natural-Gas System Pressure within Buildings: 0.5 psig or less.

1.5 SUBMITTALS

- A. Product Data: For each type of the following:
 - 1. Piping specialties.
 - 2. Valves. Include pressure rating, capacity, settings, and electrical connection data of selected models.
 - 3. Dielectric fittings.
 - 4. Mechanical sleeve seals.
 - 5. Escutcheons.
- B. Qualification Data: For qualified professional engineer.
- C. Welding certificates.
- D. Field quality-control reports.

1.6 QUALITY ASSURANCE

- A. Steel Support Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code Steel."
- B. Pipe Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.
- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture.
- B. Store and handle pipes and tubes having factory-applied protective coatings to avoid damaging coating, and protect from direct sunlight.

1.8 PROJECT CONDITIONS

A. Perform site survey, research public utility records, and verify existing utility locations. Contact utility-locating service for area where Project is located.

PART 2 - PRODUCTS

- 2.1 PIPES, TUBES, AND FITTINGS
 - A. Steel Pipe: ASTM A 53/A 53M, black steel, Schedule 40, Type E or S, Grade B.
 - 1. Malleable-Iron Threaded Fittings: ASME B16.3, Class 150, standard pattern.
 - 2. Wrought-Steel Welding Fittings: ASTM A 234/A 234M for butt welding and socket welding.
 - 3. Unions: ASME B16.39, Class 150, malleable iron with brass-to-iron seat, ground joint, and threaded ends.
 - 4. Forged-Steel Flanges and Flanged Fittings: ASME B16.5, minimum Class 150, including bolts, nuts, and gaskets of the following material group, end connections, and facings:
 - a. Material Group: 1.1.
 - b. End Connections: Threaded or butt welding to match pipe.
 - c. Lapped Face: Not permitted underground.
 - d. Gasket Materials: ASME B16.20, metallic, flat, asbestos free, aluminum orings, and spiral-wound metal gaskets.
 - e. Bolts and Nuts: ASME B18.2.1, carbon steel aboveground and stainless steel underground.
 - 5. Protective Coating for Underground Piping: Factory-applied, three-layer coating of epoxy, adhesive, and PE.
 - a. Joint Cover Kits: Epoxy paint, adhesive, and heat-shrink PE sleeves.

- 6. Mechanical Couplings:
 - 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) Dresser Piping Specialties; Division of Dresser, Inc.
 - 2) Smith-Blair, Inc.
 - b. Steel flanges and tube with epoxy finish.
 - c. Buna-nitrile seals.
 - d. Steel bolts, washers, and nuts.
 - e. Coupling shall be capable of joining PE pipe to PE pipe, steel pipe to PE pipe, or steel pipe to steel pipe.
 - f. Steel body couplings installed underground on plastic pipe shall be factory equipped with anode.

2.2 JOINING MATERIALS

- A. Joint Compound and Tape: Suitable for natural gas.
- B. Welding Filler Metals: Comply with AWS D10.12/D10.12M for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

2.3 MANUAL GAS SHUTOFF VALVES

- A. See "Aboveground Manual Gas Shutoff Valve Schedule" Article for where each valve type is applied in various services.
- B. General Requirements for Metallic Valves, NPS 2 and Smaller: Comply with ASME B16.33.
 - 1. CWP Rating: 125 psig.
 - 2. Threaded Ends: Comply with ASME B1.20.1.
 - 3. Dryseal Threads on Flare Ends: Comply with ASME B1.20.3.
 - 4. Tamperproof Feature: Locking feature for valves indicated in "Aboveground Manual Gas Shutoff Valve Schedule" Article.
 - 5. Listing: Listed and labeled by an NRTL acceptable to authorities having jurisdiction for valves 1 inch and smaller.
 - 6. Service Mark: Valves 1-1/4 inches to NPS 2 shall have initials "WOG" permanently marked on valve body.
- C. General Requirements for Metallic Valves, NPS 2-1/2 and Larger: Comply with ASME B16.38.
 - 1. CWP Rating: 125 psig.
 - 2. Flanged Ends: Comply with ASME B16.5 for steel flanges.
 - 3. Tamperproof Feature: Locking feature for valves indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
 - 4. Service Mark: Initials "WOG" shall be permanently marked on valve body.
- D. One-Piece, Bronze Ball Valve with Bronze Trim: MSS SP-110.

- 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. BrassCraft Manufacturing Company; a Masco company.
 - b. Conbraco Industries, Inc.; Apollo Div.
 - c. Lyall, R. W. & Company, Inc.
 - d. McDonald, A. Y. Mfg. Co.
 - e. Perfection Corporation; a subsidiary of American Meter Company.
- 2. Body: Bronze, complying with ASTM B 584.
- 3. Ball: Chrome-plated brass.
- 4. Stem: Bronze; blowout proof.
- 5. Seats: Reinforced TFE; blowout proof.
- 6. Packing: Separate packnut with adjustable-stem packing threaded ends.
- 7. Ends: Threaded, flared, or socket as indicated in "Aboveground Manual Gas Shutoff Valve Schedule" Article.
- 8. CWP Rating: 600 psig.
- 9. Listing: Valves NPS 1 and smaller shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction.
- 10. Service: Suitable for natural-gas service with "WOG" indicated on valve body.
- E. Two-Piece, Full-Port, Bronze Ball Valves with Bronze Trim: MSS SP-110.
 - 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. BrassCraft Manufacturing Company; a Masco company.
 - b. Conbraco Industries, Inc.; Apollo Div.
 - c. Lyall, R. W. & Company, Inc.
 - d. McDonald, A. Y. Mfg. Co.
 - e. Perfection Corporation; a subsidiary of American Meter Company.
 - 2. Body: Bronze, complying with ASTM B 584.
 - 3. Ball: Chrome-plated bronze.
 - 4. Stem: Bronze; blowout proof.
 - 5. Seats: Reinforced TFE; blowout proof.
 - 6. Packing: Threaded-body packnut design with adjustable-stem packing.
 - 7. Ends: Threaded, flared, or socket as indicated in "Aboveground Manual Gas Shutoff Valve Schedule" Article.
 - 8. CWP Rating: 600 psig.
 - 9. Listing: Valves NPS 1 and smaller shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction.
 - 10. Service: Suitable for natural-gas service with "WOG" indicated on valve body.
- F. Bronze Plug Valves: MSS SP-78.
 - 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. Lee Brass Company.
 - b. McDonald, A. Y. Mfg. Co.

- 2. Body: Bronze, complying with ASTM B 584.
- 3. Plug: Bronze.
- 4. Ends: Threaded, socket, or flanged as indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
- 5. Operator: Square head or lug type with tamperproof feature where indicated.
- 6. Pressure Class: 125 psig.
- 7. Listing: Valves NPS 1 and smaller shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction.
- 8. Service: Suitable for natural-gas service with "WOG" indicated on valve body.
- G. Cast-Iron, Nonlubricated Plug Valves: MSS SP-78.
 - 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. McDonald, A. Y. Mfg. Co.
 - b. Mueller Co.; Gas Products Div.
 - c. Xomox Corporation; a Crane company.
 - 2. Body: Cast iron, complying with ASTM A 126, Class B.
 - 3. Plug: Bronze or nickel-plated cast iron.
 - 4. Seat: Coated with thermoplastic.
 - 5. Stem Seal: Compatible with natural gas.
 - 6. Ends: Threaded or flanged as indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
 - 7. Operator: Square head or lug type with tamperproof feature where indicated.
 - 8. Pressure Class: 125 psig.
 - 9. Listing: Valves NPS 1 and smaller shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction.
 - 10. Service: Suitable for natural-gas service with "WOG" indicated on valve body.
- H. Cast-Iron, Lubricated Plug Valves: MSS SP-78.
 - 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. Flowserve.
 - b. Homestead Valve; a division of Olson Technologies, Inc.
 - c. McDonald, A. Y. Mfg. Co.
 - d. Milliken Valve Company.
 - e. Mueller Co.; Gas Products Div.
 - f. R&M Energy Systems, A Unit of Robbins & Myers, Inc.
 - 2. Body: Cast iron, complying with ASTM A 126, Class B.
 - 3. Plug: Bronze or nickel-plated cast iron.
 - 4. Seat: Coated with thermoplastic.
 - 5. Stem Seal: Compatible with natural gas.
 - 6. Ends: Threaded or flanged as indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
 - 7. Operator: Square head or lug type with tamperproof feature where indicated.
 - 8. Pressure Class: 125 psig.

- 9. Listing: Valves NPS 1 and smaller shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction.
- 10. Service: Suitable for natural-gas service with "WOG" indicated on valve body.

2.4 SLEEVES

- A. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized steel, plain ends.
- B. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.

2.5 MECHANICAL SLEEVE SEALS

- A. Description: Modular sealing element unit, designed for field assembly, to fill annular space between pipe and sleeve.
 - 1. Manufacturers: 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. Advance Products & Systems, Inc.
 - b. Calpico Inc.
 - c. Metraflex Company (The).
 - d. Pipeline Seal and Insulator, Inc.
 - 2. Sealing Elements: EPDM interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe and sleeve.
 - 3. Pressure Plates: Carbon steel.
 - 4. Connecting Bolts and Nuts: Carbon steel with corrosion-resistant coating of length required to secure pressure plates to sealing elements. Include one nut and bolt for each sealing element.

2.6 ESCUTCHEONS

- A. General Requirements for Escutcheons: Manufactured wall and ceiling escutcheons and floor plates, with ID to fit around pipe or tube, and OD that completely covers opening.
- B. One-Piece, Deep-Pattern Escutcheons: Deep-drawn, box-shaped brass with polished chrome-plated finish.
- C. One-Piece, Cast-Brass Escutcheons: With set screw.
 - 1. Finish: Polished chrome-plated.
- D. Split-Casting, Cast-Brass Escutcheons: With concealed hinge and set screw.
 - 1. Finish: Polished chrome-plated.
- E. One-Piece, Stamped-Steel Escutcheons: With set screw or spring clips and chromeplated finish.
- F. Split-Plate, Stamped-Steel Escutcheons: With concealed hinge, set screw or spring clips, and chrome-plated finish.

- G. One-Piece, Floor-Plate Escutcheons: Cast-iron floor plate.
- H. Split-Casting, Floor-Plate Escutcheons: Cast brass with concealed hinge and set screw.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine roughing-in for natural-gas piping system to verify actual locations of piping connections before equipment installation.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Close equipment shutoff valves before turning off natural gas to premises or piping section.
- B. Inspect natural-gas piping according to the International Fuel Gas Code to determine that natural-gas utilization devices are turned off in piping section affected.
- C. Comply with the International Fuel Gas Code requirements for prevention of accidental ignition.

3.3 OUTDOOR PIPING INSTALLATION

- A. Comply with the International Fuel Gas Code for installation and purging of natural-gas piping.
- B. Aboveground, Exterior-Wall Pipe Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.
 - 1. Install steel pipe for sleeves smaller than 6 inches in diameter.
 - 2. Install cast-iron "wall pipes" for sleeves 6 inches and larger in diameter.
- C. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

3.4 INDOOR PIPING INSTALLATION

- A. Comply with the International Fuel Gas Code for installation and purging of natural-gas piping.
- B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements are used to size pipe and calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.
- C. Arrange pipe spaces, chases, slots, sleeves, and openings in building structure during progress of construction, to allow for mechanical installations.

- D. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.
- E. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- F. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- G. Locate valves for easy access.
- H. Install natural-gas piping at uniform grade of 2 percent down toward drip and sediment traps.
- I. Install piping free of sags and bends.
- J. Install fittings for changes in direction and branch connections.
- K. Install escutcheons at penetrations of interior walls, ceilings, and floors.
 - 1. New Piping:
 - a. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep-pattern type.
 - b. Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, castbrass type with polished chrome-plated finish.
 - c. Piping at Ceiling Penetrations in Finished Spaces: One-piece, cast-brass type with polished chrome-plated finish.
 - d. Piping in Unfinished Service Spaces: One-piece, cast-brass type with polished chrome-plated finish.
 - e. Piping in Equipment Rooms: One-piece, cast-brass type.
 - f. Piping in Equipment Rooms: One-piece, stamped-steel type with set screw or spring clips.
 - g. Piping at Floor Penetrations in Equipment Rooms: One-piece, floor-plate type.
- L. Verify final equipment locations for roughing-in.
- M. Comply with requirements in Sections specifying gas-fired appliances and equipment for roughing-in requirements.
- N. Drips and Sediment Traps: Install drips at points where condensate may collect, including service-meter outlets. Locate where accessible to permit cleaning and emptying. Do not install where condensate is subject to freezing.
 - 1. Construct drips and sediment traps using tee fitting with bottom outlet plugged or capped. Use nipple a minimum length of 3 pipe diameters, but not less than 3 inches long and same size as connected pipe. Install with space below bottom of drip to remove plug or cap.
- O. Concealed Location Installations: Except as specified below, install concealed naturalgas piping and piping installed under the building in containment conduit constructed of steel pipe with welded joints as described in Part 2. Install a vent pipe from containment conduit to outdoors and terminate with weatherproof vent cap.

- 1. Above Accessible Ceilings: Natural-gas piping, fittings, valves, and regulators may be installed in accessible spaces without containment conduit.
- 2. In Walls or Partitions: Protect tubing installed inside partitions or hollow walls from physical damage using steel striker barriers at rigid supports.
 - a. Exception: Tubing passing through partitions or walls does not require striker barriers.
- 3. Prohibited Locations:
 - a. Do not install natural-gas piping in or through circulating air ducts, clothes or trash chutes, chimneys or gas vents (flues), ventilating ducts, or dumbwaiter or elevator shafts.
 - b. Do not install natural-gas piping in solid walls or partitions.
 - c. Do not install natural gas piping in floors, slabs or concrete.
- P. Use eccentric reducer fittings to make reductions in pipe sizes. Install fittings with level side down.
- Q. Connect branch piping from top or side of horizontal piping.
- R. Install unions in pipes NPS 2 and smaller, adjacent to each valve, at final connection to each piece of equipment. Unions are not required at flanged connections.
- S. Do not use natural-gas piping as grounding electrode.

3.5 VALVE INSTALLATION

A. Install manual gas shutoff valve for each gas appliance.

3.6 PIPING JOINT CONSTRUCTION

- A. Ream ends of pipes and tubes and remove burrs.
- B. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
- C. Threaded Joints:
 - 1. Thread pipe with tapered pipe threads complying with ASME B1.20.1.
 - 2. Cut threads full and clean using sharp dies.
 - 3. Ream threaded pipe ends to remove burrs and restore full inside diameter of pipe.
 - 4. Apply appropriate tape or thread compound to external pipe threads unless dryseal threading is specified.
 - 5. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.
- D. Welded Joints:
 - 1. Construct joints according to AWS D10.12/D10.12M, using qualified processes and welding operators.
 - 2. Bevel plain ends of steel pipe.
 - 3. Patch factory-applied protective coating as recommended by manufacturer at field welds and where damage to coating occurs during construction.

3.7 HANGER AND SUPPORT INSTALLATION

- A. Comply with requirements for pipe hangers and supports specified in Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment."
- B. Install hangers for horizontal steel piping with the following maximum spacing and minimum rod sizes:
 - 1. NPS 1and Smaller: Maximum span, 96 inches; minimum rod size, 3/8 inch.
 - 2. NPS 1-1/4: Maximum span, 108 inches; minimum rod size, 3/8 inch.
 - 3. NPS 1-1/2 and NPS 2: Maximum span, 108 inches; minimum rod size, 3/8 inch.
 - 4. NPS 2-1/2 to NPS 3-1/2: Maximum span, 10 feet; minimum rod size, 1/2 inch.
 - 5. NPS 4 and Larger: Maximum span, 10 feet; minimum rod size, 5/8 inch.

3.8 CONNECTIONS

- A. Install natural-gas piping electrically continuous and bonded to gas appliance equipment grounding conductor of the circuit powering the appliance according to NFPA 70.
- B. Install piping adjacent to appliances to allow service and maintenance of appliances.
- C. Connect piping to appliances using manual gas shutoff valves and unions. Install valve within 72 inches of each gas-fired appliance and equipment. Install union between valve and appliances or equipment.
- D. Sediment Traps: Install tee fitting with capped nipple in bottom to form drip, as close as practical to inlet of each appliance.

3.9 LABELING AND IDENTIFYING

A. Comply with requirements in Division 22 Section "Identification for Plumbing Piping and Equipment" for piping and valve identification.

3.10 PAINTING

- A. Comply with requirements in Division 09 painting Sections for painting interior and exterior natural-gas piping.
- B. Paint exposed, exterior metal piping, valves, and piping specialties, except components, with factory-applied paint or protective coating.
 - 1. Alkyd System: MPI EXT 5.1D.
 - a. Prime Coat: Alkyd anticorrosive metal primer.
 - b. Intermediate Coat: Exterior alkyd enamel matching topcoat.
 - c. Topcoat: Exterior alkyd enamel (flat).
 - d. Color: Gray.
- C. Paint exposed, interior metal piping, valves, service regulators, service meters and meter bars, earthquake valves, and piping specialties, except components, with factory-applied paint or protective coating.
 - 1. Latex Over Alkyd Primer System: MPI INT 5.1Q.

- a. Prime Coat: Alkyd anticorrosive metal primer.
- b. Intermediate Coat: Interior latex matching topcoat.
- c. Topcoat: Interior latex (flat).
- d. Color: Selected by Architect.
- D. Damage and Touchup: Repair marred and damaged factory-applied finishes with materials and by procedures to match original factory finish.

3.11 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. Tests and Inspections:
 - 1. Test, inspect, and purge natural gas according to the International Fuel Gas Code and authorities having jurisdiction.
- C. Natural-gas piping will be considered defective if it does not pass tests and inspections.
- D. Prepare test and inspection reports.

3.12 OUTDOOR PIPING SCHEDULE

- A. Aboveground natural-gas piping shall be one of the following:
 - 1. Steel pipe with malleable-iron fittings and threaded joints.
 - 2. Steel pipe with wrought-steel fittings and welded joints.

3.13 INDOOR PIPING SCHEDULE FOR SYSTEM PRESSURES LESS THAN 0.5 PSIG

- A. Aboveground, branch piping NPS 1 and smaller shall be the following:
 - 1. Steel pipe with malleable-iron fittings and threaded joints.
- B. Aboveground, distribution piping shall be one of the following:
 - 1. Steel pipe with malleable-iron fittings and threaded joints.
 - 2. Steel pipe with wrought-steel fittings and welded joints.

3.14 ABOVEGROUND MANUAL GAS SHUTOFF VALVE SCHEDULE

- A. Valves for pipe sizes NPS 2 and smaller at service meter shall be one of the following:
 - 1. Two-piece, full-port, bronze ball valves with bronze trim.
 - 2. Bronze plug valve.
- B. Valves for pipe sizes NPS 2-1/2 and larger at service meter shall be one of the following:
 - 1. Two-piece, full-port, bronze ball valves with bronze trim.
 - 2. Bronze plug valve.
 - 3. Cast-iron, nonlubricated plug valve.
- C. Distribution piping valves for pipe sizes NPS 2 and smaller shall be one of the following:

- 1. Two-piece, full-port, bronze ball valves with bronze trim.
- 2. Bronze plug valve.
- D. Distribution piping valves for pipe sizes NPS 2-1/2 and larger shall be one of the following:
 - 1. Two-piece, full-port, bronze ball valves with bronze trim.
 - 2. Bronze plug valve.
 - 3. Cast-iron, nonlubricated plug valve.
- E. Valves in branch piping for single appliance shall be one of the following:
 - 1. Two-piece, full-port, bronze ball valves with bronze trim.
 - 2. Bronze plug valve.

END OF SECTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following for soil, waste, and vent piping inside the building:
 - 1. Pipe, tube, and fittings.

1.3 DEFINITIONS

- A. ABS: Acrylonitrile-butadiene-styrene plastic.
- B. EPDM: Ethylene-propylene-diene terpolymer rubber.
- C. LLDPE: Linear, low-density polyethylene plastic.
- D. NBR: Acrylonitrile-butadiene rubber.
- E. PE: Polyethylene plastic.
- F. PVC: Polyvinyl chloride plastic.
- G. TPE: Thermoplastic elastomer.

1.4 PERFORMANCE REQUIREMENTS

- A. Components and installation shall be capable of withstanding the following minimum working pressure, unless otherwise indicated:
 - 1. Soil, Waste, and Vent Piping: 10-foot head of water.

1.5 SUBMITTALS

- A. Product Data: For pipe, tube, fittings, and couplings.
- B. Shop Drawings:
 - 1. Design Calculations: Signed and sealed by a qualified professional engineer for selecting seismic restraints.
- C. Field quality-control inspection and test reports.

1.6 QUALITY ASSURANCE

- A. Piping materials shall bear label, stamp, or other markings of specified testing agency.
- B. Comply with NSF 14, "Plastics Piping Systems Components and Related Materials," for plastic piping components. Include marking with "NSF-dwv" for plastic drain, waste, and
vent piping; "NSF-drain" for plastic drain piping; "NSF-tubular" for plastic continuous waste piping; and "NSF-sewer" for plastic sewer piping.

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.

2.2 PIPING MATERIALS

- A. Refer to Part 3 "Piping Applications" Article for applications of pipe, tube, fitting, and joining materials.
- 2.3 HUB-AND-SPIGOT, CAST-IRON SOIL PIPE AND FITTINGS
 - A. Pipe and Fittings: ASTM A 74, Service class.
 - B. Gaskets: ASTM C 564, rubber.
 - C. Calking Materials: ASTM B 29, pure lead and oakum or hemp fiber.

2.4 HUBLESS CAST-IRON SOIL PIPE AND FITTINGS

- A. Pipe and Fittings: ASTM A 888 or CISPI 301.
- B. Sovent Stack Fittings: ASME B16.45 or ASSE 1043, hubless, cast-iron aerator and deaerator drainage fittings.
- C. Shielded Couplings: ASTM C 1277 assembly of metal shield or housing, corrosion-resistant fasteners, and rubber sleeve with integral, center pipe stop.
 - 1. Standard, Shielded, Stainless-Steel Couplings: CISPI 310, with stainless-steel corrugated shield; stainless-steel bands and tightening devices; and ASTM C 564, rubber sleeve.
 - a. Manufacturers:
 - 1) Fernco, Inc.
 - 2) Ideal Div.; Stant Corp.
 - 3) Mission Rubber Co.
 - 4) Tyler Pipe; Soil Pipe Div.
 - 2. Heavy-Duty, Shielded, Stainless-Steel Couplings: With stainless-steel shield, stainless-steel bands and tightening devices, and ASTM C 564, rubber sleeve.
 - a. Manufacturers:
 - 1) Clamp-All Corp.

- 2) Ideal Div.; Stant Corp.
- 3) Mission Rubber Co.
- 4) Tyler Pipe; Soil Pipe Div.

2.5 COPPER TUBE AND FITTINGS

- A. Copper DWV Tube: ASTM B 306, drainage tube, drawn temper.
 - 1. Copper Drainage Fittings: ASME B16.23, cast copper or ASME B16.29, wrought copper, solder-joint fittings.
- B. Hard Copper Tube: ASTM B 88, Types L and M (ASTM B 88M, Types B and C), water tube, drawn temper.
 - 1. Copper Pressure Fittings: ASME B16.18, cast-copper-alloy or ASME B16.22, wrought-copper, solder-joint fittings. Furnish wrought-copper fittings if indicated.
 - 2. Copper Flanges: ASME B16.24, Class 150, cast copper with solder-joint end.
 - 3. Copper Unions: MSS SP-123, copper-alloy, hexagonal-stock body with ball-andsocket, metal-to-metal seating surfaces, and solder-joint or threaded ends.

2.6 PVC PIPE AND FITTINGS

- A. Solid-Wall PVC Pipe: ASTM D 2665, Schedule 40, drain, waste, and vent.
- B. PVC Socket Fittings: ASTM D 2665, socket type, made to ASTM D 3311, drain, waste, and vent patterns and to fit Schedule 40 pipe.
- C. Adhesive Primer: ASTM F 656
 - 1. Use adhesive primer that has a VOC content of 550 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- D. Solvent Cement: ASTM D 2564
 - 1. Use PVC solvent cement that has a VOC content of 510 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

PART 3 - EXECUTION

- 3.1 PIPING APPLICATIONS
 - A. Flanges and unions may be used on aboveground pressure piping, unless otherwise indicated.
 - B. Aboveground, soil and waste piping shall be any of the following:
 - 1. Service class, cast-iron soil pipe and fittings; gaskets; and gasketed joints.
 - 2. Hubless cast-iron soil pipe and fittings heavy-duty shielded, stainless-steel couplings; and hubless-coupling joints.
 - 3. Copper DWV tube, copper drainage fittings, and soldered joints.
 - 4. Solid-wall PVC pipe, PVC socket fittings, and solvent-cemented joints.
 - 5. Dissimilar Pipe-Material Couplings: Flexible, Shielded, nonpressure pipe couplings for joining dissimilar pipe materials with small difference in OD.

- C. Aboveground, vent piping shall be any of the following:
 - 1. Service class, cast-iron soil pipe and fittings; gaskets; and gasketed joints.
 - 2. Hubless cast-iron soil pipe and fittings; heavy-duty shielded, stainless-steel couplings; and hubless-coupling joints.
 - 3. Copper DWV tube, copper drainage fittings, and soldered joints.
 - 4. Solid-wall PVC pipe, PVC socket fittings, and solvent-cemented joints.
 - 5. Dissimilar Pipe-Material Couplings: Flexible, Shielded, nonpressure pipe couplings for joining dissimilar pipe materials with small difference in OD.
- D. Underground, soil, waste, and vent piping shall be any of the following:
 - 1. Service class, cast-iron soil piping; gaskets; and gasketed joints.
 - 2. Hubless cast-iron soil pipe and fittings; heavy-duty shielded, stainless-steel couplings; and hubless-coupling joints.
 - 3. Solid wall PVC pipe, PVC socket fittings, and solvent-cemented joints.
 - 4. Dissimilar Pipe-Material Couplings: Flexible, Shielded, Rigid, unshielded, nonpressure pipe couplings for joining dissimilar pipe materials with small difference in OD.

3.2 PIPING INSTALLATION

- A. Basic piping installation requirements are specified in Division 22 Section "Common Work Results for Plumbing."
- B. Install cleanouts at grade and extend to where building sanitary drains connect to building sanitary sewers.
- C. Install cast-iron sleeve with water stop and mechanical sleeve seal at each service pipe penetration through foundation wall. Select number of interlocking rubber links required to make installation watertight. Sleeves and mechanical sleeve seals are specified in Division 22 Section "Common Work Results for Plumbing."
- D. Install wall-penetration fitting at each service pipe penetration through foundation wall. Make installation watertight.
- E. Install cast-iron soil piping according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."
- F. Make changes in direction for soil and waste drainage and vent piping using appropriate branches, bends, and long-sweep bends. Sanitary tees and short-sweep 1/4 bends may be used on vertical stacks if change in direction of flow is from horizontal to vertical. Use long-turn, double Y-branch and 1/8-bend fittings if 2 fixtures are installed back to back or side by side with common drain pipe. Straight tees, elbows, and crosses may be used on vent lines. Do not change direction of flow more than 90 degrees. Use proper size of standard increasers and reducers if pipes of different sizes are connected. Reducing size of drainage piping in direction of flow is prohibited.
- G. Lay buried building drainage piping beginning at low point of each system. Install true to grades and alignment indicated, with unbroken continuity of invert. Place hub ends of piping upstream. Install required gaskets according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements. Maintain swab in piping and pull past each joint as completed.

- H. Install soil and waste drainage and vent piping at the State Plumbing Codes minimum slopes.
- I. Sleeves are not required for cast-iron soil piping passing through concrete slabs-ongrade if slab is without membrane waterproofing.
- J. Install PVC soil and waste drainage and vent piping according to ASTM D 2665 and state plumbing code.
- K. Install underground PVC soil and waste drainage piping according to ASTM D 2321 and state plumbing code.
- L. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.

3.3 JOINT CONSTRUCTION

- A. Basic piping joint construction requirements are specified in Division 22 Section "Common Work Results for Plumbing."
- B. Join hub-and-spigot, cast-iron soil piping with gasket joints according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for compression joints.
- C. Join hubless cast-iron soil piping according to CISPI 310 and CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for hubless-coupling joints.
- D. Soldered Joints: Use ASTM B 813, water-flushable, lead-free flux; ASTM B 32, lead-free-alloy solder; and ASTM B 828 procedure, unless otherwise indicated.
- E. PVC Nonpressure Piping Joints: Join piping according to ASTM D 2665.

3.4 VALVE INSTALLATION

- A. General valve installation requirements are specified in Division 22 Section "General-Duty Valves for Plumbing Piping."
- B. Shutoff Valves: Install shutoff valve on each sewage pump discharge.
 - 1. Install full-port ball valve for piping NPS 3 and smaller.
 - 2. Install gate valve for piping NPS 4 and larger.
- C. Check Valves: Install swing check valve, between pump and shutoff valve, on each sewage pump discharge.

3.5 HANGER AND SUPPORT INSTALLATION

- A. Pipe hangers and supports are specified in Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment." Install the following:
 - 1. Vertical Piping: MSS Type 8 or Type 42, clamps.
 - 2. Install individual, straight, horizontal piping runs according to the following:
 - a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.
 - b. Longer Than 100 Feet: MSS Type 43, adjustable roller hangers.

- c. Longer Than 100 Feet, if Indicated: MSS Type 49, spring cushion rolls.
- 3. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
- 4. Base of Vertical Piping: MSS Type 52, spring hangers.
- B. Install supports according to Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment."
- C. Support vertical piping and tubing at base and at each floor.
- D. Rod diameter may be reduced 1 size for double-rod hangers, with 3/8-inch minimum rods.
- E. Install hangers for cast-iron soil piping with the following maximum horizontal spacing and minimum rod diameters:
 - 1. NPS 1-1/2 and NPS 2: 60 inches with 3/8-inch rod.
 - 2. NPS 3: 60 inches with 1/2-inch rod.
 - 3. NPS 4 and NPS 5: 60 inches with 5/8-inch rod.
 - 4. NPS 6: 60 inches with 3/4-inch rod.
 - 5. NPS 8 to NPS 12: 60 inches with 7/8-inch rod.
- F. Install supports for vertical cast-iron soil piping every 15 feet.
- G. Install hangers for steel piping with the following maximum horizontal spacing and minimum rod diameters:
 - 1. NPS 1-1/4: 84 inches with 3/8-inch rod.
 - 2. NPS 1-1/2: 108 inches with 3/8-inch rod.
 - 3. NPS 2: 10 feet with 3/8-inch rod.
 - 4. NPS 2-1/2: 11 feet with 1/2-inch rod.
 - 5. NPS 3: 12 feet with 1/2-inch rod.
 - 6. NPS 4 and NPS 5: 12 feet with 5/8-inch rod.
 - 7. NPS 6: 12 feet with 3/4-inch rod.
 - 8. NPS 8 to NPS 12: 12 feet with 7/8-inch rod.
- H. Install supports for vertical steel piping every 15 feet.
- I. Install hangers for stainless-steel piping with the following maximum horizontal spacing and minimum rod diameters:
 - 1. NPS 2: 84 inches with 3/8-inch rod.
 - 2. NPS 3: 96 inches with 1/2-inch rod.
 - 3. NPS 4: 108 inches with 1/2-inch rod.
 - 4. NPS 6: 10 feet with 5/8-inch rod.
- J. Install supports for vertical stainless-steel piping every 10 feet.
- K. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:
 - 1. NPS 1-1/4: 72 inches with 3/8-inch rod.
 - 2. NPS 1-1/2 and NPS 2: 96 inches with 3/8-inch rod.

- 3. NPS 2-1/2: 108 inches with 1/2-inch rod.
- 4. NPS 3 to NPS 5: 10 feet with 1/2-inch rod.
- 5. NPS 6: 10 feet with 5/8-inch rod.
- 6. NPS 8: 10 feet with 3/4-inch rod.
- L. Install supports for vertical copper tubing every 10 feet.
- M. Install hangers for PVC piping with the following maximum horizontal spacing and minimum rod diameters:
 - 1. NPS 1-1/2 and NPS 2: 48 inches with 3/8-inch rod.
 - 2. NPS 3: 48 inches with 1/2-inch rod.
 - 3. NPS 4 and 5: 48 inches with 5/8-inch rod.
 - 4. NPS 6: 48 inches with 3/4-inch rod.
 - 5. NPS 8 to NPS 12: 48 inches with 7/8-inch rod.
- N. Install supports for vertical PVC piping every 48 inches.
- O. Support piping and tubing not listed above according to MSS SP-69 and manufacturer's written instructions.

3.6 CONNECTIONS

- A. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Connect soil and waste piping to exterior sanitary sewerage piping. Use transition fitting to join dissimilar piping materials.
- C. Connect drainage and vent piping to the following:
 - 1. Plumbing Fixtures: Connect drainage piping in sizes indicated, but not smaller than required by plumbing code.
 - 2. Plumbing Fixtures and Equipment: Connect atmospheric vent piping in sizes indicated, but not smaller than required by authorities having jurisdiction.
 - 3. Plumbing Specialties: Connect drainage and vent piping in sizes indicated, but not smaller than required by plumbing code.
 - 4. Equipment: Connect drainage piping as indicated. Provide shutoff valve, if indicated, and union for each connection. Use flanges instead of unions for connections NPS 2-1/2 and larger.

3.7 FIELD QUALITY CONTROL

- A. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction.
 - 1. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.
 - 2. Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.
- B. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.

- C. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.
- D. Test sanitary drainage and vent piping according to procedures of authorities having jurisdiction or, in absence of published procedures, as follows:
 - 1. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.
 - 2. Leave uncovered and unconcealed new, altered, extended, or replaced drainage and vent piping until it has been tested and approved. Expose work that was covered or concealed before it was tested.
 - 3. Roughing-in Plumbing Test Procedure: Test drainage and vent piping, except outside leaders, on completion of roughing-in. Close openings in piping system and fill with water to point of overflow, but not less than 25-foot head of water. From 15 minutes before inspection starts to completion of inspection, water level must not drop. Inspect joints for leaks.
 - 4. Finished Plumbing Test Procedure: After plumbing fixtures have been set and traps filled with water, test connections and prove they are gastight and watertight. Plug vent-stack openings on roof and building drains where they leave building. Introduce air into piping system equal to pressure of 1-inch wg. Use U-tube or manometer inserted in trap of water closet to measure this pressure. Air pressure must remain constant without introducing additional air throughout period of inspection. Inspect plumbing fixture connections for gas and water leaks.
 - 5. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
 - 6. Prepare reports for tests and required corrective action.

3.8 CLEANING

- A. Clean interior of piping. Remove dirt and debris as work progresses.
- B. Protect drains during the remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.
- C. Place plugs in ends of uncompleted piping at end of day and when work stops.

3.9 PROTECTION

A. Exposed PVC Piping: Protect plumbing vents exposed to sunlight with two coats of water-based latex paint.

END OF SECTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following sanitary drainage piping specialties:
 - 1. Cleanouts.
 - 2. Floor drains.
 - 3. Roof flashing assemblies.
 - 4. Through-penetration firestop assemblies.
 - 5. Miscellaneous sanitary drainage piping specialties.
 - 6. Flashing materials.

1.3 DEFINITIONS

- A. ABS: Acrylonitrile-butadiene-styrene plastic.
- B. FOG: Fats, oils, and greases.
- C. FRP: Fiberglass-reinforced plastic.
- D. HDPE: High-density polyethylene plastic.
- E. PE: Polyethylene plastic.
- F. PP: Polypropylene plastic.
- G. PVC: Polyvinyl chloride plastic.

1.4 QUALITY ASSURANCE

- A. Drainage piping specialties shall bear label, stamp, or other markings of specified testing agency.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- C. Comply with NSF 14, "Plastics Piping Components and Related Materials," for plastic sanitary piping specialty components.

1.5 COORDINATION

A. Coordinate size and location of roof penetrations.

PART 2 - PRODUCTS

2.1 CLEANOUTS

- A. Exposed Metal Cleanouts:
 - 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. Josam Company; Josam Div.
 - b. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
 - c. Watts Drainage Products Inc.
 - d. Zurn Plumbing Products Group; Specification Drainage Operation.
 - 2. Standard: ASME A112.36.2M for cast iron cleanout test tee.
 - 3. Size: Same as connected drainage piping
 - 4. Body Material: Hub-and-spigot, cast-iron soil pipe T-branch or Hubless, cast-iron soil pipe test tee as required to match connected piping.
 - 5. Closure: Countersunk or raised-head, brass plug.
 - 6. Closure Plug Size: Same as or not more than one size smaller than cleanout size.
 - 7. Closure: Stainless-steel plug with seal.
- B. Metal Floor Cleanouts:
 - 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. Josam Company; Josam Div.
 - b. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
 - c. Watts Drainage Products Inc.
 - d. Zurn Plumbing Products Group.
 - 2. Standard: ASME A112.36.2M for threaded, adjustable housing cleanout.
 - 3. Size: Same as connected branch.
 - 4. Type: Threaded, adjustable housing.
 - 5. Body or Ferrule: Cast iron.
 - 6. Closure: Plastic plug.
 - 7. Adjustable Housing Material: Cast iron with threads.
 - 8. Frame and Cover Material and Finish: Polished Nickel-bronze.
 - 9. Frame and Cover Shape: Round.
- C. Cast-Iron Wall Cleanouts:
 - 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. Josam Company; Josam Div.
 - b. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
 - c. Watts Drainage Products Inc.
 - d. Zurn Plumbing Products Group; Specification Drainage Operation.

- 2. Standard: ASME A112.36.2M. Include wall access.
- 3. Size: Same as connected drainage piping.
- 4. Body: Hub-and-spigot, cast-iron soil pipe T-branch or Hubless, cast-iron soil pipe test tee as required to match connected piping.
- 5. Closure: Raised-head, drilled-and-threaded Bronze plug.
- 6. Closure Plug Size: Same as or not more than one size smaller than cleanout size.
- 7. Wall Access: Round, flat, stainless-steel cover plate with screw.

2.2 FLOOR DRAINS

- A. Cast-Iron Floor Drains:
 - 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. Josam Company; Josam Div.
 - b. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
 - c. Watts Drainage Products Inc.
 - d. Zurn Plumbing Products Group.
 - 2. Standard: ASME A112.6.3.
 - 3. Pattern: Floor drain.
 - 4. Body Material: Coated cast iron.
 - 5. Outlet: Bottom.
 - 6. Coating on Interior and Exposed Exterior Surfaces: Acid-resistant enamel.
 - 7. Top or Strainer Material: Polished Nickel bronze.
 - 8. Top of Body and Strainer Finish: Polished Nickel bronze.
 - 9. Top Shape: Round.

2.3 ROOF FLASHING ASSEMBLIES

- A. Roof Flashing Assemblies:
 - 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. Acorn Engineering Company; Elmdor/Stoneman Div.
 - b. Thaler Metal Industries Ltd.
- B. Description: Manufactured assembly made of 6.0-lb/sq. ft., 0.0938-inch-thick, lead flashing collar and skirt extending at least 10 inches from pipe, with galvanized-steel boot reinforcement and counterflashing fitting.
 - 1. Open-Top Vent Cap: Without cap.
 - 2. Low-Silhouette Vent Cap: With vandal-proof vent cap.
 - 3. Extended Vent Cap: With field-installed, vandal-proof vent cap.

2.4 THROUGH-PENETRATION FIRESTOP ASSEMBLIES

A. Through-Penetration Firestop Assemblies:

- 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. ProSet Systems Inc.
- 2. Standard: UL 1479 assembly of sleeve and stack fitting with firestopping plug.
- 3. Size: Same as connected soil, waste, or vent stack.
- 4. Sleeve: Molded PVC plastic, of length to match slab thickness and with integral nailing flange on one end for installation in cast-in-place concrete slabs.
- 5. Stack Fitting: ASTM A 48/A 48M, gray-iron, hubless-pattern, wye branch with neoprene O-ring at base and gray-iron plug in thermal-release harness. Include PVC protective cap for plug.
- 6. Special Coating: Corrosion resistant on interior of fittings.

2.5 MISCELLANEOUS SANITARY DRAINAGE PIPING SPECIALTIES

- A. Open Drains:
 - 1. Description: Shop or field fabricate from ASTM A 74, Service class, hub-andspigot, cast-iron, soil-pipe fittings. Include P-trap, hub-and-spigot riser section; and where required, increaser fitting joined with ASTM C 564, rubber gaskets.
 - 2. Size: Same as connected waste piping with increaser fitting of size indicated.
- B. Deep-Seal Traps:
 - 1. Description: Cast-iron casting, with inlet and outlet matching connected piping and cleanout trap-seal primer valve connection.
 - 2. Size: Same as connected waste piping.
 - a. NPS 2: 4-inch-minimum water seal.
 - b. NPS 2-1/2 and Larger: 5-inch-minimum water seal.
- C. Air-Gap Fittings:
 - 1. Standard: ASME A112.1.2, for fitting designed to ensure fixed, positive air gap between installed inlet and outlet piping.
 - 2. Body: Bronze or cast iron.
 - 3. Inlet: Opening in top of body.
 - 4. Outlet: Larger than inlet.
 - 5. Size: Same as connected waste piping and with inlet large enough for associated indirect waste piping.

2.6 FLASHING MATERIALS

- A. Lead Sheet: ASTM B 749, Type L51121, copper bearing, with the following minimum weights and thicknesses, unless otherwise indicated:
 - 1. General Use: 4.0-lb/sq. ft., 0.0625-inch thickness.
 - 2. Vent Pipe Flashing: 3.0-lb/sq. ft., 0.0469-inch thickness.
 - 3. Burning: 6-lb/sq. ft., 0.0938-inch thickness.
- B. Copper Sheet: ASTM B 152/B 152M, of the following minimum weights and thicknesses, unless otherwise indicated:

- 1. General Applications: 12 oz./sq. ft.
- 2. Vent Pipe Flashing: 8 oz./sq. ft.
- C. Zinc-Coated Steel Sheet: ASTM A 653/A 653M, with 0.20 percent copper content and 0.04-inch minimum thickness, unless otherwise indicated. Include G90 hot-dip galvanized, mill-phosphatized finish for painting if indicated.
- D. Elastic Membrane Sheet: ASTM D 4068, flexible, chlorinated polyethylene, 40-mil minimum thickness.
- E. Fasteners: Metal compatible with material and substrate being fastened.
- F. Metal Accessories: Sheet metal strips, clamps, anchoring devices, and similar accessory units required for installation; matching or compatible with material being installed.
- G. Solder: ASTM B 32, lead-free alloy.
- H. Bituminous Coating: SSPC-Paint 12, solvent-type, bituminous mastic.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Refer to Division 22 Section "Common Work Results for Plumbing" for piping joining materials, joint construction, and basic installation requirements.
- B. Install cleanouts in aboveground piping and building drain piping according to the following, unless otherwise indicated:
 - 1. Size same as drainage piping up to NPS 4. Use NPS 4 for larger drainage piping unless larger cleanout is indicated or required per the state plumbing code.
 - 2. Locate at each change in direction of piping greater than 45 degrees.
 - 3. Locate at minimum intervals of 50 feet for piping NPS 4 and smaller and 100 feet for larger piping.
 - 4. Locate at base of each vertical soil and waste stack.
- C. For floor cleanouts for piping below floors, install cleanout deck plates with top flush with finished floor.
- D. For cleanouts located in concealed piping, install cleanout wall access covers, of types indicated, with cover flush with finished wall.
- E. Install floor drains at low points of surface areas to be drained. Set grates of drains flush with finished floor, unless otherwise indicated.
 - 1. Position floor drains for easy access and maintenance.
 - 2. Set floor drains below elevation of surrounding finished floor to allow floor drainage. Set with grates depressed according to the following drainage area radii:
 - a. Radius, 30 Inches or Less: Equivalent to 1 percent slope, but not less than 1/4-inch total depression.
 - b. Radius, 30 to 60 Inches: Equivalent to 1 percent slope.

- c. Radius, 60 Inches or Larger: Equivalent to 1 percent slope, but not greater than 1-inch total depression.
- 3. Install floor-drain flashing collar or flange so no leakage occurs between drain and adjoining flooring. Maintain integrity of waterproof membranes where penetrated.
- 4. Install individual traps for floor drains connected to sanitary building drain, unless otherwise indicated.
- F. Install roof flashing assemblies on sanitary stack vents and vent stacks that extend through roof.
- G. Install flashing fittings on sanitary stack vents and vent stacks that extend through roof.
- H. Install through-penetration firestop assemblies in plastic conductors and stacks at floor penetrations.
- I. Assemble open drain fittings and install with top of hub 2 inches above floor.
- J. Install deep-seal traps on floor drains and other waste outlets.
- K. Install air-gap fittings on draining-type backflow preventers and on indirect-waste piping discharge into sanitary drainage system.
- L. Install sleeve flashing device with each riser and stack passing through floors with waterproof membrane.
- M. Install wood-blocking reinforcement for wall-mounting-type specialties.
- N. Install traps on plumbing specialty drain outlets. Omit traps on indirect wastes unless trap is indicated.
- O. Install escutcheons at wall, floor, and ceiling penetrations in exposed finished locations and within cabinets and millwork. Use deep-pattern escutcheons if required to conceal protruding pipe fittings.

3.2 CONNECTIONS

- A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install piping adjacent to equipment to allow service and maintenance.

3.3 FLASHING INSTALLATION

- A. Fabricate flashing from single piece unless large pans, sumps, or other drainage shapes are required. Join flashing according to the following if required:
 - 1. Lead Sheets: Burn joints of lead sheets 6.0-lb/sq. ft., 0.0938-inch thickness or thicker. Solder joints of lead sheets 4.0-lb/sq. ft., 0.0625-inch thickness or thinner.
 - 2. Copper Sheets: Solder joints of copper sheets.
- B. Install sheet flashing on pipes, sleeves, and specialties passing through or embedded in floors and roofs with waterproof membrane.

- 1. Pipe Flashing: Sleeve type, matching pipe size, with minimum length of 10 inches, and skirt or flange extending at least 8 inches around pipe.
- 2. Sleeve Flashing: Flat sheet, with skirt or flange extending at least 8 inches around sleeve.
- 3. Embedded Specialty Flashing: Flat sheet, with skirt or flange extending at least 8 inches (200 mm) around specialty.
- C. Set flashing on floors and roofs in solid coating of bituminous cement.
- D. Secure flashing into sleeve and specialty clamping ring or device.
- E. Install flashing for piping passing through roofs with counterflashing or commercially made flashing fittings, according to Division 07 Section "Sheet Metal Flashing and Trim."
- F. Extend flashing up vent pipe passing through roofs and turn down into pipe, or secure flashing into cast-iron sleeve having calking recess.
- G. Fabricate and install flashing and pans, sumps, and other drainage shapes.

3.4 FIELD QUALITY CONTROL

- A. Tests and Inspections:
 - 1. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
 - 2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

3.5 PROTECTION

- A. Protect drains during remainder of construction period to avoid clogging with dirt or debris and to prevent damage from traffic or construction work.
- B. Place plugs in ends of uncompleted piping at end of each day or when work stops.

END OF SECTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following storm drainage piping inside the building:
 - 1. Pipe, tube, and fittings.

1.3 DEFINITIONS

- A. ABS: Acrylonitrile-butadiene-styrene plastic.
- B. LLDPE: Linear, low-density polyethylene plastic.
- C. PE: Polyethylene plastic.
- D. PVC: Polyvinyl chloride plastic.
- E. TPE: Thermoplastic elastomer.

1.4 PERFORMANCE REQUIREMENTS

- A. Components and installation shall be capable of withstanding the following minimum working-pressure, unless otherwise indicated:
 - 1. Storm Drainage Piping: 10-foot head of water.

1.5 SUBMITTALS

- A. Product Data: For pipe, tube, fittings, and couplings.
- B. Field quality-control inspection and test reports.

1.6 QUALITY ASSURANCE

- A. Piping materials shall bear label, stamp, or other markings of specified testing agency.
- B. Comply with NSF 14, "Plastics Piping Systems Components and Related Materials," for plastic piping components. Include marking with "NSF-drain" for plastic drain piping and "NSF-sewer" for plastic sewer piping.

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.

2.2 PIPING MATERIALS

- A. Refer to Part 3 "Piping Applications" Article for applications of pipe, tube, fitting, and joining materials.
- 2.3 HUB-AND-SPIGOT, CAST-IRON SOIL PIPE AND FITTINGS
 - A. Pipe and Fittings: ASTM A 74, Service class.
 - B. Gaskets: ASTM C 564, rubber.
 - C. Calking Materials: ASTM B 29, pure lead and oakum or hemp fiber.

2.4 HUBLESS CAST-IRON SOIL PIPE AND FITTINGS

- A. Pipe and Fittings: ASTM A 888 or CISPI 301.
- B. Shielded Couplings: ASTM C 1277 assembly of metal shield or housing, corrosion-resistant fasteners, and rubber sleeve with integral, center pipe stop.
 - 1. Standard, Shielded, Stainless-Steel Couplings: CISPI 310, with stainless-steel corrugated shield; stainless-steel bands and tightening devices; and ASTM C 564, rubber sleeve.
 - a. Available Manufacturers:
 - 1) ANACO.
 - 2) Fernco, Inc.
 - 3) Ideal Div.; Stant Corp.
 - 4) Mission Rubber Co.
 - 5) Tyler Pipe; Soil Pipe Div.
 - 2. Heavy-Duty, Shielded, Stainless-Steel Couplings: With stainless-steel shield, stainless-steel bands and tightening devices, and ASTM C 564, rubber sleeve.
 - a. Available Manufacturers:
 - 1) ANACO.
 - 2) Clamp-All Corp.
 - 3) Ideal Div.; Stant Corp.
 - 4) Mission Rubber Co.
 - 5) Tyler Pipe; Soil Pipe Div.

2.5 COPPER TUBE AND FITTINGS

- A. Copper DWV Tube: ASTM B 306, drainage tube, drawn temper.
 - 1. Copper Drainage Fittings: ASME B16.23, cast-copper or ASME B16.29, wrought-copper, solder-joint fittings.

- B. Hard Copper Tube: ASTM B 88, Types L and M (ASTM B 88M, Types B and C), water tube, drawn temper.
 - 1. Copper Pressure Fittings: ASME B16.18, cast-copper-alloy or ASME B16.22, wrought-copper, solder-joint fittings. Furnish wrought-copper fittings if indicated.
 - 2. Copper Flanges: ASME B16.24, Class 150, cast copper with solder-joint end.
 - 3. Copper Unions: MSS SP-123, copper-alloy, hexagonal-stock body with ball-andsocket, metal-to-metal seating surfaces, and solder-joint or threaded ends.

2.6 PVC PIPE AND FITTINGS

- A. Solid-Wall PVC Pipe: ASTM D 2665, drain, waste, and vent.
- B. Solvent Cement and Adhesive Primer:
 - 1. Use PVC solvent cement that has a VOC content of 510 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - 2. Use adhesive primer that has a VOC content of 550 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

PART 3 - EXECUTION

- 3.1 PIPING APPLICATIONS
 - A. Flanges and unions may be used on aboveground pressure piping, unless otherwise indicated.
 - B. Aboveground storm drainage piping shall be any of the following:
 - 1. Service class, cast-iron soil pipe and fittings; gaskets; and gasketed joints.
 - 2. Hubless cast-iron soil pipe and fittings; heavy-duty shielded, stainless-steel couplings; and coupled joints.
 - 3. Copper DWV tube, copper drainage fittings, and soldered joints.
 - 4. Solid-wall PVC pipe, PVC socket fittings, and solvent-cemented joints.
 - 5. Dissimilar Pipe-Material Couplings: Shielded, nonpressure pipe couplings for joining dissimilar pipe materials with small difference in OD.
 - C. Underground storm drainage piping shall be any of the following:
 - 1. Extra-heavy class, cast-iron soil pipe and fittings; gaskets; and gasketed joints.
 - 2. Hubless cast-iron soil pipe and fittings; heavy-duty shielded, stainless-steel couplings; and coupled joints.
 - 3. Solid-wall PVC pipe, PVC socket fittings, and solvent-cemented joints.
 - 4. Dissimilar Pipe-Material Couplings: Shielded, nonpressure pipe couplings for joining dissimilar pipe materials with small difference in OD.

3.2 PIPING INSTALLATION

- A. Storm sewer and drainage piping outside the building are specified in Division 33 Section "Storm Utility Drainage Piping."
- B. Basic piping installation requirements are specified in Division 22 Section "Common Work Results for Plumbing."

- C. Install cleanouts at grade and extend to where building storm drains connect to building storm sewers. Cleanouts are specified in Division 22 Section "Storm Drainage Piping Specialties."
- D. Install cast-iron sleeve with water stop and mechanical sleeve seal at each service pipe penetration through foundation wall. Select number of interlocking rubber links required to make installation watertight. Sleeves and mechanical sleeve seals are specified in Division 22 Section "Common Work Results for Plumbing."
- E. Install wall-penetration fitting system at each service pipe penetration through foundation wall. Make installation watertight.
- F. Install cast-iron soil piping according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."
- G. Make changes in direction for storm drainage piping using appropriate branches, bends, and long-sweep bends. Do not change direction of flow more than 90 degrees. Use proper size of standard increasers and reducers if pipes of different sizes are connected. Reducing size of drainage piping in direction of flow is prohibited.
- H. Lay buried building storm drainage piping beginning at low point of each system. Install true to grades and alignment indicated, with unbroken continuity of invert. Place hub ends of piping upstream. Install required gaskets according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements. Maintain swab in piping and pull past each joint as completed.
- I. Install storm drainage piping at the following minimum slopes, unless otherwise indicated:
 - 1. Building Storm Drain: 1 percent downward in direction of flow for piping NPS 3 and smaller; 1 percent downward in direction of flow for piping NPS 4 and larger.
 - 2. Horizontal Storm-Drainage Piping: 1 percent downward in direction of flow.
- J. Sleeves are not required for cast-iron soil piping passing through concrete slabs-ongrade if slab is without membrane waterproofing.
- K. Install PVC storm drainage piping according to ASTM D 2665 and state plumbing code.
- L. Install underground PVC storm drainage piping according to ASTM D 2321 and state plumbing code.
- M. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.

3.3 JOINT CONSTRUCTION

- A. Basic piping joint construction requirements are specified in Division 22 Section "Common Work Results for Plumbing."
- B. Hub-and-Spigot, Cast-Iron Soil Piping Gasketed Joints: Join according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for compression joints.
- C. Hub-and-Spigot, Cast-Iron Soil Piping Calked Joints: Join according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for lead and oakum calked joints.

- D. Hubless Cast-Iron Soil Piping Coupled Joints: Join according to CISPI 310 and CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for hubless-coupling joints.
- E. Soldered Joints: Use ASTM B 813, water-flushable, lead-free flux; ASTM B 32, lead-free-alloy solder; and ASTM B 828 procedure, unless otherwise indicated.
- F. PVC Nonpressure Piping Joints: Join piping according to ASTM D 2665.

3.4 HANGER AND SUPPORT INSTALLATION

- A. Pipe hangers and supports are specified in Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment." Install the following:
 - 1. Vertical Piping: MSS Type 8 or Type 42, clamps.
 - 2. Individual, Straight, Horizontal Piping Runs: According to the following:
 - a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.
 - b. Longer Than 100 Feet: MSS Type 43, adjustable roller hangers.
 - c. Longer Than 100 Feet, if Indicated: MSS Type 49, spring cushion rolls.
 - 3. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
 - 4. Base of Vertical Piping: MSS Type 52, spring hangers.
- B. Install supports according to Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment."
- C. Support vertical piping and tubing at base and at each floor.
- D. Rod diameter may be reduced 1 size for double-rod hangers, with 3/8-inch minimum rods.
- E. Install hangers for cast-iron soil piping with the following maximum horizontal spacing and minimum rod diameters:
 - 1. NPS 1-1/2 and NPS 2: 60 inches with 3/8-inch rod.
 - 2. NPS 3: 60 inches with 1/2-inch rod.
 - 3. NPS 4 and NPS 5: 60 inches with 5/8-inch rod.
 - 4. NPS 6: 60 inches with 3/4-inch rod.
 - 5. NPS 8 to NPS 12: 60 inches with 7/8-inch rod.
 - 6. Spacing for 10-foot lengths may be increased to 10 feet. Spacing for fittings is limited to 60 inches.
- F. Install supports for vertical cast-iron soil piping every 15 feet.
- G. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:
 - 1. NPS 1-1/4: 72 inches with 3/8-inch rod.
 - 2. NPS 1-1/2 and NPS 2: 96 inches with 3/8-inch rod.
 - 3. NPS 2-1/2: 108 inches with 1/2-inch rod.
 - 4. NPS 3 to NPS 5: 10 feet with 1/2-inch rod.
 - 5. NPS 6: 10 feet with 5/8-inch rod.
 - 6. NPS 8: 10 feet with 3/4-inch rod.

- H. Install supports for vertical copper tubing every 10 feet.
- I. Install hangers for PVC piping with the following maximum horizontal spacing and minimum rod diameters:
 - 1. NPS 1-1/2 and NPS 2: 48 inches with 3/8-inch rod.
 - 2. NPS 3: 48 inches with 1/2-inch rod.
 - 3. NPS 4 and NPS 5: 48 inches with 5/8-inch rod.
 - 4. NPS 6: 48 inches with 3/4-inch rod.
 - 5. NPS 8 to NPS 12: 48 inches with 7/8-inch rod.
- J. Install supports for vertical PVC piping every 48 inches.
- K. Support piping and tubing not listed above according to MSS SP-69 and manufacturer's written instructions.

3.5 CONNECTIONS

- A. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Connect interior storm drainage piping to exterior storm drainage piping. Use transition fitting to join dissimilar piping materials.
- C. Connect storm drainage piping to roof drains and storm drainage specialties.

3.6 FIELD QUALITY CONTROL

- A. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction.
 - 1. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in.
 - 2. Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.
- B. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.
- C. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.
- D. Test storm drainage piping according to procedures of authorities having jurisdiction or, in absence of published procedures, as follows:
 - 1. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.
 - 2. Leave uncovered and unconcealed new, altered, extended, or replaced storm drainage piping until it has been tested and approved. Expose work that was covered or concealed before it was tested.
 - 3. Test Procedure: Test storm drainage piping, except outside leaders, on completion of roughing-in. Close openings in piping system and fill with water to point of overflow, but not less than 25-foot head of water. From 15 minutes before

inspection starts to completion of inspection, water level must not drop. Inspect joints for leaks.

- 4. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
- 5. Prepare reports for tests and required corrective action.

3.7 CLEANING

- A. Clean interior of piping. Remove dirt and debris as work progresses.
- B. Protect drains during the remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.
- C. Place plugs in ends of uncompleted piping at end of day and when work stops.

END OF SECTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following storm drainage piping specialties:
 - 1. Cleanouts.
 - 2. Through-penetration firestop assemblies.
 - 3. Roof drains.
 - 4. Miscellaneous storm drainage piping specialties.
 - 5. Flashing materials.

1.3 DEFINITIONS

- A. ABS: Acrylonitrile-butadiene-styrene plastic.
- B. FOG: Fats, oils, and greases.
- C. FRP: Fiberglass-reinforced plastic.
- D. HDPE: High-density polyethylene plastic.
- E. PE: Polyethylene plastic.
- F. PP: Polypropylene plastic.
- G. PUR: Polyurethane plastic.
- H. PVC: Polyvinyl chloride plastic.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated.

1.5 QUALITY ASSURANCE

A. Drainage piping specialties shall bear label, stamp, or other markings of specified testing agency.

1.6 COORDINATION

A. Coordinate size and location of roof penetrations.

PART 2 - PRODUCTS

- 2.1 CLEANOUTS
 - A. Exposed Metal Cleanouts:

- 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. Josam Company; Josam Div.
 - b. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
 - c. Watts Drainage Products Inc.
 - d. Zurn Plumbing Products Group; Specification Drainage Operation.
- 2. Standard: ASME A112.36.2M for cast iron for cleanout test tee.
- 3. Size: Same as connected drainage piping
- 4. Body Material: Hub-and-spigot, cast-iron soil pipe T-branch or Hubless, cast-iron soil pipe test tee as required to match connected piping.
- 5. Closure: Countersunk or raised-head, brass plug.
- 6. Closure Plug Size: Same as or not more than one size smaller than cleanout size.
- 7. Closure: Stainless-steel plug with seal.
- B. Metal Floor Cleanouts:
 - 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. Josam Company; Josam Div.
 - b. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
 - c. Watts Drainage Products Inc.
 - d. Zurn Plumbing Products Group.
 - 2. Standard: ASME A112.36.2M for threaded, adjustable housing cleanout.
 - 3. Size: Same as connected branch.
 - 4. Type: Threaded, adjustable housing.
 - 5. Body or Ferrule: Cast iron.
 - 6. Closure: Plastic plug.
 - 7. Adjustable Housing Material: Cast iron with threads.
 - 8. Frame and Cover Material and Finish: Polished Nickel-bronze.
 - 9. Frame and Cover Shape: Round.
- C. Cast-Iron Wall Cleanouts:
 - 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. Josam Company; Josam Div.
 - b. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
 - c. Watts Drainage Products Inc.
 - d. Zurn Plumbing Products Group; Specification Drainage Operation.
 - 2. Standard: ASME A112.36.2M. Include wall access.
 - 3. Size: Same as connected drainage piping.
 - 4. Body: Hub-and-spigot, cast-iron soil pipe T-branch or Hubless, cast-iron soil pipe test tee as required to match connected piping.
 - 5. Closure: Raised-head, drilled-and-threaded Bronze plug.
 - 6. Closure Plug Size: Same as or not more than one size smaller than cleanout size.

7. Wall Access: Round, flat, stainless-steel cover plate with screw.

2.2 THROUGH-PENETRATION FIRESTOP ASSEMBLIES

- A. Through-Penetration Firestop Assemblies:
 - 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. ProSet Systems Inc.
 - 2. Standard: UL 1479 assembly of sleeve and stack fitting with firestopping plug.
 - 3. Size: Same as connected pipe.
 - 4. Sleeve: Molded PVC plastic, of length to match slab thickness and with integral nailing flange on one end for installation in cast-in-place concrete slabs.
 - 5. Stack Fitting: ASTM A 48/A 48M, gray-iron, hubless-pattern, wye branch with neoprene O-ring at base and gray-iron plug in thermal-release harness. Include PVC protective cap for plug.
 - 6. Special Coating: Corrosion resistant on interior of fittings.

2.3 ROOF DRAINS

- A. Metal Roof Drains:
 - 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. Josam Company; Josam Div.
 - b. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
 - c. Watts Drainage Products Inc.
 - d. Zurn Plumbing Products Group.
 - 2. Standard: ASME A112.21.2M.
 - 3. Pattern: Roof drain.
 - 4. Body Material: Coated cast iron.
 - 5. Dimensions of Body: 15" Dia.
 - 6. Outlet: Bottom.
 - 7. Dome Material: Coated cast iron.

2.4 FLASHING MATERIALS

- A. Copper Sheet: ASTM B 152/B 152M, 12 oz./sq. ft. thickness.
- B. Zinc-Coated Steel Sheet: ASTM A 653/A 653M, with 0.20 percent copper content and 0.04-inch minimum thickness, unless otherwise indicated. Include G90 hot-dip galvanized, mill-phosphatized finish for painting if indicated.
- C. Elastic Membrane Sheet: ASTM D 4068, flexible, chlorinated polyethylene, 40-mil minimum thickness.
- D. Fasteners: Metal compatible with material and substrate being fastened.

- E. Metal Accessories: Sheet metal strips, clamps, anchoring devices, and similar accessory units required for installation; matching or compatible with material being installed.
- F. Solder: ASTM B 32, lead-free alloy.
- G. Bituminous Coating: SSPC-Paint 12, solvent-type, bituminous mastic.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Refer to Division 22 Section "Common Work Results for Plumbing" for piping joining materials, joint construction, and basic installation requirements.
- B. Install cleanouts in aboveground piping and building drain piping according to the following, unless otherwise indicated:
 - 1. Size same as drainage piping up to NPS 4. Use NPS 4 for larger drainage piping unless larger cleanout is indicated or as required by the state plumbing code.
 - 2. Locate at each change in direction of piping greater than 45 degrees.
 - 3. Locate at minimum intervals of 50 feet for piping NPS 4 and smaller and 100 feet for larger piping.
 - 4. Locate at base of each vertical soil and waste stack.
- C. For floor cleanouts for piping below floors, install cleanout deck plates with top flush with finished floor.
- D. For cleanouts located in concealed piping, install cleanout wall access covers, of types indicated, with frame and cover flush with finished wall.
- E. Install through-penetration firestop assemblies in plastic conductors and stacks at floor penetrations.
- F. Install roof drains at low points of roof areas according to roof membrane manufacturer's written installation instructions. Roofing materials are specified in Division 07.
 - 1. Install roof-drain flashing collar or flange so that there will be no leakage between drain and adjoining roofing. Maintain integrity of waterproof membranes where penetrated.
 - 2. Position roof drains for easy access and maintenance.
- G. Install sleeve flashing device with each riser and stack passing through floors with waterproof membrane.
- H. Install escutcheons at wall, floor, and ceiling penetrations in exposed finished locations and within cabinets and millwork. Use deep-pattern escutcheons if required to conceal protruding pipe fittings.

3.2 CONNECTIONS

A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

3.3 FLASHING INSTALLATION

- A. Fabricate flashing from single piece unless large pans, sumps, or other drainage shapes are required. Join flashing according to the following if required:
 - 1. Lead Sheets: Burn joints of lead sheets 6.0-lb/sq. ft., 0.0938-inch thickness or thicker. Solder joints of lead sheets 4.0-lb/sq. ft., 0.0625-inch thickness or thinner.
 - 2. Copper Sheets: Solder joints of copper sheets.
- B. Install sheet flashing on pipes, sleeves, and specialties passing through or embedded in floors and roofs with waterproof membrane.
 - 1. Pipe Flashing: Sleeve type, matching pipe size, with minimum length of 10 inches, and skirt or flange extending at least 8 inches around pipe.
 - 2. Sleeve Flashing: Flat sheet, with skirt or flange extending at least 8 inches around sleeve.
 - 3. Embedded Specialty Flashing: Flat sheet, with skirt or flange extending at least 8 inches (200 mm) around specialty.
- C. Set flashing on floors and roofs in solid coating of bituminous cement.
- D. Secure flashing into sleeve and specialty clamping ring or device.
- E. Fabricate and install flashing and pans, sumps, and other drainage shapes.

3.4 PROTECTION

- A. Protect drains during remainder of construction period to avoid clogging with dirt or debris and to prevent damage from traffic or construction work.
- B. Place plugs in ends of uncompleted piping at end of each day or when work stops.

END OF SECTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following conventional plumbing fixtures and related components:
 - 1. Faucets for lavatories and sinks.
 - 2. Flushometers.
 - 3. Toilet seats.
 - 4. Protective shielding guards.
 - 5. Fixture supports.
 - 6. Water closets.
 - 7. Lavatories.
 - 8. Commercial sinks.
 - 9. Service basins.
 - 10. Water Coolers.
- B. Related Sections include the following:
 - 1. Division 22 Section "Domestic Water Piping Specialties" for backflow preventers, floor drains, and specialty fixtures not included in this Section.

1.3 DEFINITIONS

- A. ABS: Acrylonitrile-butadiene-styrene plastic.
- B. Accessible Fixture: Plumbing fixture that can be approached, entered, and used by people with disabilities.
- C. Cast Polymer: Cast-filled-polymer-plastic material. This material includes culturedmarble and solid-surface materials.
- D. Cultured Marble: Cast-filled-polymer-plastic material with surface coating.
- E. Fitting: Device that controls the flow of water into or out of the plumbing fixture. Fittings specified in this Section include supplies and stops, faucets and spouts, shower heads and tub spouts, drains and tailpieces, and traps and waste pipes. Piping and generalduty valves are included where indicated.
- F. FRP: Fiberglass-reinforced plastic.
- G. PMMA: Polymethyl methacrylate (acrylic) plastic.
- H. PVC: Polyvinyl chloride plastic.
- I. Solid Surface: Nonporous, homogeneous, cast-polymer-plastic material with heat-, impact-, scratch-, and stain-resistance qualities.

1.4 SUBMITTALS

- A. Product Data: For each type of plumbing fixture indicated. Include selected fixture and trim, fittings, accessories, appliances, appurtenances, equipment, and supports. Indicate materials and finishes, dimensions, construction details, and flow-control rates.
- B. Shop Drawings: Diagram power, signal, and control wiring.
- C. Operation and Maintenance Data: For plumbing fixtures to include in emergency, operation, and maintenance manuals.
- D. Warranty: Special warranty specified in this Section.

1.5 QUALITY ASSURANCE

- A. Source Limitations: Obtain plumbing fixtures, faucets, and other components of each category through one source from a single manufacturer.
 - 1. Exception: If fixtures, faucets, or other components are not available from a single manufacturer, obtain similar products from other manufacturers specified for that category.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- C. Regulatory Requirements: Comply with requirements in ICC A117.1, "Accessible and Usable Buildings and Facilities"; Public Law 90-480, "Architectural Barriers Act"; and Public Law 101-336, "Americans with Disabilities Act"; for plumbing fixtures for people with disabilities.
- D. Regulatory Requirements: Comply with requirements in Public Law 102-486, "Energy Policy Act," about water flow and consumption rates for plumbing fixtures.
- E. NSF Standard: Comply with NSF 61, "Drinking Water System Components--Health Effects," for fixture materials that will be in contact with potable water.
- F. Select combinations of fixtures and trim, faucets, fittings, and other components that are compatible.
- G. Comply with the following applicable standards and other requirements specified for plumbing fixtures:
 - 1. Solid-Surface-Material Lavatories and Sinks: ANSI/ICPA SS-1.
 - 2. Stainless-Steel Commercial, Handwash Sinks: NSF 2 construction.
 - 3. Vitreous-China Fixtures: ASME A112.19.2M.
 - 4. Water-Closet, Flush Valve, Tank Trim: ASME A112.19.5.
- H. Comply with the following applicable standards and other requirements specified for lavatory and sink faucets:
 - 1. Faucets: ASME A112.18.1.
 - 2. Hose-Coupling Threads: ASME B1.20.7.
 - 3. NSF Potable-Water Materials: NSF 61.

- 4. Supply Fittings: ASME A112.18.1.
- 5. Brass Waste Fittings: ASME A112.18.2.
- I. Comply with the following applicable standards and other requirements specified for miscellaneous fittings:
 - 1. Atmospheric Vacuum Breakers: ASSE 1001.
 - 2. Brass and Copper Supplies: ASME A112.18.1.
 - 3. Brass Waste Fittings: ASME A112.18.2.
 - 4. Battery-Operation Flushometers: ASSE 1037 and UL 1951.
- J. Comply with the following applicable standards and other requirements specified for miscellaneous components:
 - 1. Floor Drains: ASME A112.6.3.
 - 2. Grab Bars: ASTM F 446.
 - 3. Hose-Coupling Threads: ASME B1.20.7.
 - 4. Plastic Toilet Seats: ANSI Z124.5.
 - 5. Supply and Drain Protective Shielding Guards: ICC A117.1.

1.6 WARRANTY

- A. Special Warranties: Manufacturer's standard form in which manufacturer agrees to repair or replace components of whirlpools that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Structural failures of unit shell.
 - b. Faulty operation of controls, blowers, pumps, heaters, and timers.
 - c. Deterioration of metals, metal finishes, and other materials beyond normal use.
 - 2. Warranty Period for Commercial Applications: Three years from date of Substantial Completion.

PART 2 - PRODUCTS

- 2.1 Vitreous fixtures shall be American Standard, Kohler, Zurn, or approved equal.
- 2.2 Lavatory carriers shall be Jay R. Smith, Josam, Zurn, or approved equal.
- 2.3 Electric water coolers shall be Oasis, Haws, Elkay, or approved equal.
- 2.4 Water closet seats shall be Bemis, Olsonite, Zurn or approved equal.
- 2.5 Mop basins shall be Fiat, Zurn, or approved equal.
- 2.6 Plumbing fixture trim shall be American Standard, T&S Brass, Zurn or approved equal.
- 2.7 Stainless steel sinks shall be Elkay, Just, or approved equal.
- 2.8 Plumbing Fixtures.

2.9 Refer to Drawing P0.1 for Manufacturer, Model Number and Description.

PART 3 - EXECUTION

- 3.1 EXAMINATION
 - A. Examine roughing-in of water supply and sanitary drainage and vent piping systems to verify actual locations of piping connections before plumbing fixture installation.
 - B. Examine cabinets, counters, floors, and walls for suitable conditions where fixtures will be installed.
 - C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Assemble plumbing fixtures, trim, fittings, and other components according to manufacturers' written instructions.
- B. Install off-floor supports, affixed to building substrate, for wall-mounting fixtures.
 - 1. Use carrier supports with waste fitting and seal for back-outlet fixtures.
 - 2. Use carrier supports without waste fitting for fixtures with tubular waste piping.
 - 3. Use chair-type carrier supports with rectangular steel uprights for accessible fixtures.
- C. Install back-outlet, wall-mounting fixtures onto waste fitting seals and attach to supports.
- D. Install floor-mounting fixtures on closet flanges or other attachments to piping or building substrate.
- E. Install wall-mounting fixtures with tubular waste piping attached to supports.
- F. Install counter-mounting fixtures in and attached to casework.
- G. Install fixtures level and plumb according to roughing-in drawings.
- H. Install water-supply piping with stop on each supply to each fixture to be connected to water distribution piping. Attach supplies to supports or substrate within pipe spaces behind fixtures. Install stops in locations where they can be easily reached for operation.
 - Exception: Use ball or globe valves if supply stops are not specified with fixture. Valves are specified in Division 22 Section "General-Duty Valves for Plumbing Piping."
- I. Install trap and tubular waste piping on drain outlet of each fixture to be directly connected to sanitary drainage system.
- J. Install tubular waste piping on drain outlet of each fixture to be indirectly connected to drainage system.
- K. Install flushometer valves for accessible water closets and urinals with handle mounted on wide side of compartment. Install other actuators in locations that are easy for people with disabilities to reach.

- L. Install toilet seats on water closets.
- M. Install faucet-spout fittings with specified flow rates and patterns in faucet spouts if faucets are not available with required rates and patterns. Include adapters if required.
- N. Install water-supply flow-control fittings with specified flow rates in fixture supplies at stop valves.
- O. Install faucet flow-control fittings with specified flow rates and patterns in faucet spouts if faucets are not available with required rates and patterns. Include adapters if required.
- P. Install traps on fixture outlets.
 - 1. Exception: Omit trap on fixtures with integral traps.
 - 2. Exception: Omit trap on indirect wastes, unless otherwise indicated.
- Q. Install escutcheons at piping wall ceiling penetrations in exposed, finished locations and within cabinets and millwork. Use deep-pattern escutcheons if required to conceal protruding fittings. Escutcheons are specified in Division 22 Section "Common Work Results for Plumbing."
- R. Set service basins in leveling bed of cement grout. Grout is specified in Division 22 Section "Common Work Results for Plumbing."
- S. Seal joints between fixtures and walls, floors, and countertops using sanitary-type, onepart, mildew-resistant silicone sealant. Match sealant color to fixture color. Sealants are specified in Division 07 Section "Joint Sealants."

3.3 CONNECTIONS

- A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Connect fixtures with water supplies, stops, and risers, and with traps, soil, waste, and vent piping. Use size fittings required to match fixtures.
- C. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."
- D. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

3.4 FIELD QUALITY CONTROL

- A. Verify that installed plumbing fixtures are categories and types specified for locations where installed.
- B. Check that plumbing fixtures are complete with trim, faucets, fittings, and other specified components.
- C. Inspect installed plumbing fixtures for damage. Replace damaged fixtures and components.

D. Test installed fixtures after water systems are pressurized for proper operation. Replace malfunctioning fixtures and components, then retest. Repeat procedure until units operate properly.

3.5 ADJUSTING

- A. Operate and adjust faucets and controls. Replace damaged and malfunctioning fixtures, fittings, and controls.
- B. Adjust water pressure at faucets and flushometer valves to produce proper flow and stream.
- C. Replace washers and seals of leaking and dripping faucets and stops.
- D. Install fresh batteries in sensor-operated mechanisms.

3.6 CLEANING

- A. Clean fixtures, faucets, and other fittings with manufacturers' recommended cleaning methods and materials. Do the following:
 - 1. Remove faucet spouts and strainers, remove sediment and debris, and reinstall strainers and spouts.
 - 2. Remove sediment and debris from drains.
- B. After completing installation of exposed, factory-finished fixtures, faucets, and fittings, inspect exposed finishes and repair damaged finishes.

3.7 PROTECTION

- A. Provide protective covering for installed fixtures and fittings.
- B. Do not allow use of plumbing fixtures for temporary facilities unless approved in writing by Owner.

END OF SECTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. All work and material on this project shall be in compliance with all local, state and federal regulations including but not limited to the following:
 - 1. Established Federal Standards of the Occupational Safety and Health Administration under the Department of Labor.
 - 2. New Jersey UCC as based on International Building Code 2021.
 - 3. International Mechanical Code 2021.
 - 4. ASHRAE 90.1-2019.
- C. The above regulations are considered a part of the specifications and shall prevail should they differ with the plans and specifications. Prior to construction the Contractor shall notify the Architect of the difference. Should the Contractor not so notify the Architect, the Contractor shall fully comply without claim for extra costs

1.2 SUMMARY

- A. This section includes General Provisions for HVAC/Mechanical work.
- B. This Section includes the following:
 - 1. Piping materials and installation instructions common to most piping systems.
 - 2. Mechanical sleeve seals.
 - 3. Sleeves.
 - 4. Escutcheons.
 - 5. Grout.
 - 6. Equipment installation requirements common to equipment sections.
 - 7. Painting and finishing.
 - 8. Concrete bases.
 - 9. Supports and anchorages.

1.3 DEFINITIONS

- A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct chases, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.
- B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.
- C. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and chases.
- D. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.

1.4 SUBMITTALS

A. SHOP DRAWINGS AND OTHER RELATED SUBMITTALS

- 1. The type submittal information required for each item of equipment shall be as indicated in the individual sections of the specification.
- 2. When a substitute item of equipment has been submitted for approval, submit layout drawings indicating the changes necessary to adapt the substituted item of equipment to the system design.
- 3. Submittal data shall include <u>Specification</u> data, such as metal gauges, finishes, optional accessories, etc., even though such equipment and materials may be detailed on the drawings or specified. In addition, the submittal data shall include performance (certification) data, wiring diagrams where applicable, accurate dimensional data and a recommended spare parts list. Outline or dimensional drawings alone are not acceptable. No roughing-in, connections, etc., shall be done until Architect reviewed equipment submittals are in the hands of the Contractors. It shall be the Contractor's responsibility to obtain drawings and to make all connections, etc., in the neatest and most workmanlike manner possible.
- 4. In general, normal catalog information (with the particular items underlined or otherwise denoted as being the submitted item) will be acceptable as submittal data. Installation, operating and maintenance instructions must be that information, specifically applicable to the items furnished, ordinarily supplied with the equipment to the Owner with any modifications indicated. Wiring diagrams must be correct for the application. Generalized wiring diagrams, showing alternate methods of connection, will not be acceptable unless all unrelated sections are marked. out. Submittal data sheets, which indicate several different model numbers, figure numbers, optional accessories, installation arrangements, etc., shall be clearly marked to indicate the specific items of equipment to be furnished. Samples and certificates shall be furnished as requested. Submittal data must be complete for each piece of equipment; piecemeal data will not be processed.
- 5. It shall be noted that the reviewing of shop drawings by the Architect applies only to general design, arrangement, type, capacity, and quality. Such review does not apply to quantities, dimensions, connection locations and the like. In all cases, the Contractor alone shall be responsible for furnishing the proper quantity of equipment and/or materials required, that all equipment fits the available space in a satisfactory manner, all equipment characteristics are appropriate and that all connections are suitably located.
- 6. Before the project is accepted, all submittal data (shop drawings, etc.) must be complete and reviewed.
- B. Product Data: For the following:
 - 1. Transition fittings.
 - 2. Mechanical sleeve seals.
 - 3. Escutcheons.

C. SUBSTITUTION OF MATERIALS AND EQUIPMENT

1. When the Contractor requests approval of substitute materials and/or equipment, except when under formal alternate proposal, it shall be understood and agreed that such substitution, if approved, will be made without cost to the Owner, regardless of changes in connections, spacing, electrical service, etc. In all cases where substitutions affect other trades the Contractor offering such substitutions shall reimburse all affected Contractors for all necessary changes in their work (without cost to Owner).

1.5 QUALITY ASSURANCE

- A. Disclaimers and Limitations: Manufacturer's disclaimers and limitations on product warranties do not relieve the Contractor of the warranty on the Work that incorporates the products. Manufacturer's disclaimers and limitations on product warranties do not relieve suppliers, manufacturers and subcontractors required to countersign special warranties with the Contractor.
- B. Electrical Characteristics for HVAC Equipment: Equipment of higher electrical characteristics may be furnished provided such proposed equipment is approved in writing and connecting electrical services, circuit breakers, and conduit sizes are appropriately modified. If minimum energy ratings or efficiencies are specified, equipment shall comply with requirements.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture.
- B. Store plastic pipes protected from direct sunlight. Support to prevent sagging and bending.

1.7 COORDINATION

- A. Coordination Between Trades:
 - 1. Carefully examine all architectural, structural, electrical and any other drawings and specifications pertaining to the construction before fabricating and installing the work described and indicated under these drawings and specifications. Cooperate with all other Contractors in locating piping, ductwork, sleeves, equipment, etc., in order to avoid conflict with all other Contractor's work. No extra compensation will be allowed to cover the cost of relocating piping, ducts, etc., or equipment found encroaching on space required by others.
 - 2. Lay out work from construction lines and levels established by the General Contractor. This Contractor shall be responsible for the proper location and placement of his work.
 - 3. Any discrepancies occurring on the accompanying drawings and between the drawings and the specifications shall be reported to the Architect prior to any fabrication and installation so that a workable solution can be presented. Extra payment will not be allowed for the relocation of, or revision to, piping, ductwork, equipment, etc., not installed in accordance with the above instructions, and which interferes with work and equipment of other trades.
- B. Arrange for pipe spaces, chases, slots, and openings in building structure during progress of construction, to allow for HVAC installations.
- C. Coordinate installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components as they are constructed.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

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

2.2 PIPE, TUBE, AND FITTINGS

A. Refer to individual Division 23 piping Sections for pipe, tube, and fitting materials and joining methods.

2.3 JOINING MATERIALS

A. Refer to individual Division 23 piping Sections for special joining materials not listed below.

2.4 SLEEVES

- A. Galvanized-Steel Sheet: 0.0239-inch (0.6-mm) minimum thickness; round tube closed with welded longitudinal joint.
- B. Steel Pipe: ASTM A 53, Type E, Grade B, Schedule 40, galvanized, plain ends.
- C. Cast Iron: Cast or fabricated "wall pipe" equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.

2.5 ESCUTCHEONS

- A. Description: Manufactured wall and ceiling escutcheons and floor plates, with an ID to closely fit around pipe, tube, and insulation of insulated piping and an OD that completely covers opening.
- B. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with polished chromeplated finish.
- C. One-Piece, Cast-Brass Type: With set screw.
 - 1. Finish: Polished chrome-plated.
- D. Split-Casting, Cast-Brass Type: With concealed hinge and set screw.
 - 1. Finish: Polished chrome-plated.
- E. One-Piece, Stamped-Steel Type: With set screw or spring clips and chrome-plated finish.
- F. Split-Plate, Stamped-Steel Type: With concealed hinge, set screw or spring clips, and chrome-plated finish.
- G. One-Piece, Floor-Plate Type: Cast-iron floor plate.
- H. Split-Casting, Floor-Plate Type: Cast brass with concealed hinge and set screw.

2.6 GROUT

- A. Description: ASTM C 1107, Grade B, nonshrink and nonmetallic, dry hydraulic-cement grout.
 - 1. Characteristics: Post-hardening, volume-adjusting, nonstaining, noncorrosive, nongaseous, and recommended for interior and exterior applications.
 - 2. Design Mix: 5000-psi (34.5-MPa), 28-day compressive strength.
 - 3. Packaging: Premixed and factory packaged.

PART 3 - EXECUTION

- 3.1 STRUCTURAL RESPONSIBILITY
 - A. Properly shore, brace, support, etc., any construction to guard against cracking, settling, collapsing, displacing or weakening. No structural member shall be cut without the written consent of the Architect.
 - B. Any damage occurring to the structure, due to failure to exercise proper precautions or due to action of the elements, shall be promptly and properly made good to the satisfaction of the Owner or Architect, without cost.

3.2 PROTECTION OF THE BUILDNG AND STORED EQUIPMENT

- A. Do not store materials or equipment on any floor or roof of building in such quantity that these parts of the building will be overloaded in any way. Do not move heavy equipment across any floor or roof without first submitting the details of the work to the Architect and having obtained his approval. In cases where frequent movement of men or materials over the roof is encountered, provide walking boards or other suitable protection for the roofing.
- B. Provide suitable storage for, and completely protect all materials and equipment prior to installation. Storage shall be dry, clean and safe. Any materials or equipment lost through theft or mishandling shall be replaced, all without additional cost to the Owner

3.3 DRAWINGS

A. The drawings accompanying these specifications are diagrammatic and indicate the general design and arrangement of the proposed work. Do not scale drawings for the exact location of equipment and work. The exact routing and/or location of piping, ductwork, sleeves, equipment, etc., unless specifically dimensioned on the drawings, shall be determined to suit field conditions encountered, and to avoid interferences with other Contractors' work.

3.4 EQUIPMENT CONNECTIONS

A. Make all water and drainage connections, etc., to equipment furnished by others under this Contract whenever such equipment is shown on any of the drawings or mentioned in any section of the specifications, unless otherwise specifically specified hereinafter.

3.5 TOOLS

A. Furnish and install all special wrenches, valve handles, keys, or other special tools as necessary to dismantle or service any piece of equipment installed. This shall include thermostat keys in the number directed by the Architect.

3.6 PERMITS AND APPROVALS

A. All permits and certificates of approval for the complete system shall be obtained by the respective Contractors from the authorities governing such work. The cost of all permits, tap-in-fees and approvals shall be borne by the Contractor furnishing the work, except as noted in the General Requirements. All work shall be approved by the Architect before final payment will be made.

3.7 TEMPORARY UTILITIES

A. Temporary utilities for water, gas, electricity, and heat shall be provided as indicated under the "General Requirements" of the Specifications.

3.8 PIPING SYSTEMS - COMMON REQUIREMENTS

- A. Install piping according to the following requirements and Division 23 Sections specifying piping systems.
- B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.
- C. Install piping in concealed locations, unless otherwise indicated and except in equipment rooms and service areas.
- D. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- F. Install piping to permit valve servicing.
- G. Install piping at indicated slopes.
- H. Install piping free of sags and bends.
- I. Install fittings for changes in direction and branch connections.
- J. Install piping to allow application of insulation.
- K. Select system components with pressure rating equal to or greater than system operating pressure.
- L. Install escutcheons for penetrations of walls, ceilings, and floors according to the following:

- 1. New Piping:
 - a. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep-pattern type.
 - b. Insulated Piping: One-piece, stamped-steel type with spring clips.
 - c. Bare Piping in Unfinished Service Spaces: One-piece, stamped-steel type with concealed or exposed-rivet hinge and spring clips set screw or spring clips.
 - d. Bare Piping in Equipment Rooms: One-piece, cast-brass type.
 - e. Bare Piping in Equipment Rooms: One-piece, stamped-steel type with set screw or spring clips.
 - f. Bare Piping at Floor Penetrations in Equipment Rooms: One-piece, floorplate type.
- M. Sleeves are not required for core-drilled holes.
- N. Permanent sleeves are not required for holes formed by removable PE sleeves.
- O. Install sleeves for pipes passing through concrete and masonry walls and concrete floor and roof slabs.
 - 1. Cut sleeves to length for mounting flush with both surfaces.
 - a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches (50 mm) above finished floor level. Extend cast-iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified.
 - 2. Install sleeves in new walls and slabs as new walls and slabs are constructed.
 - 3. Install sleeves that are large enough to provide 1/4-inch (6.4-mm) annular clear space between sleeve and pipe or pipe insulation. Use the following sleeve materials:
 - a. Steel Pipe Sleeves: For pipes smaller than NPS 6 (DN 150).
 - 1) Seal space outside of sleeve fittings with grout.
 - 4. Except for underground wall penetrations, seal annular space between sleeve and pipe or pipe insulation, using joint sealants appropriate for size, depth, and location of joint. Refer to Division 07 92 00 Section "Joint Sealants" for materials and installation.
- P. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Refer to Division 07 84 13 Section "Penetration Firestopping" for materials.
- Q. Verify final equipment locations for roughing-in.
- R. Refer to equipment specifications in other Sections of these Specifications for roughing-in requirements.

3.9 PIPING JOINT CONSTRUCTION

- A. Join pipe and fittings according to the following requirements and Division 23 Sections specifying piping systems.
- B. Soldered Joints: Apply ASTM B 813, water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook," using lead-free solder alloy complying with ASTM B 32.

3.10 PIPING CONNECTIONS

- A. Make connections according to the following, unless otherwise indicated:
 - 1. Install unions, in piping NPS 2 (DN 50) and smaller, adjacent to each valve and at final connection to each piece of equipment.

3.11 EQUIPMENT INSTALLATION - COMMON REQUIREMENTS

- A. Install equipment to allow maximum possible headroom unless specific mounting heights are indicated.
- B. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.
- C. Install HVAC equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference to other installations. Extend grease fittings to accessible locations.
- D. Install equipment to allow right of way for piping installed at required slope.

3.12 PAINTING

- A. Painting of HVAC systems, equipment, and components is specified (if applicable) in Division 09 Sections "Interior Painting" and "Exterior Painting."
- B. Damage and Touchup: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.

3.13 CONCRETE BASES

- A. Concrete Bases: Anchor equipment to concrete base according to equipment manufacturer's written instructions and according to seismic codes at Project.
 - 1. Construct concrete bases of dimensions indicated, but not less than 4 inches (100 mm) larger in both directions than supported unit.
 - 2. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch (450-mm) centers around the full perimeter of the base.
 - 3. Install epoxy-coated anchor bolts for supported equipment that extend through concrete base, and anchor into structural concrete floor.
 - 4. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.

- 5. Install anchor bolts to elevations required for proper attachment to supported equipment.
- 6. Install anchor bolts according to anchor-bolt manufacturer's written instructions.
- 7. Use 3000-psi (20.7-MPa), 28-day compressive-strength concrete and reinforcement as specified in Division 03."

3.14 GROUTING

- A. Mix and install grout for HVAC equipment base bearing surfaces, pump and other equipment base plates, and anchors.
- B. Clean surfaces that will come into contact with grout.
- C. Provide forms as required for placement of grout.
- D. Avoid air entrapment during placement of grout.
- E. Place grout, completely filling equipment bases.
- F. Place grout on concrete bases and provide smooth bearing surface for equipment.
- G. Place grout around anchors.
- H. Cure placed grout.

3.15 INSTALLATION

- A. All equipment shall be installed at locations indicated.
- B. Assembly and installation of equipment shall be in strict accordance with manufacturer's installation instructions.
- C. Equipment shall be securely anchored in place. Care shall be exercised to correctly orient equipment before securing in place.

3.16 EQUIPMENT PADS AND GROUTING

- A. Floor-mounted equipment, such as air handling units, boilers, water heaters, etc., shall be provided with a suitable concrete pad. Each pad shall have suitable hold-down bolts in pipe sleeves, of sufficient number to properly secure the apparatus. Hold-down bolts shall be accurately located by template prepared from actual measurement of the equipment or from certified drawings furnished by the equipment manufacturer. Hold-down bolts shall be set in wrought iron pipe sleeves ³/₄" larger than the bolts to facilitate alignment of equipment.
- B. All pads shall be complete with all pipe sleeves, anchor bolts, reinforcing steel, concrete, etc., as required. Pads larger than 18" in width shall be reinforced with ½" bars on 9" centers, both ways. Bars shall be approximately 3" below top of pad. All parts of pads and foundations shall be properly spaced. If exposed parts of the pads and foundations are rough after removing forms, all rough surfaces shall be rubbed to a smooth surface.
- C. Pads, unless indicated otherwise, shall extend 4" above the finished floor and shall be securely anchored to the floor so vibration or stresses cannot cause lateral movement.

- D. In general, pads for equipment such as air handling units, pumps, etc., shall extend 6" beyond base dimensions.
- E. Where grouting is required, equipment shall be set to use by jack screws or by use of wedges where no jack screws are provided. After grout has set up, the supporting jack screws or wedges shall be removed and the holes left by removal of the wedges shall be dry packed.

3.17 EQUIPMENT MOUNTING

- A. All equipment with moving parts, such as fans, air handling units, etc., shall be mounted on vibration supports and in addition, said equipment shall be isolated from external connections, such as piping, ducts, raceways, etc., by means of flexible connectors.
- B. Unitary equipment, such as small exhaust fans, etc., shall be rigidly braced and mounted to wall, floor, or ceiling, as required, and tightly gasketed and sealed to mounting surface to prevent air leakage and to obtain quiet operation
- C. Where drivers are connected with couplings, the alignment shall be checked and the driver reconnected. Couplings shall have tolerances as indicated by the manufacturer.
- D. Where drivers are connected with belt or chain drives, the driver and driver shafts shall be aligned parallel. The motor adjustment shall be loosened sufficiently to put on the belts or chain and then tightened to the proper centerline distance or tension. No belt compound shall be used.

3.18 PLATFORMS AND SUPPORTING STANDS

- A. Each piece of equipment or apparatus mounted above the floor level shall be supported in accordance with the best recognized practice.
- B. Such supporting or mounting means shall be provided by each Contractor for all equipment furnished by them.

3.19 METAL GUARDS

A. Furnish and install in approved expanded metal or sheet metal guard around all exposed moving and rotating parts, such as pump couplings, belt drives, fan belts, etc.

3.20 FRAMING

A. All rectangular or special shaped openings in walls, partitions, roofs, ceilings, etc., including plaster, stucco, or similar materials shall be framed by means of plaster frames, casing beads, wood or metal angle members, as required. The intent of this paragraph is to prohibit cutting and patching in new construction and to provide smooth, even termination of wall, floor, and ceiling finishes, as well as to provide a fastening means for grilles, diffusers, etc. Lintels shall be provided over all openings in walls, etc., when not specifically indicated elsewhere. Lintels shall be of size and shape to prevent excessive deflection and shall be approved by Architect prior to installation.

3.21 CUTTING, FITTING AND PATCHING

- A. Each respective Contractor shall do all cutting and drilling of masonry, steel, wood, or iron work, and all fitting necessary for the proper installation of all apparatus and materials.
- B. No cutting or drilling of the structure, of any kind, shall be done without first obtaining permission from Architect. All cutting and drilling shall be done under the supervision of the General Contractor in strict accordance with instructions furnished by Architect.
- C. All patching and finishing shall be the responsibility of the Contractor whose cutting or drilling makes such patching and finishing necessary. Patching and finishing shall be done by workmen skilled in the trade affected (masonry, plastering, painting, etc.).

3.22 CLEANING, TESTING AND PREPARATION FOR START-UP

- A. All equipment shall be cleaned of all foreign material.
- B. All equipment shall be lubricated and placed in proper working order. Drives on rotating equipment shall be checked for proper rotation and alignment. V-belt drives shall be checked and adjusted for proper tension. All fans shall be operated for at least 24 hours so that the initial stretch of the V-belt drives will take place before testing. When the belts have stretched, the fan drives shall be realigned and adjusted for tightness to make sure that the excess slippage is eliminated. All drives shall be set for the recommended speeds. All sheaves and bearing blocks shall be checked for any loose screws or nuts.
- C. All controls and safety devices shall be checked to determine that they are in place and properly installed.
- D. Where equipment is intended to contain fluids, it shall be filled and tested for leaks as recommended by the equipment manufacturer.
- E. Equipment shall be operated for a reasonable time to determine any undue vibration, heating of parts, or other improper operation.

END OF SECTION

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 hangers and supports for HVAC system piping and equipment:
 - 1. Steel pipe hangers and supports.
 - 2. Trapeze pipe hangers.
 - 3. Metal framing systems.
 - 4. Equipment supports.
- B. This specification is inclusive in nature to indicate the design intent with materials available. Not all products listed may be required.
- C. This specification is not intended to be all inclusive. Piping shall be supported utilizing products based on the design requirements.

1.3 DEFINITIONS

- A. MSS: Manufacturers Standardization Society for The Valve and Fittings Industry Inc.
- B. Terminology: As defined in MSS SP-90, "Guidelines on Terminology for Pipe Hangers and Supports."

1.4 PERFORMANCE REQUIREMENTS

- A. Design supports for multiple pipes, including pipe stands, capable of supporting combined weight of supported systems, system contents, and test water.
- B. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

1.5 SUBMITTALS

- A. Shop Drawings: Show fabrication and installation details and include calculations for the following:
 - 1. Trapeze pipe hangers. Include Product Data for components.
 - 2. Metal framing systems. Include Product Data for components.
 - 3. Equipment supports.

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.

2.2 STEEL PIPE HANGERS AND SUPPORTS

- A. Description: MSS SP-58, Types 1 through 58, factory-fabricated components. Refer to Part 3 "Hanger and Support Applications" Article for where to use specific hanger and support types.
- B. Available Manufacturers:
 - 1. AAA Technology & Specialties Co., Inc.
 - 2. B-Line Systems, Inc.; a division of Cooper Industries.
 - 3. Globe Pipe Hanger Products, Inc.
 - 4. Grinnell Corp.
 - 5. National Pipe Hanger Corporation.
 - 6. PHD Manufacturing, Inc.
 - 7. Piping Technology & Products, Inc.
- C. Galvanized, Metallic Coatings: Pregalvanized or hot dipped.
- D. Nonmetallic Coatings: Plastic coating, jacket, or liner.
- E. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion for support of bearing surface of piping.

2.3 TRAPEZE PIPE HANGERS

- A. Description: MSS SP-69, Type 59, shop- or field-fabricated pipe-support assembly made from structural-steel shapes with MSS SP-58 hanger rods, nuts, saddles, and U-bolts.
- 2.4 METAL FRAMING SYSTEMS
 - A. Description: MFMA-3, shop- or field-fabricated pipe-support assembly made of steel channels and other components.
 - B. Available Manufacturers:
 - 1. B-Line Systems, Inc.; a division of Cooper Industries.
 - 2. Power-Strut Div.; Tyco International, Ltd.
 - 3. Thomas & Betts Corporation.
 - 4. Unistrut Corp.; Tyco International Ltd.
 - C. Coatings: Manufacturer's standard finish, unless bare metal surfaces are indicated.
 - D. Nonmetallic Coatings: Plastic coating, jacket, or liner.

2.5 THERMAL-HANGER SHIELD INSERTS

- A. Description: 100-psig- (690-kPa-) minimum, compressive-strength insulation insert encased in sheet metal shield.
- B. Available Manufacturers:

- 1. PHS Industries, Inc.
- 2. Pipe Shields, Inc.
- 3. Rilco Manufacturing Company, Inc.
- 4. Value Engineered Products, Inc.
- C. Insulation-Insert Material for Cold Piping: Water-repellent treated, ASTM C 533, Type I calcium silicate or ASTM C 552, Type II cellular glass with vapor barrier.
- D. Insulation-Insert Material for Hot Piping: Water-repellent treated, ASTM C 533, Type I calcium silicate or ASTM C 552, Type II cellular glass.
- E. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.
- F. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.
- G. Insert Length: Extend 2 inches (50 mm) beyond sheet metal shield for piping operating below ambient air temperature.

2.6 EQUIPMENT SUPPORTS

A. Description: Welded, shop- or field-fabricated equipment support made from structuralsteel shapes.

2.7 MISCELLANEOUS MATERIALS

- A. Structural Steel: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.
- B. Grout: ASTM C 1107, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout; suitable for interior and exterior applications.
 - 1. Properties: Nonstaining, noncorrosive, and nongaseous.
 - 2. Design Mix: 5000-psi (34.5-MPa), 28-day compressive strength.

PART 3 - EXECUTION

3.1 HANGER AND SUPPORT APPLICATIONS

- A. Specific hanger and support requirements are specified in Sections specifying piping systems and equipment.
- B. Comply with MSS SP-69 for pipe hanger selections and applications that are not specified in piping system Sections.
- C. Use hangers and supports with galvanized, metallic coatings for piping and equipment that will not have field-applied finish.
- D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.
- E. Use padded hangers for piping that is subject to scratching.

- F. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
 - 1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated stationary pipes, NPS 1/2 to NPS 14.
 - 2. Yoke-Type Pipe Clamps (MSS Type 2): For suspension of 120 to 450 deg F pipes, NPS 4 to NPS 16, requiring up to 4 inches of insulation.
 - 3. Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension of pipes, NPS 3/4 to NPS 14, requiring clamp flexibility and up to 4 inches of insulation.
 - 4. Pipe Hangers (MSS Type 5): For suspension of pipes, NPS 1/2 to NPS 4, to allow off-center closure for hanger installation before pipe erection.
- G. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
 - 1. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
 - 2. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with barjoist construction to attach to top flange of structural shape.
 - 3. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
 - 4. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
 - 5. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
 - 6. C-Clamps (MSS Type 23): For structural shapes.
 - 7. Side-Beam Clamps (MSS Type 27): For bottom of steel I-beams.
- H. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
 - 1. Steel Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.
 - 2. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.
 - 3. Thermal-Hanger Shield Inserts: For supporting insulated pipe.
- I. Comply with MSS SP-69 for trapeze pipe hanger selections and applications that are not specified in piping system Sections.
- J. Comply with MFMA-102 for metal framing system selections and applications that are not specified in piping system Sections.
- K. Use powder-actuated fasteners or mechanical-expansion anchors instead of building attachments where required in concrete construction.

3.2 HANGER AND SUPPORT INSTALLATION

A. Steel Pipe Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from building structure.

- B. Trapeze Pipe Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Arrange for grouping of parallel runs of horizontal piping and support together on field-fabricated trapeze pipe hangers.
 - 1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified above for individual pipe hangers.
- C. Metal Framing System Installation: Arrange for grouping of parallel runs of piping and support together on field-assembled metal framing systems.
- D. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.
- E. Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers, and other accessories.
- F. Equipment Support Installation: Fabricate from welded-structural-steel shapes.
- G. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, NPS 2-1/2 and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.
- H. Load Distribution: Install hangers and supports so piping live and dead loads and stresses from movement will not be transmitted to connected equipment.
- I. Insulated Piping: Comply with the following:
 - 1. Attach clamps and spacers to piping.
 - a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.
 - b. Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.
 - c. Do not exceed pipe stress limits according to ASME B31.1 for power piping and ASME B31.9 for building services piping.
 - 2. Install MSS SP-58, Type 39, protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.
 - a. Option: Thermal-hanger shield inserts may be used. Include steel weightdistribution plate for pipe NPS 4 and larger if pipe is installed on rollers.
 - 3. Install MSS SP-58, Type 40, protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.
 - a. Option: Thermal-hanger shield inserts may be used. Include steel weightdistribution plate for pipe NPS 4 and larger if pipe is installed on rollers.
 - 4. Shield Dimensions for Pipe: Not less than the following:
 - a. NPS 1/4 to NPS 3-1/2: 12 inches long and 0.048 inch thick.

- 5. Insert Material: Length at least as long as protective shield.
- 6. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

3.3 EQUIPMENT SUPPORTS

- A. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor.
- B. Grouting: Place grout under supports for equipment and make smooth bearing surface.
- C. Provide lateral bracing, to prevent swaying, for equipment supports.

3.4 METAL FABRICATIONS

- A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers and equipment supports.
- B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.

3.5 INSTALLATION

- A. Unless otherwise specifically indicated, all supporting, hanging, and anchoring of piping, ductwork, equipment, etc., shall be done by each Contractor as is necessary for completion of the work.
- B. Supporting and hanging shall be done so that extensive load will not be placed on any one hanger and so as to allow for proper pitching and expansion of piping. Hangers and supports shall be placed as near as possible to joints, turns, and branches.
- C. For concrete construction, utilize adjustable concrete inserts for fasteners except that expansion anchors shall be used for heavy loading and conditions and power driven devices may be used for light loading conditions. Utilize beam clamps for fastening to steel joists and beams and expansion anchors in masonry construction. When piping is run in joist webbing, utilize bar joist clamps for fastening unless otherwise detailed. Whenever possible, piping shall be top mounted on trapeze type hangers with each pipe individually clamped to trapeze hanger.
- D. Trapeze hangers shall be supported by steel rods of sufficient diameter to support piping from joists or concrete construction. Where required, piping may be double mounted on trapeze hangers. Where conditions permit, trapeze hangers may be surface mounted on exposed joists by means of approved beam clamps, or to concrete construction by means of approved adjustable inserts or expansion anchors.
- E. Install all miscellaneous steel other than designed building structural members as required to provide means of securing hangers, supports, etc., where piping does not pass directly below or cross steel joists.
- F. Piping shall not be supported by the equipment to which it is connected. Support all piping so as to remove any load or stress from the equipment. Particular attention shall be given to equipment where flexible connectors are involved, such as base-mounted pumps. Piping shall be rigidly supported on both sides of flexible connectors. Install flexible connectors as indicated.

- G. Where piping, etc., is run vertically, approved riser clamps, brackets, or other means shall be utilized at approximately 10'-0" center to center, minimum, and utilized at the base of the vertical run.
- H. Piping supported below by knee-braced frames and brackets at walls, columns, etc. shall be supported by rollers for heating hot water, domestic hot water and chilled water for pipe sizes 2½" and larger. Rollers shall be sized for thickness of insulation. Other piping shall be clamped or held in place to maintain alignment.
- I. Support piping likely to transmit vibration noises with isolator hangers.
- J. Support all ceiling-hung equipment (equipment with any moving parts) from steel spring type vibration isolators.
- K. Copper clad type hangers shall be provided for uninsulated copper tubing and pipe.
- L. Clevis type hangers shall be provided for all heating hot water and chilled water for pipe sizes 2" and smaller. Hangers for insulated pipe shall be sized for the thickness of insulation to pass through the hangers. Swivel split ring or split ring hangers may be provided in sizes 2" and smaller in lieu of clevis type.
- M. Roller type hangers shall be provided for all heating hot water, chilled water and steam for pipe sizes 2½" and larger. Hangers shall be sized for the thickness of insulation applied to pass through the hangers.
- N. Where two or more pipes are run parallel to one another, they may be supported from a trapeze type hanger arrangement. Hanger shall be properly sized to support all piping installed on hangers. Rollers shall be provided for heating hot water, and chilled water for pipe sizes 2½" and larger. Rollers shall be sized for thickness of insulation. Other piping shall be clamped or held in place to maintain alignment.
- O. Pipe covering protection saddles for the insulation thickness installed shall be provided for all heating hot water which is steel pipe 2½" and larger. Pipe covering shields for the insulation thickness installed shall be provided for all heating hot water, chilled water for pipe sizes 2" and smaller, and all copper pipe for pipe sizes 2½" and larger. Wood insulation saddles for the insulation thickness installed shall be provided for all be provided for all chilled water for pipe sizes 2½" and larger. Pipe covering protection sleeves for the insulation thickness installed shall be provided in place of pipe covering shields at locations where pipe is supported below by knee-braced frames, brackets and trapeze type hangers where piping is clamped or held in place to maintain alignment and where top rollers are installed.
- P. Under no condition will perforated band iron or steel wire drive hangers be permitted
- Q. In general, support piping at the following spacing:
 - 1. Steel and copper piping 8' intervals for piping 3" and smaller; 12' intervals for larger piping, except if requested at closer spacing for future piping as indicated.

3.6 ADJUSTING

A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.

B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches (40 mm).

3.7 PAINTING

- A. Touch Up: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.
 - 1. Apply paint by brush or spray to provide minimum dry film thickness of 2.0 mils (0.05 mm).
- B. Touch Up: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal are specified in Division 09 painting Sections. Section "High-Performance Coatings."
- C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END OF SECTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Equipment labels.
 - 2. Warning signs and labels.
 - 3. Duct labels.
 - 4. Stencils.
 - 5. Valve tags.
 - 6. Warning tags.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Samples: For color, letter style, and graphic representation required for each identification material and device.
- C. Equipment Label Schedule: Include a listing of all equipment to be labeled with the proposed content for each label.
- D. Valve numbering scheme.
- E. Valve Schedules: For each piping system to include in maintenance manuals.

1.4 COORDINATION

- A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.
- B. Coordinate installation of identifying devices with locations of access panels and doors.
- C. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2 - PRODUCTS

- 2.1 EQUIPMENT LABELS
 - A. Metal Labels for Equipment:
 - 1. Material and Thickness: Brass, 0.032-inch or Stainless steel, 0.025-inch minimum thickness, and having predrilled or stamped holes for attachment hardware.
 - 2. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
 - 3. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger

lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.

- 4. Fasteners: Stainless-steel rivets or self-tapping screws.
- 5. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
- B. Plastic Labels for Equipment:
 - 1. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch thick, and having predrilled holes for attachment hardware.
 - 2. Letter Color: White.
 - 3. Background Color: Blue.
 - 4. Maximum Temperature: Able to withstand temperatures up to 160 deg F.
 - 5. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
 - 6. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
 - 7. Fasteners: Stainless-steel rivets or self-tapping screws.
 - 8. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
- C. Label Content: Include equipment's Drawing designation or unique equipment number, Drawing numbers where equipment is indicated (plans, details, and schedules), plus the Specification Section number and title where equipment is specified.
- D. Equipment Label Schedule: For each item of equipment to be labeled, on 8-1/2-by-11inch (A4) bond paper. Tabulate equipment identification number and identify Drawing numbers where equipment is indicated (plans, details, and schedules), plus the Specification Section number and title where equipment is specified. Equipment schedule shall be included in operation and maintenance data.

2.2 WARNING SIGNS AND LABELS

- A. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch thick, and having predrilled holes for attachment hardware.
- B. Letter Color: Red, White or Yellow.
- C. Background Color: Red or Yellow.
- D. Maximum Temperature: Able to withstand temperatures up to 160 deg F.
- E. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
- F. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
- G. Fasteners: Stainless-steel rivets or self-tapping screws.

- H. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
- I. Label Content: Include caution and warning information, plus emergency notification instructions.

2.3 DUCT LABELS

- A. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/16 inch thick, and having predrilled holes for attachment hardware.
- B. Minimum Label Size: Length and width vary for required label content.
- C. Fasteners: Stainless-steel self-tapping screws.
- D. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
- E. Duct Label Contents: Include identification of duct service using same designations or abbreviations as used on Drawings; also include duct size and an arrow indicating flow direction.
 - 1. Flow-Direction Arrows: Integral with duct system service lettering to accommodate both directions or as separate unit on each duct label to indicate flow direction.

2.4 STENCILS

- A. Stencils: Prepared with letter sizes according to ASME A13.1 for piping; minimum letter height of 1-1/4 inches for ducts; and minimum letter height of 3/4 inch for access panel and door labels, equipment labels, and similar operational instructions.
 - 1. Stencil Material: Fiberboard or metal.
 - 2. Stencil Paint: Exterior, gloss, alkyd or acrylic enamel black unless otherwise indicated. Paint may be in pressurized spray-can form.
 - 3. Identification Paint: Exterior, alkyd or acrylic enamel in colors according to ASME A13.1 unless otherwise indicated.

2.5 WARNING TAGS

- A. Warning Tags: Preprinted or partially preprinted, accident-prevention tags, of plasticized card stock with matte finish suitable for writing.
 - 1. Size: Approximately 4 by 7 inches.
 - 2. Fasteners: Reinforced grommet, Brass grommet, and wire or string.
 - 3. Nomenclature: Large-size primary caption such as "DANGER," "CAUTION," or "DO NOT OPERATE."
 - 4. Color: Yellow background with black lettering.

PART 3 - EXECUTION

3.1 EQUIPMENT, PIPING, AND DUCTWORK

A. All main items of mechanical equipment shall be identified with signs made of laminated plastic with 1/8" or larger engraved letters. Signs shall be securely attached by rustproof screws or some other permanent means. Information on sign shall include name of equipment, rating, maintenance instructions, and any other important data.

- B. All painting of piping shall be the responsibility as specified under Section "Painting" of Division "Finishes".
- C. All exposed and accessible piping (above removable ceilings, etc.) above ³/₄" in diameter shall be identified as to function and direction of flow by means of manufactured pipe markers.

3.2 PREPARATION

A. Clean piping and equipment surfaces of substances that could impair bond of identification devices, including dirt, oil, grease, release agents, and incompatible primers, paints, and encapsulants.

3.3 EQUIPMENT LABEL INSTALLATION

- A. Install or permanently fasten labels on each major item of mechanical equipment.
- B. Locate equipment labels where accessible and visible.

3.4 DUCT LABEL INSTALLATION

- A. Install plastic-laminated or self-adhesive duct labels with permanent adhesive on air ducts.
- B. Stenciled Duct Label Option: Stenciled labels, showing service and flow direction, may be provided instead of plastic-laminated duct labels, at Installer's option, if lettering larger than 1 inch high is needed for proper identification because of distance from normal location of required identification.
- C. Locate labels near points where ducts enter into concealed spaces and at maximum intervals of 25 feet in each space where ducts are exposed or concealed by removable ceiling system.

3.5 WARNING-TAG INSTALLATION

A. Write required message on, and attach warning tags to, equipment and other items where required.

END OF SECTION

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes TAB to produce design objectives for the following:
 - 1. Air Systems:
 - a. Constant-volume air systems.
 - 2. HVAC equipment quantitative-performance settings.
 - 3. Verifying that control devices are functioning properly.
 - 4. Reporting results of activities and procedures specified in this Section.

1.2 SUBMITTALS

- A. Certified TAB Reports: Submit two copies of reports prepared, as specified in this Section, on approved forms certified by TAB firm.
- B. Warranties specified in this Section.

1.3 QUALITY ASSURANCE

- A. TAB Firm Qualifications: Engage a TAB firm certified by AABC, NEBB or TABB.
- B. Certification of TAB Reports: Certify TAB field data reports. This certification includes the following:
 - 1. Review field data reports to validate accuracy of data and to prepare certified TAB reports.
 - 2. Certify that TAB team complied with approved TAB plan and the procedures specified and referenced in this Specification.
- C. TAB Report Forms: Use standard forms from AABC's "National Standards for Testing and Balancing Heating, Ventilating, and Air Conditioning Systems." NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems." or SMACNA's TABB "HVAC Systems - Testing, Adjusting, and Balancing." TAB firm's forms approved by Architect. TABB "Contractors Certification Manual."
- D. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1-2019, Section 7.2.2 "Air Balancing."
- E. ASHRAE/IESNA 90.1-2019 Compliance: Applicable requirements in ASHRAE/IESNA 90.1-2019, Section 6.7.2.3 "System Balancing."

1.4 COORDINATION

- A. Coordinate the efforts of factory-authorized service representatives for systems and equipment, HVAC controls installers, and other mechanics to operate HVAC systems and equipment to support and assist TAB activities.
- B. Perform TAB after leakage and pressure tests on air systems have been satisfactorily completed.

1.5 WARRANTY

- A. National Project Performance Guarantee: Provide a guarantee on AABC's "National Standards for Testing and Balancing Heating, Ventilating, and Air Conditioning Systems" forms stating that AABC will assist in completing requirements of the Contract Documents if TAB firm fails to comply with the Contract Documents. Guarantee includes the following provisions:
 - 1. The certified TAB firm has tested and balanced systems according to the Contract Documents.
 - 2. Systems are balanced to optimum performance capabilities within design and installation limits.
- B. Special Guarantee: Provide a guarantee on NEBB forms stating that NEBB will assist in completing requirements of the Contract Documents if TAB firm fails to comply with the Contract Documents. Guarantee shall include the following provisions:
 - 1. The certified TAB firm has tested and balanced systems according to the Contract Documents.
 - 2. Systems are balanced to optimum performance capabilities within design and installation limits.
- PART 2 PRODUCTS (Not Applicable)
- PART 3 EXECUTION
- 3.1 EXAMINATION
 - A. Examine the Contract Documents to become familiar with Project requirements and to discover conditions in systems' designs that may preclude proper TAB of systems and equipment.
 - 1. Verify that balancing devices, such as test ports, gage cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers, are required by the Contract Documents. Verify that quantities and locations of these balancing devices are accessible and appropriate for effective balancing and for efficient system and equipment operation.
 - B. Examine approved submittal data of HVAC systems and equipment.
 - C. Examine Project Record Documents described in Division 01 Section "Project Record Documents."
 - D. Examine design data, including HVAC system descriptions, statements of design assumptions for environmental conditions and systems' output, and statements of philosophies and assumptions about HVAC system and equipment controls.
 - E. Examine equipment performance data including fan and pump curves. Relate performance data to Project conditions and requirements, including system effects that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system. Calculate system effect factors to reduce performance ratings of HVAC equipment when installed under conditions different from those presented when the equipment was performance tested at the factory. To calculate system effects for air systems, use tables and charts found in AMCA 201, "Fans and Systems," Sections 7

through 10; or in SMACNA's "HVAC Systems--Duct Design," Sections 5 and 6. Compare this data with the design data and installed conditions.

- F. Examine system and equipment installations to verify that they are complete and that testing, cleaning, adjusting, and commissioning specified in individual Sections have been performed.
- G. Examine system and equipment test reports.
- H. Examine HVAC system and equipment installations to verify that indicated balancing devices, such as test ports, gage cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers, are properly installed, and that their locations are accessible and appropriate for effective balancing and for efficient system and equipment operation.
- I. Examine systems for functional deficiencies that cannot be corrected by adjusting and balancing.
- J. Examine HVAC equipment to ensure that clean filters have been installed, bearings are greased, belts are aligned and tight, and equipment with functioning controls is ready for operation.
- K. Examine heat-transfer coils for correct piping connections and for clean and straight fins.
- L. Examine equipment for installation and for properly operating safety interlocks and controls.
- M. Examine automatic temperature system components to verify the following:
 - 1. Dampers, valves, and other controlled devices are operated by the intended controller.
 - 2. Dampers and valves are in the position indicated by the controller.
 - 3. Integrity of valves and dampers for free and full operation and for tightness of fully closed and fully open positions. This includes dampers in multizone units, mixing boxes, and variable-air-volume terminals.
 - 4. Thermostats and humidistats are located to avoid adverse effects of sunlight, drafts, and cold walls.
 - 5. Sensors are located to sense only the intended conditions.
 - 6. Sequence of operation for control modes is according to the Contract Documents.
 - 7. Controller set points are set at indicated values.
 - 8. Interlocked systems are operating.
- N. Report deficiencies discovered before and during performance of TAB procedures. Observe and record system reactions to changes in conditions. Record default set points if different from indicated values.

3.2 PREPARATION

- A. Prepare a TAB plan that includes strategies and step-by-step procedures.
- B. Complete system readiness checks and prepare system readiness reports. Verify the following:
 - 1. Permanent electrical power wiring is complete.

- 2. Hydronic systems are filled, clean, and free of air.
- 3. Automatic temperature-control systems are operational.
- 4. Equipment and duct access doors are securely closed.
- 5. Balance, smoke, and fire dampers are open.
- 6. Isolating and balancing valves are open and control valves are operational.
- 7. Ceilings are installed in critical areas where air-pattern adjustments are required and access to balancing devices is provided.
- 8. Windows and doors can be closed so indicated conditions for system operations can be met.

3.3 GENERAL PROCEDURES FOR TESTING AND BALANCING

- A. Perform testing and balancing procedures on each system according to the procedures contained in ASHRAE 111, AABC's "National Standards for Testing and Balancing Heating, Ventilating, and Air Conditioning Systems", NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems", SMACNA's TABB "HVAC Systems Testing, Adjusting, and Balancing" and this Section.
 - 1. Comply with requirements in ASHRAE 62.1-2004, Section 7.2.2 "Air Balancing."
- B. Cut insulation, ducts, pipes, and equipment cabinets for installation of test probes to the minimum extent necessary to allow adequate performance of procedures. After testing and balancing, close probe holes and patch insulation with new materials identical to those removed. Restore vapor barrier and finish according to insulation Specifications for this Project.
- C. Mark equipment and balancing device settings with paint or other suitable, permanent identification material, including damper-control positions, valve position indicators, fan-speed-control levers, and similar controls and devices, to show final settings.

3.4 GENERAL PROCEDURES FOR BALANCING AIR SYSTEMS

- A. Prepare test reports for both fans and outlets. Obtain manufacturer's outlet factors and recommended testing procedures. Crosscheck the summation of required outlet volumes with required fan volumes.
- B. Prepare schematic diagrams of systems' "as-built" duct layouts.
- C. For variable-air-volume systems, develop a plan to simulate diversity.
- D. Determine the best locations in main and branch ducts for accurate duct airflow measurements.
- E. Check airflow patterns from the outside-air louvers and dampers and the return- and exhaust-air dampers, through the supply-fan discharge and mixing dampers.
- F. Locate start-stop and disconnect switches, electrical interlocks, and motor starters.
- G. Verify that motor starters are equipped with properly sized thermal protection.
- H. Check dampers for proper position to achieve desired airflow path.
- I. Check for airflow blockages.

- J. Check condensate drains for proper connections and functioning.
- K. Check for proper sealing of air-handling unit components.
- L. Check for proper sealing of air duct system.

3.5 PROCEDURES FOR CONSTANT-VOLUME AIR SYSTEMS

- A. Adjust fans to deliver total indicated airflows within the maximum allowable fan speed listed by fan manufacturer.
 - 1. Measure fan static pressures to determine actual static pressure as follows:
 - a. Measure outlet static pressure as far downstream from the fan as practicable and upstream from restrictions in ducts such as elbows and transitions.
 - b. Measure static pressure directly at the fan outlet or through the flexible connection.
 - c. Measure inlet static pressure of single-inlet fans in the inlet duct as near the fan as possible, upstream from flexible connection and downstream from duct restrictions.
 - d. Measure inlet static pressure of double-inlet fans through the wall of the plenum that houses the fan.
 - 2. Measure static pressure across each component that makes up an air-handling unit, rooftop unit, and other air-handling and -treating equipment.
 - a. Simulate dirty filter operation and record the point at which maintenance personnel must change filters.
 - 3. Measure static pressures entering and leaving other devices such as sound traps, heat recovery equipment, and air washers, under final balanced conditions.
 - 4. Compare design data with installed conditions to determine variations in design static pressures versus actual static pressures. Compare actual system effect factors with calculated system effect factors to identify where variations occur. Recommend corrective action to align design and actual conditions.
 - 5. Obtain approval from Architect for adjustment of fan speed higher or lower than indicated speed. Make required adjustments to pulley sizes, motor sizes, and electrical connections to accommodate fan-speed changes.
 - 6. Do not make fan-speed adjustments that result in motor overload. Consult equipment manufacturers about fan-speed safety factors. Modulate dampers and measure fan-motor amperage to ensure that no overload will occur. Measure amperage in full cooling, full heating, economizer, and any other operating modes to determine the maximum required brake horsepower.
- B. Adjust volume dampers for main duct, submain ducts, and major branch ducts to indicated airflows within specified tolerances.
 - 1. Measure static pressure at a point downstream from the balancing damper and adjust volume dampers until the proper static pressure is achieved.
 - a. Where sufficient space in submain and branch ducts is unavailable for Pitottube traverse measurements, measure airflow at terminal outlets and inlets and calculate the total airflow for that zone.

- 2. Remeasure each submain and branch duct after all have been adjusted. Continue to adjust submain and branch ducts to indicated airflows within specified tolerances.
- C. Measure terminal outlets and inlets without making adjustments.
 - 1. Measure terminal outlets using a direct-reading hood or outlet manufacturer's written instructions and calculating factors.
- D. Adjust terminal outlets and inlets for each space to indicated airflows within specified tolerances of indicated values. Make adjustments using volume dampers rather than extractors and the dampers at air terminals.
 - 1. Adjust each outlet in same room or space to within specified tolerances of indicated quantities without generating noise levels above the limitations prescribed by the Contract Documents.
 - 2. Adjust patterns of adjustable outlets for proper distribution without drafts.

3.6 PROCEDURES FOR MOTORS

- A. Motors, 1/2 HP and Larger: Test at final balanced conditions and record the following data:
 - 1. Manufacturer, model, and serial numbers.
 - 2. Motor horsepower rating.
 - 3. Motor rpm.
 - 4. Efficiency rating.
 - 5. Nameplate and measured voltage, each phase.
 - 6. Nameplate and measured amperage, each phase.
 - 7. Starter thermal-protection-element rating.
- B. Motors Driven by Variable-Frequency Controllers: Test for proper operation at speeds varying from minimum to maximum. Test the manual bypass for the controller to prove proper operation. Record observations, including controller manufacturer, model and serial numbers, and nameplate data.

3.7 PROCEDURES FOR HEAT EXCHANGER

A. measure entering and leaving water temperature and flow and steam pressure.

3.8 PROCEDURES FOR TEMPERATURE MEASUREMENTS

- A. During TAB, report the need for adjustment in temperature regulation within the automatic temperature-control system.
- B. Measure indoor wet- and dry-bulb temperatures every other hour for a period of two successive eight-hour days, in each separately controlled zone, to prove correctness of final temperature settings. Measure when the building or zone is occupied.
- C. Measure outside-air, wet- and dry-bulb temperatures.
- 3.9 TEMPERATURE-CONTROL VERIFICATION
 - A. Confirm project sequence of operations is met.

3.10 TOLERANCES

- A. Set HVAC system airflow and water flow rates within the following tolerances:
 - 1. Supply, Return, and Exhaust Fans and Equipment with Fans: Plus 5 to plus 10 percent.
 - 2. Air Outlets and Inlets: 0 to minus 10 percent.

3.11 FINAL REPORT

- A. General: Typewritten, or computer printout in letter-quality font, on standard bond paper, in three-ring binder, tabulated and divided into sections by tested and balanced systems.
- B. Include a certification sheet in front of binder signed and sealed by the certified testing and balancing engineer.
 - 1. Include a list of instruments used for procedures, along with proof of calibration.
- C. Final Report Contents: In addition to certified field report data, include the following:
 - 1. Pump curves.
 - 2. Fan curves.
 - 3. Manufacturers' test data.
 - 4. Field test reports prepared by system and equipment installers.
 - 5. Other information relative to equipment performance, but do not include Shop Drawings and Product Data.
- D. General Report Data: In addition to form titles and entries, include the following data in the final report, as applicable:
 - 1. Title page.
 - 2. Name and address of TAB firm.
 - 3. Project name.
 - 4. Project location.
 - 5. Architect's name and address.
 - 6. Engineer's name and address.
 - 7. Contractor's name and address.
 - 8. Report date.
 - 9. Signature of TAB firm who certifies the report.
 - 10. Table of Contents with the total number of pages defined for each section of the report. Number each page in the report.
 - 11. Summary of contents including the following:
 - a. Indicated versus final performance.
 - b. Notable characteristics of systems.
 - c. Description of system operation sequence if it varies from the Contract Documents.
 - 12. Nomenclature sheets for each item of equipment.
 - 13. Data for terminal units, including manufacturer, type size, and fittings.
 - 14. Notes to explain why certain final data in the body of reports varies from indicated values.
 - 15. Test conditions for fans and pump performance forms including the following:

- a. Settings for outside-, return-, and exhaust-air dampers.
- b. Conditions of filters.
- c. Cooling coil, wet- and dry-bulb conditions.
- d. Fan drive settings including settings and percentage of maximum pitch diameter.
- e. Settings for supply-air, static-pressure controller.
- f. Other system operating conditions that affect performance.
- E. System Diagrams: Include schematic layouts of air and hydronic distribution systems. Present each system with single-line diagram and include the following:
 - 1. Quantities of outside, supply, return, and exhaust airflows.
 - 2. Water and steam flow rates.
 - 3. Duct, outlet, and inlet sizes.
 - 4. Pipe and valve sizes and locations.
 - 5. Terminal units.
 - 6. Balancing stations.
 - 7. Position of balancing devices.

3.12 ADDITIONAL TESTS

- A. Within 90 days of completing TAB, perform additional testing and balancing to verify that balanced conditions are being maintained throughout and to correct unusual conditions.
- B. Seasonal Periods: If initial TAB procedures were not performed during near-peak summer and winter conditions, perform additional testing, inspecting, and adjusting during near-peak summer and winter conditions.

END OF SECTION

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Insulation Materials:
 - a. Flexible elastomeric.
 - b. Mineral fiber.
 - 2. Adhesives.
 - 3. Mastics.
 - 4. Sealants.
 - 5. Factory-applied jackets.
 - 6. Tapes.
 - 7. Securements.
 - 8. Corner angles.

1.2 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings:
 - 1. Detail application of protective shields, saddles, and inserts at hangers for each type of insulation and hanger.
 - 2. Detail attachment and covering of heat tracing inside insulation.
 - 3. Detail insulation application at pipe expansion joints for each type of insulation.
 - 4. Detail insulation application at elbows, fittings, flanges, valves, and specialties for each type of insulation.
 - 5. Detail removable insulation at piping specialties, equipment connections, and access panels.
 - 6. Detail application at linkages of control devices.
- C. Field quality-control reports.

1.3 QUALITY ASSURANCE

- A. Fire-Test-Response Characteristics: Insulation and related materials shall have fire-test-response characteristics indicated, as determined by testing identical products per ASTM E 84, by a testing and inspecting agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing and inspecting agency.
 - 1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smokedeveloped index of 50 or less.
 - 2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smokedeveloped index of 150 or less.

PART 2 - PRODUCTS

2.1 INSULATION MATERIALS

- A. Comply with requirements in Part 3 schedule articles for where insulating materials shall be applied.
- B. Products shall not contain asbestos, lead, mercury, or mercury compounds.
- C. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.
- D. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.
- E. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.
- F. Flexible Elastomeric: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type I for tubular materials and Type II for sheet materials.
 - 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. Aeroflex USA Inc.; Aerocel.
 - b. Armacell LLC; AP Armaflex.
 - c. RBX Corporation; Insul-Sheet 1800 and Insul-Tube 180.
- G. Mineral-Fiber Blanket Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 553, Type II and ASTM C 1290, Type I or II with factoryapplied vinyl jacket, III with factory-applied FSK jacket or III with factory-applied FSP jacket. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
 - 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. CertainTeed Corp.; Duct Wrap.
 - b. Johns Manville; Microlite.
 - c. Knauf Insulation; Duct Wrap.
 - d. Manson Insulation Inc.; Alley Wrap.
 - e. Owens Corning; All-Service Duct Wrap.
- H. Mineral-Fiber Board Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 612, Type IA or Type IB. For duct and plenum applications, provide insulation with factory-applied ASJ or with factory-applied FSK jacket. For equipment applications, provide insulation with factory-applied ASJ or with factoryapplied FSK jacket. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
 - 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. CertainTeed Corp.; Commercial Board.

- b. Fibrex Insulations Inc.; FBX.
- c. Johns Manville; 800 Series Spin-Glas.
- d. Knauf Insulation; Insulation Board.
- e. Manson Insulation Inc.; AK Board.
- f. Owens Corning; Fiberglas 700 Series.

2.2 ADHESIVES

- A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated, unless otherwise indicated.
- B. Flexible Elastomeric: Comply with MIL-A-24179A, Type II, Class I.
 - 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. Aeroflex USA Inc.; Aeroseal.
 - b. Armacell LCC; 520 Adhesive.
 - c. Foster Products Corporation, H. B. Fuller Company; 85-75.
 - d. RBX Corporation; Rubatex Contact Adhesive.
 - 2. For indoor applications, use adhesive that has a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- C. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.
 - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Childers Products, Division of ITW; CP-82.
 - b. Foster Products Corporation, H. B. Fuller Company; 85-20.
 - c. ITW TACC, Division of Illinois Tool Works; S-90/80.
 - d. Marathon Industries, Inc.; 225.
 - e. Mon-Eco Industries, Inc.; 22-25.
 - 2. For indoor applications, use adhesive that has a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- D. PVC Jacket Adhesive: Compatible with PVC jacket.
 - 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. Dow Chemical Company (The); 739, Dow Silicone.
 - b. Johns-Manville; Zeston Perma-Weld, CEEL-TITE Solvent Welding Adhesive.
 - c. P.I.C. Plastics, Inc.; Welding Adhesive.
 - d. Speedline Corporation; Speedline Vinyl Adhesive.
 - 2. For indoor applications, use adhesive that has a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.3 MASTICS

- A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-C-19565C, Type II.
- B. Vapor-Barrier Mastic: Water based; suitable for indoor and outdoor use on below ambient services.
 - 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. Childers Products, Division of ITW; CP-35.
 - b. Foster Products Corporation, H. B. Fuller Company; 30-90.
 - c. ITW TACC, Division of Illinois Tool Works; CB-50.
 - d. Marathon Industries, Inc.; 590.
 - e. Mon-Eco Industries, Inc.; 55-40.
 - f. Vimasco Corporation; 749.
 - 2. Water-Vapor Permeance: ASTM E 96, Procedure B, 0.013 perm at 43-mil dry film thickness.
 - 3. Service Temperature Range: Minus 20 to plus 180 deg F.
 - 4. Solids Content: ASTM D 1644, 59 percent by volume and 71 percent by weight.
 - 5. Color: White.

2.4 SEALANTS

- A. Joint Sealants:
 - 1. Materials shall be compatible with insulation materials, jackets, and substrates.
 - 2. Permanently flexible, elastomeric sealant.
 - 3. Service Temperature Range: Minus 100 to plus 300 deg F.
 - 4. Color: White or gray.
 - 5. For indoor applications, use sealants that have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- B. FSK and Metal Jacket Flashing Sealants:
 - 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. Childers Products, Division of ITW; CP-76-8.
 - b. Foster Products Corporation, H. B. Fuller Company; 95-44.
 - c. Marathon Industries, Inc.; 405.
 - d. Mon-Eco Industries, Inc.; 44-05.
 - e. Vimasco Corporation; 750.
 - 2. Materials shall be compatible with insulation materials, jackets, and substrates.
 - 3. Fire- and water-resistant, flexible, elastomeric sealant.
 - 4. Service Temperature Range: Minus 40 to plus 250 deg F.
 - 5. Color: Aluminum.
 - 6. For indoor applications, use sealants that have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- C. ASJ Flashing Sealants, and Vinyl, PVDC, and PVC Jacket Flashing Sealants:

- 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. Childers Products, Division of ITW; CP-76.
- 2. Materials shall be compatible with insulation materials, jackets, and substrates.
- 3. Fire- and water-resistant, flexible, elastomeric sealant.
- 4. Service Temperature Range: Minus 40 to plus 250 deg F.
- 5. Color: White.
- 6. For indoor applications, use sealants that have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.5 FACTORY-APPLIED JACKETS

- A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:
 - 1. ASJ: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C 1136, Type I.
 - 2. ASJ-SSL: ASJ with self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip; complying with ASTM C 1136, Type I.
 - 3. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C 1136, Type II.
 - 4. FSP Jacket: Aluminum-foil, fiberglass-reinforced scrim with polyethylene backing; complying with ASTM C 1136, Type II.
 - 5. PVDC Jacket for Indoor Applications: 4-mil-thick, white PVDC biaxially oriented barrier film with a permeance at 0.02 perms when tested according to ASTM E 96 and with a flame-spread index of 5 and a smoke-developed index of 20 when tested according to ASTM E 84.
 - a. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - 1) Dow Chemical Company (The); Saran 540 Vapor Retarder Film and Saran 560 Vapor Retarder Film.

2.6 FIELD-APPLIED JACKETS

- A. Field-applied jackets shall comply with ASTM C 921, Type I, unless otherwise indicated.
- B. FSK Jacket: Aluminum-foil-face, fiberglass-reinforced scrim with kraft-paper backing.
- C. Aluminum Jacket: Comply with ASTM B 209, Alloy 3003, 3005, 3105 or 5005, Temper H-14.
 - 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. Childers Products, Division of ITW; Metal Jacketing Systems.
 - b. PABCO Metals Corporation; Surefit.
 - c. RPR Products, Inc.; Insul-Mate.
 - 2. Sheet and roll stock ready for shop or field sizing.

- 3. Finish and thickness are indicated in field-applied jacket schedules.
- 4. Moisture Barrier for Outdoor Applications: 3-mil- thick, heat-bonded polyethylene and kraft paper 2.5-mil- thick Polysurlyn.
- 5. Factory-Fabricated Fitting Covers:
 - a. Same material, finish, and thickness as jacket.
 - b. Preformed 2-piece or gore, 45- and 90-degree, short- and long-radius elbows.
 - c. Flange and union covers.
 - d. Field fabricate fitting covers only if factory-fabricated fitting covers are not available.

2.7 TAPES

- A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136.
 - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0835.
 - b. Compac Corp.; 104 and 105.
 - c. Ideal Tape Co., Inc., an American Biltrite Company; 428 AWF ASJ.
 - d. Venture Tape; 1540 CW Plus, 1542 CW Plus, and 1542 CW Plus/SQ.
 - 2. Width: 3 inches.
 - 3. Thickness: 11.5 mils.
 - 4. Adhesion: 90 ounces force/inch in width.
 - 5. Elongation: 2 percent.
 - 6. Tensile Strength: 40 lbf/inch in width.
 - 7. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.
- B. FSK Tape: Foil-face, vapor-retarder tape matching factory-applied jacket with acrylic adhesive; complying with ASTM C 1136.
 - 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. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0827.
 - b. Compac Corp.; 110 and 111.
 - c. Ideal Tape Co., Inc., an American Biltrite Company; 491 AWF FSK.
 - d. Venture Tape; 1525 CW, 1528 CW, and 1528 CW/SQ.
 - 2. Width: 3 inches.
 - 3. Thickness: 6.5 mils.
 - 4. Adhesion: 90 ounces force/inch in width.
 - 5. Elongation: 2 percent.
 - 6. Tensile Strength: 40 lbf/inch in width.
 - 7. FSK Tape Disks and Squares: Precut disks or squares of FSK tape.
- C. PVC Tape: White vapor-retarder tape matching field-applied PVC jacket with acrylic adhesive. Suitable for indoor and outdoor applications.

- 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0555.
 - b. Compac Corp.; 130.
 - c. Ideal Tape Co., Inc., an American Biltrite Company; 370 White PVC tape.
 - d. Venture Tape; 1506 CW NS.
- 2. Width: 2 inches.
- 3. Thickness: 6 mils.
- 4. Adhesion: 64 ounces force/inch in width.
- 5. Elongation: 500 percent.
- 6. Tensile Strength: 18 lbf/inch in width.
- D. Aluminum-Foil Tape: Vapor-retarder tape with acrylic adhesive.
 - 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. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0800.
 - b. Compac Corp.; 120.
 - c. Ideal Tape Co., Inc., an American Biltrite Company; 488 AWF.
 - d. Venture Tape; 3520 CW.
 - 2. Width: 2 inches.
 - 3. Thickness: 3.7 mils.
 - 4. Adhesion: 100 ounces force/inch in width.
 - 5. Elongation: 5 percent.
 - 6. Tensile Strength: 34 lbf/inch in width.

2.8 SECUREMENTS

- A. Insulation Pins and Hangers:
 - 1. Metal, Adhesively Attached, Perforated-Base Insulation Hangers: Baseplate welded to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place. Comply with the following requirements:
 - a. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - 1) AGM Industries, Inc.; Tactoo Insul-Hangers, Series T.
 - 2) GEMCO; Perforated Base.
 - 3) Midwest Fasteners, Inc.; Spindle.
 - b. Baseplate: Perforated, galvanized carbon-steel sheet, 0.030 inch thick by 2 inches square.
 - c. Spindle: Copper- or zinc-coated, low carbon steel Aluminum or Stainless steel, fully annealed, 0.106-inch-diameter shank, length to suit depth of insulation indicated.

- d. Adhesive: Recommended by hanger manufacturer. Product with demonstrated capability to bond insulation hanger securely to substrates indicated without damaging insulation, hangers, and substrates.
- 2. Nonmetal, Adhesively Attached, Perforated-Base Insulation Hangers: Baseplate fastened to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place. Comply with the following requirements:
 - a. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - 1) GEMCO; Nylon Hangers.
 - 2) Midwest Fasteners, Inc.; Nylon Insulation Hangers.
 - b. Baseplate: Perforated, nylon sheet, 0.030 inch thick by 1-1/2 inches in diameter.
 - c. Spindle: Nylon, 0.106-inch-diameter shank, length to suit depth of insulation indicated, up to 2-1/2 inches.
 - d. Adhesive: Recommended by hanger manufacturer. Product with demonstrated capability to bond insulation hanger securely to substrates indicated without damaging insulation, hangers, and substrates.
- 3. Self-Sticking-Base Insulation Hangers: Baseplate welded to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place. Comply with the following requirements:
 - a. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - 1) AGM Industries, Inc.; Tactoo Insul-Hangers, Series TSA.
 - 2) GEMCO; Press and Peel.
 - 3) Midwest Fasteners, Inc.; Self Stick.
 - b. Baseplate: Galvanized carbon-steel sheet, 0.030 inch thick by 2 inches square.
 - c. Spindle: Copper- or zinc-coated, low carbon steel, Aluminum or Stainless steel, fully annealed, 0.106-inch-diameter shank, length to suit depth of insulation indicated.
 - d. Adhesive-backed base with a peel-off protective cover.
- 4. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch-thick, galvanized-steel, aluminum, stainless-steel sheet, with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches in diameter.
 - a. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - 1) AGM Industries, Inc.; RC-150.

- 2) GEMCO; R-150.
- 3) Midwest Fasteners, Inc.; WA-150.
- 4) Nelson Stud Welding; Speed Clips.
- b. Protect ends with capped self-locking washers incorporating a spring steel insert to ensure permanent retention of cap in exposed locations.
- 5. Nonmetal Insulation-Retaining Washers: Self-locking washers formed from 0.016inch-thick nylon sheet, with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches in diameter.
 - a. Products: Subject to compliance with requirements available products that may be incorporated into the Work include, but are not limited to, the following:
 - 1) GEMCO.
 - 2) Midwest Fasteners, Inc.
- B. Staples: Outward-clinching insulation staples, nominal 3/4-inch- (19-mm-) wide, stainless steel or Monel.

PART 3 - EXECUTION

- 3.1 PREPARATION
 - A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.
 - B. Coordinate insulation installation with the trade installing heat tracing. Comply with requirements for heat tracing that apply to insulation.

3.2 GENERAL INSTALLATION REQUIREMENTS

- A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of equipment, ducts and fittings, and piping including fittings, valves, and specialties.
- B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of equipment, duct system, and pipe system as specified in insulation system schedules.
- C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.
- D. Install insulation with longitudinal seams at top and bottom of horizontal runs.
- E. Install multiple layers of insulation with longitudinal and end seams staggered.
- F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.
- G. Keep insulation materials dry during application and finishing.
- H. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.
- I. Install insulation with least number of joints practical.
- J. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.
 - 1. Install insulation continuously through hangers and around anchor attachments.
 - 2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
 - 3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
 - 4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.
- K. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.
- L. Install insulation with factory-applied jackets as follows:
 - 1. Draw jacket tight and smooth.
 - 2. Cover circumferential joints with 3-inch-wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches o.c.
 - 3. Overlap jacket longitudinal seams at least 1-1/2 inches. Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 2 inches o.c.
 - a. For below ambient services, apply vapor-barrier mastic over staples.
 - 4. Cover joints and seams with tape as recommended by insulation material manufacturer to maintain vapor seal.
 - 5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to duct and pipe flanges and fittings.
- M. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.
- N. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.
- O. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.

3.3 PENETRATIONS

A. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.

- 1. Seal penetrations with flashing sealant.
- 2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
- 3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches.
- 4. Seal jacket to wall flashing with flashing sealant.
- B. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.
- C. Insulation Installation at Floor Penetrations:
 - 1. Duct: Install insulation continuously through floor penetrations that are not fire rated. For penetrations through fire-rated assemblies, terminate insulation at fire damper sleeves and externally insulate damper sleeve beyond floor to match adjacent duct insulation. Overlap damper sleeve and duct insulation at least 2 inches.
 - 2. Pipe: Install insulation continuously through floor penetrations.

3.4 GENERAL PIPE INSULATION INSTALLATION

A. Requirements in this article generally apply to all insulation materials except where more specific requirements are specified in various pipe insulation material installation articles.

3.5 FLEXIBLE ELASTOMERIC INSULATION INSTALLATION

- A. Seal longitudinal seams and end joints with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
- B. Insulation Installation on Pipe Flanges:
 - 1. Install pipe insulation to outer diameter of pipe flange.
 - 2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
 - 3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of sheet insulation of same thickness as pipe insulation.
 - 4. Secure insulation to flanges and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
- C. Insulation Installation on Pipe Fittings and Elbows:
 - 1. Install mitered sections of pipe insulation.
 - 2. Secure insulation materials and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
- D. Insulation Installation on Valves and Pipe Specialties:
 - 1. Install preformed valve covers manufactured of same material as pipe insulation when available.

- 2. When preformed valve covers are not available, install cut sections of pipe and sheet insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
- 3. Install insulation to flanges as specified for flange insulation application.
- 4. Secure insulation to valves and specialties and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

3.6 MINERAL-FIBER INSULATION INSTALLATION

- A. Insulation Installation on Straight Pipes and Tubes:
 - 1. Secure each layer of preformed pipe insulation to pipe with wire or bands and tighten bands without deforming insulation materials.
 - 2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
 - 3. For insulation with factory-applied jackets on above ambient surfaces, secure laps with outward clinched staples at 6 inches o.c.
 - 4. For insulation with factory-applied jackets on below ambient surfaces, do not staple longitudinal tabs but secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.
- B. Insulation Installation on Pipe Flanges:
 - 1. Install preformed pipe insulation to outer diameter of pipe flange.
 - 2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
 - 3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with mineral-fiber blanket insulation.
 - 4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch, and seal joints with flashing sealant.
- C. Insulation Installation on Pipe Fittings and Elbows:
 - 1. Install preformed sections of same material as straight segments of pipe insulation when available.
 - 2. When preformed insulation elbows and fittings are not available, install mitered sections of pipe insulation, to a thickness equal to adjoining pipe insulation. Secure insulation materials with wire or bands.
- D. Insulation Installation on Valves and Pipe Specialties:
 - 1. Install preformed sections of same material as straight segments of pipe insulation when available.
 - 2. When preformed sections are not available, install mitered sections of pipe insulation to valve body.
 - 3. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
 - 4. Install insulation to flanges as specified for flange insulation application.
- E. Blanket Insulation Installation on Ducts and Plenums: Secure with adhesive and insulation pins.

- 1. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for 100 percent coverage of duct and plenum surfaces.
- 2. Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions.
- 3. Install either capacitor-discharge-weld pins and speed washers or cupped-head, capacitor-discharge-weld pins on sides and bottom of horizontal ducts and sides of vertical ducts as follows:
 - a. On duct sides with dimensions 18 inches and smaller, place pins along longitudinal centerline of duct. Space 3 inches maximum from insulation end joints, and 16 inches o.c.
 - b. On duct sides with dimensions larger than 18 inches, place pins 16 inches o.c. each way, and 3 inches maximum from insulation joints. Install additional pins to hold insulation tightly against surface at cross bracing.
 - c. Pins may be omitted from top surface of horizontal, rectangular ducts and plenums.
 - d. Do not overcompress insulation during installation.
 - e. Impale insulation over pins and attach speed washers.
 - f. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.
- 4. For ducts and plenums with surface temperatures below ambient, install a continuous unbroken vapor barrier. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches from 1 edge and 1 end of insulation segment. Secure laps to adjacent insulation section with 1/2-inch outward-clinching staples, 1 inch o.c. Install vapor barrier consisting of factory- or field-applied jacket, adhesive, vapor-barrier mastic, and sealant at joints, seams, and protrusions.
 - a. Repair punctures, tears, and penetrations with tape or mastic to maintain vapor-barrier seal.
 - b. Install vapor stops for ductwork and plenums operating below 50 deg F at 18-foot intervals. Vapor stops shall consist of vapor-barrier mastic applied in a Z-shaped pattern over insulation face, along butt end of insulation, and over the surface. Cover insulation face and surface to be insulated a width equal to 2 times the insulation thickness but not less than 3 inches.
- 5. Overlap unfaced blankets a minimum of 2 inches on longitudinal seams and end joints. At end joints, secure with steel bands spaced a maximum of 18 inches o.c.
- 6. Install insulation on rectangular duct elbows and transitions with a full insulation section for each surface. Install insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.
- 7. Insulate duct stiffeners, hangers, and flanges that protrude beyond insulation surface with 6-inch- wide strips of same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with pins spaced 6 inches o.c.
- F. Board Insulation Installation on Ducts and Plenums: Secure with adhesive and insulation pins.
 - 1. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for 100 percent coverage of duct and plenum surfaces.
 - 2. Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions.

- 3. Install either capacitor-discharge-weld pins and speed washers or cupped-head, capacitor-discharge-weld pins on sides and bottom of horizontal ducts and sides of vertical ducts as follows:
 - a. On duct sides with dimensions 18 inches and smaller, place pins along longitudinal centerline of duct. Space 3 inches maximum from insulation end joints, and 16 inches o.c.
 - b. On duct sides with dimensions larger than 18 inches, space pins 16 inches o.c. each way, and 3 inches maximum from insulation joints. Install additional pins to hold insulation tightly against surface at cross bracing.
 - c. Pins may be omitted from top surface of horizontal, rectangular ducts and plenums.
 - d. Do not overcompress insulation during installation.
 - e. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.
- 4. For ducts and plenums with surface temperatures below ambient, install a continuous unbroken vapor barrier. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches from 1 edge and 1 end of insulation segment. Secure laps to adjacent insulation section with 1/2-inch outward-clinching staples, 1 inch o.c. Install vapor barrier consisting of factory- or field-applied jacket, adhesive, vapor-barrier mastic, and sealant at joints, seams, and protrusions.
 - a. Repair punctures, tears, and penetrations with tape or mastic to maintain vapor-barrier seal.
 - b. Install vapor stops for ductwork and plenums operating below 50 deg F at 18-foot intervals. Vapor stops shall consist of vapor-barrier mastic applied in a Z-shaped pattern over insulation face, along butt end of insulation, and over the surface. Cover insulation face and surface to be insulated a width equal to 2 times the insulation thickness but not less than 3 inches.
- 5. Install insulation on rectangular duct elbows and transitions with a full insulation section for each surface. Groove and score insulation to fit as closely as possible to outside and inside radius of elbows. Install insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.
- 6. Insulate duct stiffeners, hangers, and flanges that protrude beyond insulation surface with 6-inch- wide strips of same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with pins spaced 6 inches o.c.

3.7 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. Tests and Inspections:
 - 1. Inspect ductwork, randomly selected by Architect, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection shall be limited to one location(s) for each duct system defined in the "Duct Insulation Schedule, General" Article.
 - 2. Inspect field-insulated equipment, randomly selected by Architect, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection shall be limited to one location(s) for each type of equipment

defined in the "Equipment Insulation Schedule" Article. For large equipment, remove only a portion adequate to determine compliance.

- 3. Inspect pipe, fittings, strainers, and valves, randomly selected by Architect, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection shall be limited to three locations of straight pipe, three locations of threaded fittings, three locations of welded fittings, two locations of threaded strainers, two locations of welded strainers, three locations of threaded valves, and three locations of flanged valves for each pipe service defined in the "Piping Insulation Schedule, General" Article.
- C. All insulation applications will be considered defective Work if sample inspection reveals noncompliance with requirements.

3.8 INDOOR DUCT AND PLENUM INSULATION SCHEDULE

- A. Concealed, Supply-Air Duct and Plenum Insulation: Mineral-fiber blanket, 1-1/2 inches thick and 1.5-lb/cu. ft. nominal density to meet R-6.
- B. Concealed, Outdoor-Air Duct and Plenum Insulation: Mineral-fiber blanket, 1-1/2 inches thick and 1.5-lb/cu. ft. nominal density to meet R-6.
- C. Exposed, Supply-Air Duct and Plenum Insulation: Mineral-fiber board, 1-1/2 inches thick and 1.5-lb/cu. ft. nominal density to meet R-6.
- D. Exposed, Outdoor-Air Duct and Plenum Insulation: Mineral-fiber board, 1-1/2 inches thick and 1.5-lb/cu. ft nominal density to meet R-6.
- E. Concealed, Return-Air Duct and Plenum Insulation (located in unconditioned spaces only): Mineral-fiber blanket, 1-1/2 inches thick and 1.5-lb/cu. ft. nominal density to meet R-6.

3.9 PIPING INSULATION SCHEDULE, GENERAL

- A. Acceptable preformed pipe and tubular insulation materials and thicknesses are identified for each piping system and pipe size range. If more than one material is listed for a piping system, selection from materials listed is Contractor's option.
- B. Items Not Insulated: Unless otherwise indicated, do not install insulation on the following:
 - 1. Underground piping.
 - 2. Chrome-plated pipes and fittings unless there is a potential for personnel injury.

3.10 INDOOR PIPING INSULATION SCHEDULE

- A. Refrigerant Suction and Hot-Gas Piping: Flexible elastomeric or Mineral-fiber, preformed pipe insulation, 1 inch thick.
- B. Refrigerant Suction and Hot-Gas Flexible Tubing: Flexible elastomeric, 1 inch thick.
- C. Condensate Piping: Flexible elastomeric, 1 inch thick OR Mineral-fiber 1 inch thick.

END OF SECTION

PART 1 – GENERAL

1.1 DESCRIPTION

- A. Systems Verification is the systematic process of ensuring that all building systems perform interactively according to the design intent and the Owner's operational needs. The systems verification process shall encompass and coordinate the traditionally separate functions of systems documentation, equipment start-up/checkout, control system calibration and point to point (PTP) checkout, testing and balancing, verification, field functional performance testing and Owner training.
- B. The mechanical contractor is responsible assuring that Systems Verification for mechanical systems is completed as directed by the general contractor.

1.2 SYSTEMS TO BE VERIFIED

- A. The following new systems will require documentation provided by the mechanical contractor verifying that they have been installed and are operating in accordance with contract documents project:
 - 1. HVAC Systems
 - Exhaust fans
 - Roof Top Units
 - Split system A/C units
 - 2. Plumbing
 - Gas Service

PART 2 – PRODUCTS

- 2.1 TEST EQUIPMENT
 - A. All test equipment shall be of sufficient quality and accuracy to test and/or measure system performance within the tolerances written in the Specifications. Temperature sensors, pressure sensors and digital thermometers shall have a certified calibration within the past year from the date of measurement. All testing equipment shall be calibrated according to the manufacturer's recommended intervals, and certificates shall be readily available.

PART 3 – CHECKLISTS

- 3.1 GENERAL
 - A. Pre-functional and Functional Performance checklists are included at the end of this Section.
 - B. All mechanical equipment and systems will have pre-functional inspection (PFI) and functional performance test (FPT) checklists completed and approved by signature of the mechanical contractor.

- C. Once completed and signed, the mechanical contractor will transmit the checklist to the general contractor. The general contractor shall incorporate all completed checklists for each piece of equipment tested in the project closeout documents.
- D. The mechanical contractor shall note on the checklist in the space provided any deviations of installed equipment from the design documents (plans and/or specifications). Deviations will be supplemented by the approved Request for Information (RFI) or correspondence received from the general contractor by the design engineer or Owner approving the deviation from design. Technical Specification 230810-3.
- E. The checklists attached to this section contain the minimum information required for verification of each specific equipment or systems.
- F. The mechanical contractor shall supplement the checklists where feasible with other documents provided by subcontractors or manufacturers where applicable to validate equipment operations and warranties.

PART 4 - EXECUTION

4.1 PRE-FUNCTIONAL CHECKLISTS

- A. General: Pre-functional inspections shall ensure that the mechanical equipment and systems are installed in accordance with design documents, building codes, and manufacturer's recommendations. The pre-functional inspection shall address issues related to ease of access and maintainability.
- B. Each piece of equipment should receive a pre-functional inspection and checkout. The prefunctional portion of each checklist is intentionally designed as a broad, high level check of the completed installation and is not intended to cover all the detailed checks necessary during the installation process or during the vendor startup required for some equipment.
- C. The mechanical contractor shall provide additional information where necessary to supplement the pre-functional checklists provided by the A/E team; this information may include, but is not limited to, detailed checklists verifying installation in compliance with contract documents, field notes, and third party or manufacturer verifications that specific components of installed equipment have been inspected for proper installation.
- D. The mechanical contractor shall inspect the installed equipment, date and initial each item that passes inspection. Only individuals that have direct knowledge and witnesses that a line item task on the pre-functional checklist was actually performed shall initial and date that item as complete. Upon completion of each checked item, the mechanical contractor shall notify the general contractor that items have been completed, and request an independent verification from a representative of the general contractor of completion.

4.2 FUNCTIONAL PERFORMANCE TESTS

A. General: The objective of the functional performance tests is to demonstrate that each system is operating according to the documented design intent and Contract Documents. Functional testing facilitates bringing the systems from a state of substantial completion to full dynamic operation. Additionally during the testing process, areas of deficient performance are identified and corrected, improving the operation and functioning of the systems.

- B. The general contractor, mechanical contractor and subcontractors shall test, witness and document the operation of each piece of mechanical equipment, date and initial each item that passes inspection.
- C. The mechanical contractor's signature and date of completion shall validate that all HVAC control sequence of operations for that piece of equipment have been verified to be operational and calibrated. HVAC control sequence of operations shall include verification that interlocks with life safety systems (fire alarm, smoke alarm and emergency shut offs) have been tested.

SECTION 230810 - MECHANICAL SYSTEMS VERIFICATION REQUIREMENTS

VERIFICATION CHECKLIST – Packaged Rootop Units	
General Contractor:	Project:
Subcontractor:	
RTU No	Area Served:
Manufacturer:	Model No
Serial No	Motor H.P.
Warranty Start Date:	Duration:

Upon each stage of completion for the Pre-functional and Functional Performance tasks noted below, the completion date shall be noted, and initials of both the mechanical and general contractor shall authorize that the completion dates have been verified to be accurate.

PRE	-FUNCTIONAL INSPECTION	Completion Date	Mechanical Contractor	General Contractor
a.	Physical Installation			
b.	Mechanical Services			
C.	Electrical Services			
d.	Control Systems			
FUNCTIONAL PERFORMANCE		Completion Date	Mechanical Contractor	General Contractor
a.	Manufacturer's Start up			
b.	Capacity (CFM) design/actual			
C.	Control sequence verified			
d.	Run 24 Hour trend at 3 minutes intervals: OA Temp.: DA Temp.: Ch. Water Valve pos.; Mix Air Temp.; RA Temp. and Humidity; Supply CFM; Return CFM; OA CFM setpt.			
e.	For each AHU plot data in spreadsheet format for engineer's review			
f.	Test and Balance			
g.	Fire Alarm Interlock			
h.	Owners Acceptance/Training			GC's Initials:
				Owner's Initials:

Deviations from Design Specifications: Item:

Attached RFI/Correspondence:

By signature below, the design engineer and architect are consenting that the above inspections have been performed and completed, and equipment and related systems are operating in accordance with the documented design intent and Contract Documents.

Engineering Company:	Signature:	Date:
Architectural Firm:	Signature:	Date:

SECTION 230810 - MECHANICAL SYSTEMS VERIFICATION REQUIREMENTS

VERIFICATION CHECKLIST – Exhaust Fans	
General Contractor:	Project:
Subcontractor:	
Fan No	System / Area Served:
Manufacturer:	Model No
Serial No	CFM
Warranty Start Date:	Duration:

Upon each stage of completion for the Pre-functional and Functional Performance tasks noted below, the completion date shall be noted, and initials of both the mechanical and general contractor shall authorize that the completion dates have been verified to be accurate.

PRE-FUNCTIONAL INSPECTION		Completion Date	Mechanical Contractor	General Contractor	
a.	Physical Installation				
b.	Mechanical Services				
C.	Electrical Services				
d.	Control Systems				
FUN	CTIONAL PERFORMANCE		Completion Date	Mechanical Contractor	General Contractor
a.	Manufacturer's Start up				
b.	Capacity	(CFM)			
	design/actual				
C.	Control sequence verified				
d.	AHU interlock verified				
e.	Owner Acceptance/Training				Owner's Initials
					GC's Initials

Deviations from Design Specifications: Item:

Attached RFI/Correspondence:

By signature below, the design engineer and architect are consenting that the above inspections have been performed and completed, and equipment and related systems are operating in accordance with the documented design intent and Contract Documents.

Engineering Company:	Signature:	Date:
Architectural Firm:	Signature:	Date:

END OF SECTION

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes pipe and fitting materials, joining methods, special-duty valves, and specialties for the following:
 - 1. Condensate-drain piping

1.2 PERFORMANCE REQUIREMENTS

- A. Hydronic piping components and installation shall be capable of withstanding the following minimum working pressure and temperature:
 - 1. Condensate-Drain Piping: 120 deg F. Condensate piping shall be sloped at minimum of 1/8" per 1'-0" as required by plumbing code.

1.3 QUALITY ASSURANCE

- A. Installer Qualifications:
 - 1. Installers of Pressure-Sealed Joints: Installers shall be certified by the pressureseal joint manufacturer as having been trained and qualified to join piping with pressure-seal pipe couplings and fittings.
- B. ASME Compliance: Comply with ASME B31.9, "Building Services Piping," for materials, products, and installation.

PART 2 - PRODUCTS

2.1 COPPER TUBE AND FITTINGS

- A. Drawn-Temper Copper Tubing: ASTM B 88, Type L (ASTM B 88M, Type B).
- B. DWV Copper Tubing: ASTM B 306, Type DWV.
- C. Wrought-Copper Fittings: ASME B16.22.
 - 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. Anvil International, Inc.
 - b. S. P. Fittings; a division of Star Pipe Products.
 - c. Victaulic Company of America.
- D. Copper or Bronze Pressure-Seal Fittings:
 - 1. Available Manufacturers: Subject to compliance with requirements, a manufacturer offering products that may be incorporated into the Work include, but not limited to, Stadler-Viega.
 - 2. Housing: Copper.
 - 3. O-Rings and Pipe Stops: EPDM.
 - 4. Tools: Manufacturer's special tools.

5. Minimum 200-psig (1379-kPa) working-pressure rating at 250 deg F (121 deg C).

2.2 JOINING MATERIALS

- A. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.
 - 1. ASME B16.21, nonmetallic, flat, asbestos free, 1/8-inch (3.2-mm) maximum thickness unless thickness or specific material is indicated.
 - a. Full-Face Type: For flat-face, Class 125, cast-iron and cast-bronze flanges.
 - b. Narrow-Face Type: For raised-face, Class 250, cast-iron and steel flanges.
- B. Plastic, Pipe-Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer, unless otherwise indicated.
- C. Gasket Material: Thickness, material, and type suitable for fluid to be handled and working temperatures and pressures.

PART 3 - EXECUTION

3.1 PIPING APPLICATIONS

- A. Condensate piping installed indoors shall be Copper Type L, drawn-temper copper tubing, wrought-copper fittings, and pressure-sealed fittings.
- B. Condensate piping installed on the roof shall be Schedule 40 CPVC.

3.2 PIPING INSTALLATIONS

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicate piping locations and arrangements if such were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings. All offsets, fittings, valves, and accessories required by these specifications, but not specifically indicated or shown shall be furnished and installed as required for system installation.
- B. Install piping in concealed locations, unless otherwise indicated and except in equipment rooms and service areas.
- C. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- D. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- E. Install piping at indicated slopes.
- F. Install piping free of sags and bends.
- G. Install fittings for changes in direction and branch connections.
- H. Install piping to allow application of insulation.

- I. Select system components with pressure rating equal to or greater than system operating pressure.
- J. Reduce pipe sizes using eccentric reducer fitting installed with level side up.
- K. Install branch connections to mains using mechanically formed tees or tee fittings in main pipe, with the branch connected to the bottom of the main pipe. For up-feed risers, connect the branch to the top of the main pipe.
- L. Install valves according to manufacturer's installation instructions.
- M. Install unions in piping, NPS 2 and smaller at final connections of equipment, and elsewhere as indicated.
- N. Install escutcheons as where needed.

3.3 CUTTING, FITTING AND PATCHING

- A. Perform all cutting and drilling of masonry, steel, wood or iron work and all fitting necessary for the proper installation of all piping systems.
- B. No cutting or drilling of the structure, of any kind, shall be done without first obtaining permission from the Architect.
- C. All patching and finishing shall be the responsibility of the Contractor whose cutting or drilling makes such patching and finishing necessary. Patching and finishing shall be done by workman skilled in the trade affected (masonry, plastering, painting, etc.).

3.4 INTERIOR PIPING

- A. Install piping parallel to building walls and floors unless indicated otherwise. Arrange piping in groups as neatly as possible and at proper levels, spacing, etc., to avoid interference with other trades, such as electrical, plumbing, heating, ventilating, and structural.
- B. Assemble and install piping without undue stresses and strains. Make provisions for expansion, contraction, and structural settlement. Building structural members shall not be weakened or impaired by cutting or notching, unless adequate provision is made with the approval of the Architect for carrying the structural load.
- C. Furnish and maintain in a clean and protected condition all piping materials, including valves, fittings, and accessories. Clean the inside of all piping materials of dirt, dust, and other foreign material. Protect installed materials from damage and foreign objects with plugs, caps, or covers.
- D. Install traps in a place or position which is accessible for servicing.

3.5 HANGERS AND SUPPORTS

- A. Hanger, support, and anchor devices are specified in Division 23 Section "Hangers and Supports for HVAC Piping and Equipment." Comply with the following requirements for maximum spacing of supports.
- B. Install the following pipe attachments:

- 1. Adjustable steel clevis hangers for individual horizontal piping less than 20 feet (6 m) long.
- 2. Spring hangers to support vertical runs.
- 3. Provide copper-clad hangers and supports for hangers and supports in direct contact with copper pipe.
- C. Install hangers for steel piping with the following maximum spacing and minimum rod sizes:
 - 1. NPS 3/4 (DN 20): Maximum span, 7 feet (2.1 m); minimum rod size, 1/4 inch (6.4 mm).
- D. Install hangers for drawn-temper copper piping with the following maximum spacing and minimum rod sizes:
 - 1. NPS 3/4 (DN 20): Maximum span, 5 feet (1.5 m); minimum rod size, 1/4 inch (6.4 mm).

END OF SECTION

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes refrigerant piping used for air-conditioning applications. Design is delegated to equipment manufacturer.

1.2 PERFORMANCE REQUIREMENTS

- A. Line Test Pressure for R-410a
 - 1. Suction Lines for Air-Conditioning Applications: 300 psig.
 - 2. Suction Lines for Heat-Pump Applications: 535 psig.
 - 3. Hot-Gas and Liquid Lines: 535 psig.

1.3 SUBMITTALS

- A. Product Data including pipe material, type, and fittings.
- 1.4 PRODUCT STORAGE AND HANDLING
 - A. Store piping in a clean and protected area with end caps in place to ensure that piping interior and exterior are clean when installed.

PART 2 - PRODUCTS

- 2.1 COPPER TUBE AND FITTINGS
 - A. Copper Tube: ASTM B 88, Type K, Type L, or ASTM B280 Type ACR.
 - B. Wrought-Copper Fittings: ASME B16.22.
 - C. Wrought-Copper Unions: ASME B16.22.
 - D. Solder Filler Metals: ASTM B 32. Use 95-5 tin antimony or alloy HB solder to join copper socket fittings on copper pipe.
 - E. Brazing Filler Metals: AWS A5.8.
 - F. Flexible Connectors:
 - 1. Body: Tin-bronze bellows with woven, flexible, tinned-bronze-wire-reinforced protective jacket.
 - 2. End Connections: Socket ends.
 - 3. Offset Performance: Capable of minimum 3/4-inch misalignment in minimum 7-inch-long assembly.
 - 4. Pressure Rating: Factory test at minimum 500 psig.
 - 5. Maximum Operating Temperature: 250 deg F.

2.2 VALVES AND SPECIALTIES

A. Diaphragm Packless Valves:

- 1. Body and Bonnet: Forged brass or cast bronze; globe design with straight-through or angle pattern.
- 2. Diaphragm: Phosphor bronze and stainless steel with stainless-steel spring.
- 3. Operator: Rising stem and hand wheel.
- 4. Seat: Nylon.
- 5. End Connections: Socket, union, or flanged.
- 6. Working Pressure Rating: 500 psig
- 7. Maximum Operating Temperature: 275 deg F
- B. Check Valves:
 - 1. Body: Ductile iron, forged brass, or cast bronze; globe pattern.
 - 2. Bonnet: Bolted ductile iron, forged brass, or cast bronze; or brass hex plug.
 - 3. Piston: Removable polytetrafluoroethylene seat.
 - 4. Closing Spring: Stainless steel.
 - 5. Manual Opening Stem: Seal cap, plated-steel stem, and graphite seal.
 - 6. End Connections: Socket, union, threaded, or flanged.
 - 7. Maximum Opening Pressure: 0.50 psig.
 - 8. Working Pressure Rating: 500 psig.
 - 9. Maximum Operating Temperature: 275 deg F.
- C. Service Valves:
 - 1. Body: Forged brass with brass cap including key end to remove core.
 - 2. Core: Removable ball-type check valve with stainless-steel spring.
 - 3. Seat: Polytetrafluoroethylene.
 - 4. End Connections: Copper spring.
 - 5. Working Pressure Rating: 500 psig .
- D. Safety Relief Valves: Comply with ASME Boiler and Pressure Vessel Code; listed and labeled by an NRTL.
- E. Thermostatic Expansion Valves: Comply with ARI 750.
- F. Replaceable-Core Filter Dryers: Comply with ARI 730.
- G. Permanent Filter Dryers: Comply with ARI 730.
- H. Liquid Accumulators: Comply with ARI 495.

PART 3 - EXECUTION

3.1 PIPING APPLICATIONS

- A. Suction Lines NPS 1-1/2 for Conventional Air-Conditioning Applications: Copper, Type ACR, annealed-temper tubing and wrought-copper fittings with brazed joints.
- B. Hot-Gas and Liquid Lines and Suction Lines for Heat-Pump Applications: Copper, Type ACR or Type L, annealed-temper tubing and wrought-copper fittings with soldered joints.
- 3.2 VALVE AND SPECIALTY APPLICATIONS
 - A. Install diaphragm packless valves in suction and discharge lines of compressor.

- B. Install service valves for gage taps at strainers if they are not an integral part of strainers.
- C. Install a check valve at the compressor discharge and a liquid accumulator at the compressor suction connection.
- D. Except as otherwise indicated, install diaphragm packless valves on inlet and outlet side of filter dryers.
- E. Install a full-sized, three-valve bypass around filter dryers.
- F. Install solenoid valves upstream from each expansion valve. Install solenoid valves in horizontal lines with coil at top.
- G. Install thermostatic expansion valves as close as possible to distributors on evaporators.
 - 1. Install valve so diaphragm case is warmer than bulb.
 - 2. Secure bulb to clean, straight, horizontal section of suction line using two bulb straps. Do not mount bulb in a trap or at bottom of the line.
 - 3. If external equalizer lines are required, make connection where it will reflect suction-line pressure at bulb location.
- H. Install moisture/liquid indicators in liquid line at the inlet of the thermostatic expansion valve or at the inlet of the evaporator coil capillary tube.
- I. Install strainers upstream from and adjacent to the following unless they are furnished as an integral assembly for device being protected:
 - 1. Solenoid valves.
 - 2. Thermostatic expansion valves.
 - 3. Compressor.
- J. Install filter dryers in liquid line between compressor and thermostatic expansion valve, and in the suction line at the compressor.
- K. Install flexible connectors at compressors.

3.3 PIPING INSTALLATION

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems.
- B. Install refrigerant piping according to ASHRAE 15 and manufacturer recommendations.
- C. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.
- D. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- F. Install piping adjacent to machines to allow service and maintenance.

- G. Install piping free of sags and bends.
- H. Install fittings for changes in direction and branch connections.
- I. Select system components with pressure rating equal to or greater than system operating pressure.
- J. Install piping as short and direct as possible, with a minimum number of joints, elbows, and fittings.
- K. Arrange piping to allow inspection and service of refrigeration equipment. Install valves and specialties in accessible locations to allow for service and inspection. Install access doors or panels as specified in Division 08 Section "Access Doors and Frames" if valves or equipment requiring maintenance is concealed behind finished surfaces.
- L. Slope refrigerant piping as follows:
 - 1. Install horizontal hot-gas discharge piping with a uniform slope downward away from compressor.
 - 2. Install horizontal suction lines with a uniform slope downward to compressor.
 - 3. Install traps and double risers to entrain oil in vertical runs.
 - 4. Liquid lines may be installed level.
- M. When brazing or soldering, remove solenoid-valve coils and sight glasses; also remove valve stems, seats, and packing, and accessible internal parts of refrigerant specialties. Do not apply heat near expansion-valve bulb.
- N. Install pipe sleeves at penetrations in exterior walls and floor assemblies.
- O. Install piping with adequate clearance between pipe and adjacent walls and hangers or between pipes for insulation installation.
- P. Install sleeves through floors, walls, or ceilings, sized to permit installation of fullthickness insulation.
- Q. Seal pipe penetrations through exterior walls according to Division 07 Section "Joint Sealants" for materials and methods.
- R. Identify refrigerant piping and valves according to Division 23 Section "Identification for HVAC Piping and Equipment."

3.4 PIPE JOINT CONSTRUCTION

- A. Soldered Joints: Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook."
- B. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," Chapter "Pipe and Tube."

3.5 HANGERS AND SUPPORTS

- A. Install the following pipe attachments:
 - 1. Adjustable steel clevis hangers for individual horizontal runs less than 20 feet long.

- 2. Spring hangers to support vertical runs.
- 3. Copper-clad hangers and supports for hangers and supports in direct contact with copper pipe.
- B. Install hangers for copper tubing with the following maximum spacing and minimum rod sizes:
 - 1. NPS 1/2: Maximum span, 60 inches; minimum rod size, 1/4 inch.
 - 2. NPS 5/8: Maximum span, 60 inches; minimum rod size, 1/4 inch.
 - 3. NPS 1: Maximum span, 72 inches; minimum rod size, 1/4 inch.
 - 4. NPS 1-1/4: Maximum span, 96 inches; minimum rod size, 3/8 inch.
 - 5. NPS 1-1/2: Maximum span, 96 inches; minimum rod size, 3/8 inch.

3.6 FIELD QUALITY CONTROL

- A. Perform tests and inspections and prepare test reports.
- B. Tests and Inspections:
 - 1. Comply with ASME B31.5, Chapter VI.
 - 2. Test refrigerant piping and specialties. Isolate compressor, condenser, evaporator, and safety devices from test pressure if they are not rated above the test pressure.
 - 3. Test high- and low-pressure side piping of each system separately at not less than the pressures indicated in Part 1 "Performance Requirements" Article.
 - a. Fill system with nitrogen to the required test pressure.
 - b. System shall maintain test pressure at the manifold gage throughout duration of test.
 - c. Test joints and fittings with electronic leak detector or by brushing a small amount of soap and glycerin solution over joints.
 - d. Remake leaking joints using new materials, and retest until satisfactory results are achieved.

3.7 SYSTEM CHARGING

- A. Charge system using the following procedures:
 - 1. Install core in filter dryers after leak test but before evacuation.
 - 2. Evacuate entire refrigerant system with a vacuum pump to 500 micrometers. If vacuum holds for 12 hours, system is ready for charging.
 - 3. Break vacuum with refrigerant gas, allowing pressure to build up to 2 psig.
 - 4. Charge system with a new filter-dryer core in charging line.

3.8 ADJUSTING

- A. Adjust thermostatic expansion valve to obtain proper evaporator superheat.
- B. Adjust high- and low-pressure switch settings to avoid short cycling in response to fluctuating suction pressure.
- C. Adjust set-point temperature of air-conditioning or chilled-water controllers to the system design temperature.

- D. Perform the following adjustments before operating the refrigeration system, according to manufacturer's written instructions:
 - 1. Open shutoff valves in condenser water circuit.
 - 2. Verify that compressor oil level is correct.
 - 3. Open compressor suction and discharge valves.
 - 4. Open refrigerant valves except bypass valves that are used for other purposes.
 - 5. Check open compressor-motor alignment and verify lubrication for motors and bearings.
- E. Replace core of replaceable filter dryer after system has been adjusted and after design flow rates and pressures are established.

END OF SECTION

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Single-wall rectangular ducts and fittings.
 - 2. Sheet metal materials.
 - 3. Sealants and gaskets.
 - 4. Hangers and supports.

B. Related Sections:

1. Division 23 Section "Testing, Adjusting, and Balancing for HVAC" for testing, adjusting, and balancing requirements for metal ducts.

1.2 PERFORMANCE REQUIREMENTS

- A. Duct Design: Duct construction, including sheet metal thicknesses, seam and joint construction, reinforcements, and hangers and supports, shall comply with SMACNA's "HVAC Duct Construction Standards Metal and Flexible" and performance requirements and design criteria indicated in "Duct Schedule" Article.
- B. Structural Performance: Duct hangers and supports and seismic restraints shall withstand the effects of gravity and seismic loads and stresses within limits and under conditions described in SMACNA's "HVAC Duct Construction Standards Metal and Flexible" and International Building Code's seismic requirements.
- C. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1-2019. No insulation surfaces shall contact air stream.
- D. Carefully coordinate duct construction, color, painting, location, etc. with the Architectural drawings, Architect, and construction manager. Submit all ductwork features before fabrication, ordering, etc. in a shop drawing for Architect/Engineering approval.

1.3 SUBMITTALS

- A. Product Data: For each type of the following products:
 - 1. Adhesives.
 - 2. Sealants and gaskets.
- B. Shop Drawings:
 - 1. Factory- and shop-fabricated ducts and fittings.
 - 2. Fittings.
 - 3. Reinforcement and spacing.
 - 4. Seam and joint construction.
 - 5. Hangers and supports, including methods for duct and building attachment and vibration isolation.
- C. Coordination Drawings: Contractor shall provide plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

- 1. Duct installation in congested spaces, indicating coordination with general construction, building components, and other building services. Indicate proposed changes to duct layout.
- 2. Suspended ceiling components.
- 3. Structural members to which duct will be attached.
- 4. Size and location of initial access modules for acoustical tile.
- 5. Penetrations of fire-rated construction.
- 6. Items penetrating finished ceiling including the following:
 - a. Lighting fixtures.
 - b. Air outlets and inlets.
 - c. Speakers.
 - d. Sprinklers.
 - e. Access panels.
- D. Field quality-control reports.

1.4 QUALITY ASSURANCE

- A. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1-2019, Section 5 "Systems and Equipment" and Section 7 "Construction and System Start-Up."
- B. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1-2019, Section 6.4.4 "HVAC System Construction and Insulation."
- C. <u>FUNCTIONAL CRITERIA:</u> Construct rectangular ductwork to meet all functional criteria defined in Section VII, of the SMACNA "HVAC Duct Construction Standards, Metal and Flexible" <u>1995 First Edition.</u> All ductwork must comply with local, state and federal code requirements.

PART 2 - PRODUCTS

- 2.1 SINGLE-WALL RECTANGULAR DUCTS AND FITTINGS
 - A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" based on indicated static-pressure class unless otherwise indicated.
 - B. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 1-4, "Transverse (Girth) Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
 - C. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards Metal and Flexible," Figure 1-5, "Longitudinal Seams Rectangular Ducts," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards Metal and Flexible."
 - D. Elbows, Transitions, Offsets, Branch Connections, and Other Duct Construction: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards Metal and Flexible," Chapter 2, "Fittings and Other Construction," for static-pressure class,

applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

2.2 SHEET METAL MATERIALS

- A. General Material Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.
- B. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.
 - 1. Galvanized Coating Designation: G90 (Z275).
 - 2. Finishes for Surfaces Exposed to View: Mill phosphatized.

2.3 SEALANT AND GASKETS

- A. General Sealant and Gasket Requirements: Surface-burning characteristics for sealants and gaskets shall be a maximum flame-spread index of 25 and a maximum smoke-developed index of 50 when tested according to UL 723; certified by an NRTL.
- B. Two-Part Tape Sealing System:
 - 1. Tape: Woven cotton fiber impregnated with mineral gypsum and modified acrylic/silicone activator to react exothermically with tape to form hard, durable, airtight seal.
 - 2. Tape Width: 3 inches (76 mm); 4 inches (102 mm); and 6 inches (152 mm)dependant on duct size.
 - 3. Sealant: Modified styrene acrylic.
 - 4. Water resistant.
 - 5. Mold and mildew resistant.
 - 6. Maximum Static-Pressure Class: 10-inch wg (2500 Pa), positive and negative.
 - 7. Service: Indoor and outdoor.
 - 8. Service Temperature: Minus 40 to plus 200 deg F (Minus 40 to plus 93 deg C).
 - 9. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum.
 - 10. For indoor applications, use sealant that has a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- C. Water-Based Joint and Seam Sealant:
 - 1. Application Method: Brush on.
 - 2. Solids Content: Minimum 65 percent.
 - 3. Shore A Hardness: Minimum 20.
 - 4. Water resistant.
 - 5. Mold and mildew resistant.
 - 6. VOC: Maximum 75 g/L (less water).
 - 7. Maximum Static-Pressure Class: 10-inch wg (2500 Pa), positive and negative.
 - 8. Service: Indoor or outdoor.
 - 9. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum sheets.
- D. Solvent-Based Joint and Seam Sealant:

- 1. Application Method: Brush on.
- 2. Base: Synthetic rubber resin.
- 3. Solvent: Toluene and heptane.
- 4. Solids Content: Minimum 60 percent.
- 5. Shore A Hardness: Minimum 60.
- 6. Water resistant.
- 7. Mold and mildew resistant.
- 8. For indoor applications, use sealant that has a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- 9. VOC: Maximum 395 g/L.
- 10. Maximum Static-Pressure Class: 10-inch wg (2500 Pa), positive or negative.
- 11. Service: Indoor or outdoor.
- 12. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum sheets.
- E. Flanged Joint Sealant: Comply with ASTM C 920.
 - 1. General: Single-component, acid-curing, silicone, elastomeric.
 - 2. Type: S.
 - 3. Grade: NS.
 - 4. Class: 25.
 - 5. Use: O.
 - 6. For indoor applications, use sealant that has a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- F. Flange Gaskets: Butyl rubber, neoprene, or EPDM polymer with polyisobutylene plasticizer.

2.4 HANGERS AND SUPPORTS

- A. Hanger Rods for Noncorrosive Environments: Cadmium-plated steel rods and nuts.
- B. Strap and Rod Sizes: Comply with SMACNA's "HVAC Duct Construction Standards -Metal and Flexible," Table 4-1 (Table 4-1M), "Rectangular Duct Hangers Minimum Size," and Table 4-2, "Minimum Hanger Sizes for Round Duct."
- C. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.
- D. Trapeze and Riser Supports:
 - 1. Supports for Galvanized-Steel Ducts: Galvanized-steel shapes and plates.
 - 2. Supports for Stainless-Steel Ducts: Stainless-steel shapes and plates.
 - 3. Supports for Aluminum Ducts: Aluminum or galvanized steel coated with zinc chromate.

PART 3 - EXECUTION

3.1 DUCT INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of duct system. Indicated duct locations, configurations, and arrangements were used to size ducts and calculate friction loss for air-handling equipment sizing and for other

design considerations. Install duct systems as indicated unless deviations to layout are approved on Shop Drawings and Coordination Drawings.

- B. Install ducts according to SMACNA's "HVAC Duct Construction Standards Metal and Flexible" unless otherwise indicated.
- C. Install ducts with fewest possible joints.
- D. Install factory- or shop-fabricated fittings for changes in direction, size, and shape and for branch connections.
- E. Unless otherwise indicated, install ducts vertically and horizontally, and parallel and perpendicular to building lines.
- F. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.
- G. Install ducts with a clearance of 6" (150 mm), plus allowance for insulation thickness.
- H. Route ducts to avoid passing through transformer vaults and electrical equipment rooms and enclosures.
- I. Where ducts pass through non-fire-rated interior partitions and exterior walls and are exposed to view, cover the opening between the partition and duct or duct insulation with sheet metal flanges of same metal thickness as the duct. Overlap openings on four sides by at least 1-1/2 inches (38 mm).
- J. Where ducts pass through fire-rated interior partitions and exterior walls, fire dampers. Comply with requirements in Division 23 Section "Air Duct Accessories" for fire and smoke dampers.
- K. Protect duct interiors from moisture, construction debris and dust, and other foreign materials. Generally comply with SMACNA's "Duct Cleanliness for New Construction Guidelines."
- L. Flexible connections shall be provided at all connections between ducts and equipment such as fans or air handling units.
- M. Provide access doors at all fire damper locations and such other locations as required to allow servicing or inspection of equipment or accessories.
- N. All offsets, fittings, and accessories required by the Contract Documents but not specifically indicated shall be furnished and installed in strict accordance with the Specifications.

3.2 DUCT SEALING

A. Seal ducts for duct static-pressure, seal classes, and leakage classes specified in "Duct Schedule" Article according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

3.3 HANGER AND SUPPORT INSTALLATION

- A. Comply with SMACNA's "HVAC Duct Construction Standards Metal and Flexible," Chapter 4, "Hangers and Supports."
- B. Building Attachments: Concrete inserts, powder-actuated fasteners, or structural-steel fasteners appropriate for construction materials to which hangers are being attached.
 - 1. Where practical, install concrete inserts before placing concrete.
 - 2. Install powder-actuated concrete fasteners after concrete is placed and completely cured.
 - 3. Use powder-actuated concrete fasteners for standard-weight aggregate concretes or for slabs more than 4 inches (100 mm) thick.
 - 4. Do not use powder-actuated concrete fasteners for lightweight-aggregate concretes or for slabs less than 4 inches (100 mm) thick.
 - 5. Do not use powder-actuated concrete fasteners for seismic restraints.
- C. Hanger Spacing: Comply with SMACNA's "HVAC Duct Construction Standards Metal and Flexible," Table 4-1 (Table 4-1M), "Rectangular Duct Hangers Minimum Size," and Table 4-2, "Minimum Hanger Sizes for Round Duct," for maximum hanger spacing; install hangers and supports within 24 inches (610 mm) of each elbow and within 48 inches (1200 mm) of each branch intersection. In addition, locate hangers as follows:
- D. Hangers Exposed to View: Threaded rod and angle or channel supports. The use of cable hangers is prohibited. Conceal hangers: The use of cable hangers is prohibited.
- E. Support vertical ducts with steel angles or channel secured to the sides of the duct with welds, bolts, sheet metal screws, or blind rivets; support at each floor and at a maximum intervals of 16 feet (5 m).
- F. Install upper attachments to structures. Select and size upper attachments with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

3.4 CONNECTIONS

- A. Make connections to equipment with flexible connectors.
- B. Comply with SMACNA's "HVAC Duct Construction Standards Metal and Flexible" for branch, outlet and inlet, and terminal unit connections.
- C. Refer to Division 23 Section "Flexible Ducts" to for performance requirements of flexible ducts.

3.5 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. Leakage Tests:
 - 1. Comply with SMACNA's "HVAC Air Duct Leakage Test Manual." Submit a test report for each test.
 - 2. Disassemble, reassemble, and seal segments of systems to accommodate leakage testing and for compliance with test requirements.

- 3. Test for leaks before applying external insulation.
- 4. Conduct tests at static pressures equal to maximum design pressure of system or section being tested. If static-pressure classes are not indicated, test system at maximum system design pressure. Do not pressurize systems above maximum design operating pressure.
- C. Duct System Cleanliness:
 - 1. Visually inspect duct system to ensure that no visible contaminants are present.
 - 2. Clean duct system(s) before testing, adjusting, and balancing.

3.6 START UP

- A. Air Balance: Comply with requirements in Division 23 Section "Testing, Adjusting, and Balancing for HVAC."
- 3.7 DUCT SCHEDULE
 - A. Fabricate ducts with galvanized sheet steel except as otherwise indicated and as follows:
 - B. Supply Ducts:
 - 1. Ducts Connected to Rooftop Units:
 - a. Pressure Class: Positive 2-inch wg.
 - C. Return Ducts:
 - 1. Ducts Connected to Rooftop Units:
 - a. Pressure Class: Negative 3-inch wg.
 - D. Exhaust Ducts:
 - 1. Ducts Connected to Fans Exhausting Air:
 - a. Pressure Class: Negative 3-inch wg.
 - E. Elbow Configuration:
 - 1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards Metal and Flexible," Figure 2-2, "Rectangular Elbows."
 - a. Radius Type RE 1 with minimum 1.5 radius-to-diameter ratio.
 - b. Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-3, "Vanes and Vane Runners," and Figure 2-4, "Vane Support in Elbows."
 - 2. Round Duct: Comply with SMACNA's "HVAC Duct Construction Standards Metal and Flexible," Figure 3-3, "Round Duct Elbows."
 - a. Minimum Radius-to-Diameter Ratio and Elbow Segments: Comply with SMACNA's "HVAC Duct Construction Standards Metal and Flexible,"

Table 3-1, "Mitered Elbows." Elbows with less than 90-degree change of direction have proportionately fewer segments.

- 1) Radius-to Diameter Ratio: 1.5.
- b. Round Elbows, 12 Inches and Smaller in Diameter: Stamped or pleated.
- c. Round Elbows, 14 Inches and Larger in Diameter: Standing seam or Welded.
- F. Branch Configuration:
 - 1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards Metal and Flexible," Figure 2-6, "Branch Connections."
 - a. Rectangular Main from RTU to Rectangular Main: take-offs from main trunk of packaged equipment on roof shall be standard Bellmouth fittings as shown in SMACNA Figure 2-7 "Offsets and Transitions."
 - b. Rectangular Main to Rectangular Branch: 45-degree entry.
 - c. Rectangular Main to Round Branch: Spin in with damper.
 - 2. Round and Flat Oval: Comply with SMACNA's "HVAC Duct Construction Standards Metal and Flexible," Figure 3-4, "90 Degree Tees and Laterals," and Figure 3-5, "Conical Tees."
 - a. Velocity 1000 to 1500 fpm (5 to 7.6 m/s): Conical tap.
 - b. Velocity 1500 fpm (7.6 m/s) or Higher: 45-degree lateral.

END OF SECTION

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Backdraft and pressure relief dampers.
 - 2. Manual volume dampers.
 - 3. Flange connectors.
 - 4. Turning vanes.
 - 5. Duct-mounted access doors.
 - 6. Flexible connectors.
 - 7. Flexible ducts.
 - 8. Duct accessory hardware.

1.2 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: For duct accessories. Include plans, elevations, sections, details and attachments to other work.
 - 1. Detail duct accessories fabrication and installation in ducts and other construction. Include dimensions, weights, loads, and required clearances; and method of field assembly into duct systems and other construction. Include the following:
 - a. Special fittings.
 - b. Manual volume damper installations.
 - c. Control damper installations.
 - d. Wiring Diagrams: For power, signal, and control wiring.
- C. Operation and maintenance data.

1.3 QUALITY ASSURANCE

A. Comply with NFPA 90A, "Installation of Air Conditioning and Ventilating Systems," and with NFPA 90B, "Installation of Warm Air Heating and Air Conditioning Systems."

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Comply with SMACNA's "HVAC Duct Construction Standards Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.
- B. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.
 - 1. Galvanized Coating Designation: G90 (Z275).
 - 2. Exposed-Surface Finish: Mill phosphatized.

C. Reinforcement Shapes and Plates: Galvanized-steel reinforcement where installed on galvanized sheet metal ducts; compatible materials for aluminum and stainless-steel ducts.

2.2 BACKDRAFT AND PRESSURE RELIEF DAMPERS

- 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. Air Balance Inc.; a division of Mestek, Inc.
 - 2. American Warming and Ventilating; a division of Mestek, Inc.
 - 3. Cesco Products; a division of Mestek, Inc.
 - 4. Duro Dyne Inc.
 - 5. Greenheck Fan Corporation.
 - 6. Lloyd Industries, Inc.
 - 7. Nailor Industries Inc.
 - 8. NCA Manufacturing, Inc.
 - 9. Pottorff; a division of PCI Industries, Inc.
 - 10. Ruskin Company.
 - 11. SEMCO Incorporated.
 - 12. Vent Products Company, Inc.
- B. Description: Gravity balanced.
- C. Maximum Air Velocity: 2000 fpm.
- D. Maximum System Pressure: 1-inch wg.
- E. Frame: 0.052-inch-thick, galvanized sheet steel 0.063-inch-thick extruded aluminum or 0.052-inch- thick stainless steel, with welded corners and mounting flange.
- F. Blades: Multiple single-piece blades, center-pivoted, maximum 6-inch width, 0.025-inch-thick, roll-formed aluminum or 0.050-inch-thick aluminum sheet with sealed edges.
- G. Blade Action: Parallel.
- H. Blade Seals: Felt, Vinyl foam, Extruded vinyl, mechanically locked or Neoprene, mechanically locked.
- I. Blade Axles:
 - 1. Material: Nonferrous metal, Galvanized steel, Plated steel, Stainless steel, Nonmetallic or Aluminum.
 - 2. Diameter: 0.20 inch.
- J. Tie Bars and Brackets: Aluminum or Galvanized steel.
- K. Return Spring: Adjustable tension.
- L. Bearings: Steel ball or synthetic pivot bushings.
- M. Accessories:

- 1. Adjustment device to permit setting for varying differential static pressure.
- 2. Counterweights and spring-assist kits for vertical airflow installations.
- 3. Screen Mounting: Rear mounted.
- 4. Screen Material: Galvanized steel or Aluminum.
- 5. Screen Type: Bird.
- 6. 90-degree stops.

2.3 MANUAL VOLUME DAMPERS

- A. Standard, Steel, Manual Volume Dampers:
 - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Air Balance Inc.; a division of Mestek, Inc.
 - b. American Warming and Ventilating; a division of Mestek, Inc.
 - c. Flexmaster U.S.A., Inc.
 - d. McGill AirFlow LLC.
 - e. METALAIRE, Inc.
 - f. Nailor Industries Inc.
 - g. Pottorff; a division of PCI Industries, Inc.
 - h. Ruskin Company.
 - i. Trox USA Inc.
 - j. Vent Products Company, Inc.
 - 2. Standard leakage rating, with linkage outside airstream.
 - 3. Suitable for horizontal or vertical applications.
 - 4. Frames:
 - a. Hat-shaped, galvanized or stainless-steel channels, 0.064-inch minimum thickness.
 - b. Mitered and welded corners.
 - c. Flanges for attaching to walls and flangeless frames for installing in ducts.
 - 5. Blades:
 - a. Multiple or single blade.
 - b. Parallel- or opposed-blade design.
 - c. Stiffen damper blades for stability.
 - d. Galvanized Stainless-steel, 0.064 inch thick.
 - 6. Blade Axles: Galvanized steel, Stainless steel or Nonferrous metal.
 - 7. Bearings:
 - a. Oil-impregnated bronze, Molded synthetic or Stainless-steel sleeve.
 - b. Dampers in ducts with pressure classes of 3-inch wg or less shall have axles full length of damper blades and bearings at both ends of operating shaft.
 - 8. Tie Bars and Brackets: Galvanized steel.

- B. Jackshaft:
 - 1. Size: 1-inch diameter.
 - 2. Material: Galvanized-steel pipe rotating within pipe-bearing assembly mounted on supports at each mullion and at each end of multiple-damper assemblies.
 - 3. Length and Number of Mountings: As required to connect linkage of each damper in multiple-damper assembly.
- C. Damper Hardware:
 - 1. Zinc-plated, die-cast core with dial and handle made of 3/32-inch-thick zinc-plated steel, and a 3/4-inch hexagon locking nut.
 - 2. Include center hole to suit damper operating-rod size.
 - 3. Include elevated platform for insulated duct mounting.

2.4 FLANGE CONNECTORS

- 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. Ductmate Industries, Inc.
 - 2. Nexus PDQ; Division of Shilco Holdings Inc.
 - 3. Ward Industries, Inc.; a division of Hart & Cooley, Inc.
- B. Description: Add-on or roll-formed, factory-fabricated, slide-on transverse flange connectors, gaskets, and components.
- C. Material: Galvanized steel.
- D. Gage and Shape: Match connecting ductwork.

2.5 TURNING VANES

- 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. Ductmate Industries, Inc.
 - 2. Duro Dyne Inc.
 - 3. METALAIRE, Inc.
 - 4. SEMCO Incorporated.
 - 5. Ward Industries, Inc.; a division of Hart & Cooley, Inc.
- B. Manufactured Turning Vanes for Metal Ducts: Curved blades of galvanized sheet steel; support with bars perpendicular to blades set; set into vane runners suitable for duct mounting.
- C. General Requirements: Comply with SMACNA's "HVAC Duct Construction Standards -Metal and Flexible"; Figures 2-3, "Vanes and Vane Runners," and 2-4, "Vane Support in Elbows."
- D. Vane Construction: Single wall for ducts up to 48 inches wide and double wall for larger dimensions.

2.6 DUCT-MOUNTED ACCESS DOORS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. American Warming and Ventilating; a division of Mestek, Inc.
 - 2. Cesco Products; a division of Mestek, Inc.
 - 3. Ductmate Industries, Inc.
 - 4. Flexmaster U.S.A., Inc.
 - 5. Greenheck Fan Corporation.
 - 6. McGill AirFlow LLC.
 - 7. Nailor Industries Inc.
 - 8. Pottorff; a division of PCI Industries, Inc.
 - 9. Ventfabrics, Inc.
 - 10. Ward Industries, Inc.; a division of Hart & Cooley, Inc.
- B. Duct-Mounted Access Doors: Fabricate access panels according to SMACNA's "HVAC Duct Construction Standards Metal and Flexible"; Figures 2-10, "Duct Access Doors and Panels," and 2-11, "Access Panels Round Duct."
 - 1. Door:
 - a. Double wall, rectangular.
 - b. Galvanized sheet metal with insulation fill and thickness as indicated for duct pressure class.
 - c. Hinges and Latches: 1-by-1-inch butt or piano hinge and cam latches.
 - d. Fabricate doors airtight and suitable for duct pressure class.
 - 2. Frame: Galvanized sheet steel, with bend-over tabs and foam gaskets.
 - 3. Number of Hinges and Locks:
 - a. Access Doors Less Than 12 Inches Square: No hinges and two sash locks.
 - b. Access Doors up to 18 Inches Square: Two hinges and two sash locks.
 - c. Access Doors up to 24 by 48 Inches: Three hinges and two compression latches with outside and inside handles.
 - d. Access Doors Larger Than 24 by 48 Inches: Four hinges and two compression latches with outside and inside handles.

2.7 FLEXIBLE CONNECTORS

- 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. Ductmate Industries, Inc.
 - 2. Duro Dyne Inc.
 - 3. Ventfabrics, Inc.
 - 4. Ward Industries, Inc.; a division of Hart & Cooley, Inc.
- B. Materials: Flame-retardant or noncombustible fabrics.
- C. Coatings and Adhesives: Comply with UL 181, Class 1.

- D. Metal-Edged Connectors: Factory fabricated with a fabric strip 3-1/2 inches wide attached to 2 strips of 2-3/4-inch-wide, 0.028-inch-thick, galvanized sheet steel or 0.032-inch-thick aluminum sheets. Provide metal compatible with connected ducts.
- E. Indoor System, Flexible Connector Fabric: Glass fabric double coated with neoprene.
 - 1. Minimum Weight: 26 oz./sq. yd..
 - 2. Tensile Strength: 480 lbf/inch in the warp and 360 lbf/inch in the filling.
 - 3. Service Temperature: Minus 40 to plus 200 deg F.

2.8 FLEXIBLE DUCTS

- A. Refer to Division 23 Section "Flexible Ducts" to for performance requirements of flexible ducts.
- 2.9 DUCT ACCESSORY HARDWARE
 - A. Instrument Test Holes: Cast iron or cast aluminum to suit duct material, including screw cap and gasket. Size to allow insertion of pitot tube and other testing instruments and of length to suit duct-insulation thickness.
 - B. Adhesives: High strength, quick setting, neoprene based, waterproof, and resistant to gasoline and grease.

PART 3 - EXECUTION

- 3.1 INSTALLATION
 - A. Install duct accessories according to applicable details in SMACNA's "HVAC Duct Construction Standards Metal and Flexible" for metal ducts and in NAIMA AH116, "Fibrous Glass Duct Construction Standards," for fibrous-glass ducts.
 - B. Install duct accessories of materials suited to duct materials; use galvanized-steel accessories in galvanized-steel and fibrous-glass ducts, stainless-steel accessories in stainless-steel ducts, and aluminum accessories in aluminum ducts.
 - C. Install backdraft dampers at inlet of exhaust fans or exhaust ducts as close as possible to exhaust fan unless otherwise indicated.
 - D. Install volume dampers at points on supply, return, and exhaust systems where branches extend from larger ducts.
 - E. Set dampers to fully open position before testing, adjusting, and balancing.
 - F. Install test holes at fan inlets and outlets and elsewhere as indicated.
 - G. Install duct access doors on sides of ducts to allow for inspecting, adjusting, and maintaining accessories and equipment at the following locations:
 - 1. Downstream from manual volume dampers, control dampers, backdraft dampers, and equipment.
 - 2. Upstream from turning vanes.
 - 3. Control devices requiring inspection.
 - 4. Elsewhere as indicated.

- H. Install access doors with swing against duct static pressure.
- I. Access Door Sizes:
 - 1. One-Hand or Inspection Access: 8 by 5 inches.
 - 2. Two-Hand Access: 12 by 6 inches.
 - 3. Head and Hand Access: 18 by 10 inches.
 - 4. Head and Shoulders Access: 21 by 14 inches.
- J. Label access doors according to Division 23 Section "Identification for HVAC Piping and Equipment" to indicate the purpose of access door.
- K. Install flexible connectors to connect ducts to equipment.
- L. Connect diffusers to ducts with maximum 60-inch lengths of flexible duct clamped or strapped in place.
- M. Connect flexible ducts to metal ducts with draw bands.
- N. Install duct test holes where required for testing and balancing purposes.
- O. Install thrust limits at centerline of thrust, symmetrical on both sides of equipment. Attach thrust limits at centerline of thrust and adjust to a maximum of 1/4-inch (6-mm) movement during start and stop of fans.
- P. Install turning vanes in supply duct only.

3.2 FIELD QUALITY CONTROL

- A. Tests and Inspections:
 - 1. Operate dampers to verify full range of movement.
 - 2. Inspect locations of access doors and verify that purpose of access door can be performed.
 - 3. Inspect turning vanes for proper and secure installation.

END OF SECTION
PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Non-insulated flexible ducts.
 - 2. Insulated flexible ducts.

1.2 SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: For flexible ducts.
 - 1. Include plans showing locations and mounting and attachment details.

1.3 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: As referenced in Division 23 Section "Metal Ducts" for coordination drawing requirements.

PART 2 - PRODUCTS

2.1 ASSEMBLY DESCRIPTION

- A. Comply with NFPA 90A, "Installation of Air Conditioning and Ventilating Systems," and with NFPA 90B, "Installation of Warm Air Heating and Air Conditioning Systems."
- B. Comply with SMACNA's "HVAC Duct Construction Standards Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.
- C. Comply with the Air Diffusion Council's "ADC Flexible Air Duct Test Code FD 72-R1."
- D. Comply with ASTM E 96/E 96M, "Test Methods for Water Vapor Transmission of Materials."

2.2 NON-INSULATED FLEXIBLE DUCTS

- A. Basis of Design Manufacturer: Thermaflex or approved equal.
- B. Non-Insulated, Flexible Duct: UL 181, Class 1, two-ply vinyl film supported by helically wound, spring-steel wire.
 - 1. Pressure Rating: 4-inch wg positive and 2.0-inch wg negative.
 - 2. Maximum Air Velocity: 4000 fpm.

2.3 INSULATED FLEXIBLE DUCTS

A. Basis of Design Manufacturer: Thermaflex or approved equal.

- B. Insulated, Flexible Duct: UL 181, Class 1, two-ply vinyl film supported by helically wound, spring-steel wire; fibrous-glass insulation; polyethylenevapor-barrier film.
 - 1. Pressure Rating: 4-inch wg positive and 2-inch wg negative.
 - 2. Maximum Air Velocity: 4000 fpm.
 - 3. Insulation R-Value: 4.2

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install flexible ducts according to applicable details in SMACNA's "HVAC Duct Construction Standards Metal and Flexible" for metal ducts and in NAIMA AH116, "Fibrous Glass Duct Construction Standards," for fibrous-glass ducts.
- B. Install in indoor applications only. Insulated flexible duct shall be utilized for supply air ductwork, non-insulated shall be utilized for return/exhaust ductwork.
- C. Connect diffusers and registers to ducts with maximum 60-inch lengths of flexible duct clamped or strapped in place.
- D. Connect flexible ducts to metal ducts with draw bands.
- E. Install duct test holes where required for testing and balancing purposes.
- F. Installation:
 - 1. Install ducts fully extended.
 - 2. Do not bend ducts across sharp corners.
 - 3. Bends of flexible ducting shall not exceed a minimum of one duct diameter.
 - 4. Avoid contact with metal fixtures, water lines, pipes, or conduits.
 - 5. Install flexible ducts in a direct line, without sags, twists, or turns.
- G. Supporting Flexible Ducts:
 - 1. Suspend flexible ducts with bands 1-1/2 inches wide or wider and spaced a maximum of 48 inches apart. Maximum centerline sag between supports shall not exceed 1/2 inch per 12 inches.
 - 2. Install extra supports at bends placed approximately one duct diameter from center line of the bend.
 - 3. Ducts may rest on ceiling joists or truss supports. Spacing between supports shall not exceed the maximum spacing per manufacturer's written installation instructions.
 - 4. Vertically installed ducts shall be stabilized by support straps at a maximum of 72 inches o.c.

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
 - 1. Backward-inclined centrifugal fans.

1.2 SUBMITTALS

- A. Product Data: Include rated capacities, furnished specialties, and accessories for each type of product indicated.
- B. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
- C. Field quality-control test reports.
- D. Operation and maintenance data.

1.3 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- B. AMCA Compliance: Products shall comply with performance requirements and shall be licensed to use the AMCA-Certified Ratings Seal.
- C. NEMA Compliance: Motors and electrical accessories shall comply with NEMA 1.

PART 2 - PRODUCTS

- 2.1 BACKWARD-INCLINED CENTRIFUGAL FANS
 - A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - C. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:
 - 1. ABB Fan Group North America.
 - 2. Acme Engineering & Mfg. Corp.
 - 3. Aerovent; a Twin City Fan Company.
 - 4. Airmaster Fan Co.
 - 5. Ammerman; General Resource Corp.
 - 6. Bayley Fans; a division of Lau Industries, Inc.
 - 7. Captive Aire
 - 8. Chicago Fan Company

- 9. Greenheck Corporation
- D. Description: Factory-fabricated, -assembled, -tested, and -finished, direct drive centrifugal fans consisting of housing, wheel, fan shaft, bearings, motor and disconnect switch, drive assembly, and support structure.
- E. Housings: Formed panels to make curved-scroll housings with shaped cutoff; with doors or panels to allow access to internal parts and components.
 - 1. Panel Bracing: Steel angle- or channel-iron member supports for mounting and supporting fan scroll, wheel, motor, and accessories.
 - 2. Spun inlet cone with flange.
 - 3. Outlet flange.
- F. Backward-Inclined Wheels: Single-width-single-inlet construction with curved inlet flange, backplate, backward-inclined blades welded or riveted to flange and backplate; cast-iron or cast-steel hub riveted to backplate and fastened to shaft with set screws.
- G. Shafts: Statically and dynamically balanced and selected for continuous operation at maximum rated fan speed and motor horsepower, with final alignment and belt adjustment made after installation.
 - 1. Turned, ground, and polished hot-rolled steel with keyway. Ship with a protective coating of lubricating oil.
 - 2. Designed to operate at no more than 70 percent of first critical speed at top of fan's speed range.
- H. Prelubricated and Sealed Shaft Bearings: Self-aligning, pillow-block-type ball bearings.
 - 1. Ball-Bearing Rating Life: ABMA 9, LI0 at 50,000 hours.
 - 2. Roller-Bearing Rating Life: ABMA 11, LI0 at 50,000 hours.

2.2 SOURCE QUALITY CONTROL

- A. Sound-Power Level Ratings: Comply with AMCA 301, "Methods for Calculating Fan Sound Ratings from Laboratory Test Data." Factory test fans according to AMCA 300, "Reverberant Room Method for Sound Testing of Fans." Label fans with the AMCA-Certified Ratings Seal.
- B. Fan Performance Ratings: Establish flow rate, pressure, power, air density, speed of rotation, and efficiency by factory tests and ratings according to AMCA 210, "Laboratory Methods of Testing Fans for Rating."

PART 3 - EXECUTION

- 3.1 INSTALLATION
 - A. Install centrifugal fans level and plumb.
 - B. Install units with clearances for service and maintenance.
 - C. Label fans according to requirements specified in Division 23 Section "Identification for HVAC Piping and Equipment."

3.2 CONNECTIONS

- A. Duct installation and connection requirements are specified in other Division 23 Sections. Drawings indicate general arrangement of ducts and duct accessories. Make final duct connections with flexible connectors. Flexible connectors are specified in Division 23 Section "Air Duct Accessories."
- B. Install ducts adjacent to fans to allow service and maintenance.
- C. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."
- D. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."
- E. Label units according to requirements specified in Division 23 Section "Identification for HVAC Piping and Equipment."

3.3 FIELD QUALITY CONTROL

- A. Perform the following field tests and inspections and prepare test reports:
 - 1. Verify that shipping, blocking, and bracing are removed.
 - 2. Verify that unit is secure on mountings and supporting devices and that connections to ducts and electrical components are complete. Verify that proper thermal-overload protection is installed in motors, starters, and disconnect switches.
 - 3. Verify that cleaning and adjusting are complete.
 - 4. Disconnect fan drive from motor, verify proper motor rotation direction, and verify fan wheel free rotation and smooth bearing operation.
 - 5. Verify lubrication for bearings and other moving parts.
 - 6. Verify that manual volume control in connected ductwork systems are in fully open position.
 - 7. Refer to Division 23 Section "Testing, Adjusting, and Balancing for HVAC" for testing, adjusting, and balancing procedures.
 - 8. Remove and replace malfunctioning units and retest as specified above.
- B. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

PART 1 - GENERAL

- 1.1 SUMMARY
 - A. Section Includes:
 - 1. Rectangular and square ceiling diffusers.
 - 2. Louver face diffusers.
 - 3. Fixed face grilles.
 - B. Related Sections:
 - 1. Division 23 Section "Air Duct Accessories" for volume-control dampers not integral to diffusers, registers, and grilles.

1.2 SUBMITTALS

- A. Product Data: For each type of product indicated, include the following:
 - 1. Data Sheet: Indicate materials of construction, finish, and mounting details; and performance data including throw and drop, static-pressure drop, and noise ratings.
 - 2. Diffuser, Register, and Grille Schedule: Indicate drawing designation, room location, quantity, model number, size, and accessories furnished.

PART 2 - PRODUCTS

- 2.1 CEILING DIFFUSERS
 - A. Rectangular and Square Ceiling Diffusers
 - 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:
 - 2. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
 - a. A-J Manufacturing Co., Inc.
 - b. Anemostat Products; a Mestek company.
 - c. Carnes.
 - d. Hart & Cooley Inc.
 - e. Krueger.
 - f. METALAIRE, Inc.
 - g. Nailor Industries Inc.
 - h. Price Industries.
 - i. Titus.
 - j. Tuttle & Bailey.
 - 3. Devices shall be specifically designed for variable-air-volume flows.
 - 4. Material: Steel.
 - 5. Finish: Baked enamel, color selected by Architect.
 - 6. Face Size: As scheduled.
 - 7. Face Style: Plaque.

- 8. Mounting: As scheduled. All diffusers mounted in a hard ceiling shall be provided with appropriate frame.
- 9. Pattern: Fixed.
- B. Louver Face Diffuser
 - 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:
 - 2. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
 - a. A-J Manufacturing Co., Inc.
 - b. Anemostat Products; a Mestek company.
 - c. Carnes.
 - d. METALAIRE, Inc.
 - e. Nailor Industries Inc.
 - f. Price Industries.
 - g. Titus.
 - h. Tuttle & Bailey.
 - 3. Devices shall be specifically designed for variable-air-volume flows.
 - 4. Material: Steel.
 - 5. Finish: Baked enamel, color selected by Architect.
 - 6. Face Size: As scheduled.
 - 7. Mounting: As scheduled. All diffusers mounted in a hard ceiling shall be provided with appropriate frame.
 - 8. Pattern: Core style, as scheduled.

2.2 REGISTERS AND GRILLES

- A. Fixed Face Grille:
 - 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:
 - 2. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
 - a. A-J Manufacturing Co., Inc.
 - b. Anemostat Products; a Mestek company.
 - c. Carnes.
 - d. Dayus Register & Grille Inc.
 - e. Hart & Cooley Inc.
 - f. Krueger.
 - g. Nailor Industries Inc.
 - h. Price Industries.
 - i. Titus.
 - j. Tuttle & Bailey.
 - 3. Material: Steel or Aluminum.
 - 4. Finish: Baked enamel, color selected by Architect.
 - 5. Face Arrangement: Core, as scheduled.
 - 6. Core Construction: Integral.

- 7. Mounting: As scheduled. All registers and grilles mounted in a hard ceiling shall be provided with appropriate frame.
- 2.3 SOURCE QUALITY CONTROL
 - A. Verification of Performance: Rate diffusers, registers, and grilles according to ASHRAE 70, "Method of Testing for Rating the Performance of Air Outlets and Inlets."

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install diffusers, registers, and grilles level and plumb.
- B. Ceiling-Mounted Outlets and Inlets: Drawings indicate general arrangement of ducts, fittings, and accessories. Air outlet and inlet locations have been indicated to achieve design requirements for air volume, noise criteria, airflow pattern, throw, and pressure drop. Make final locations where indicated, as much as practical. For units installed in lay-in ceiling panels, locate units in the center of panel. Where architectural features or other items conflict with installation, notify Architect for a determination of final location.
- C. Install diffusers and grilles with airtight connections to ducts and to allow service and maintenance of dampers and fire dampers.

3.2 ADJUSTING

A. After installation, adjust diffusers and grilles to air patterns indicated, or as directed, before starting air balancing.

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes packaged, outdoor, central-station air-handling units (rooftop units) with the following components and accessories:
 - 1. Direct-expansion cooling.
 - 2. Gas furnaces.
 - 3. Economizer outdoor- and return-air damper section.
 - 4. Integral, space temperature controls.
 - 5. Roof curbs.

1.2 SUBMITTALS

- A. Product Data: Include manufacturer's technical data for each RTU, including rated capacities, dimensions, required clearances, characteristics, furnished specialties, and accessories.
- B. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
 - 1. Wiring Diagrams: Power, signal, and control wiring.
 - 2. Factory Sequence of Operations: Sequence provided by RTU manufacturer shall meet or exceed what is specified on the drawings.
- C. Operation and maintenance data.
- D. Warranty.

1.3 QUALITY ASSURANCE

- A. ARI Compliance:
 - 1. Comply with ARI 210/240 and ARI 340/360 for testing and rating energy efficiencies for RTUs.
 - 2. Comply with ARI 270 for testing and rating sound performance for RTUs.
- B. ASHRAE Compliance:
 - 1. Comply with ASHRAE 15 for refrigerant system safety.
 - 2. Comply with ASHRAE 33 for methods of testing cooling and heating coils.
 - 3. Comply with applicable requirements in ASHRAE 62.1-2019, Section 5 "Systems and Equipment" and Section 7 "Construction and Startup."
- C. ASHRAE/IESNA 90.1-2019 Compliance: Applicable requirements in ASHRAE/IESNA 90.1-2019, Section 6 "Heating, Ventilating, and Air-Conditioning."
- D. NFPA Compliance: Comply with NFPA 90A and NFPA 90B.
- E. UL Compliance: Comply with UL 1995.

F. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

1.4 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to replace components of RTUs that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Period for Compressors: Manufacturer's standard, but not less than five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Carrier Corporation.
 - 2. Daikin.
 - 3. Trane; American Standard Companies, Inc.
 - 4. JCI Johnson Controls.

2.2 CASING

- A. General Fabrication Requirements for Casings: Formed and reinforced double-wall insulated panels, fabricated to allow removal for access to internal parts and components, with joints between sections sealed.
- B. Exterior Casing Material: Galvanized steel with factory-painted finish, with pitched roof panels and knockouts with grommet seals for electrical and piping connections and lifting lugs.
 - 1. Exterior Casing Thickness: 0.0626 inch thick.
 - 2. Casing shall be treated with additional Polyurethane, Metallic Pigmented Coating capable of meeting the following, basis of design is Protecall:
 - a. ASTM B117 Salt Spray
 - b. ASTM D2794
- C. Inner Casing Fabrication Requirements:
 - 1. Inside Casing: Galvanized steel, 0.034 inch thick.
- D. Casing Insulation and Adhesive: Comply with NFPA 90A or NFPA 90B.
 - 1. Materials: ASTM C 1071, Type I.
 - 2. Thickness: 1 inch.
 - 3. Liner materials shall have air-stream surface coated with an erosion- and temperature-resistant coating or faced with a plain or coated fibrous mat or fabric.
 - 4. Liner Adhesive: Comply with ASTM C 916, Type I.

- E. Condensate Drain Pans: Formed sections of galvanized-steel sheet, a minimum of 2 inches, and complying with ASHRAE 62.1-2019.
 - 1. Double-Wall Construction: Fill space between walls with foam insulation and seal moisture tight.
 - 2. Drain Connections: Threaded nipple both sides of drain pan.
 - 3. Pan-Top Surface Coating: Corrosion-resistant compound.
- F. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1-2019.

2.3 FANS

- A. Direct-Driven Supply-Air Fans: Double width, forward curved, centrifugal; with permanently lubricated, ECM motor resiliently mounted in the fan inlet. Aluminum or painted-steel wheels, and galvanized- or painted-steel fan scrolls.
- B. Belt-Driven Supply-Air Fans: Double width, forward curved, centrifugal; with permanently lubricated, single-speed motor installed on an adjustable fan base resiliently mounted in the casing. Aluminum or painted-steel wheels, and galvanized- or painted-steel fan scrolls.
- C. Condenser-Coil Fan: Propeller, mounted on shaft of permanently lubricated motor.
- D. Relief-Air Fan: Forward curved, shaft mounted on permanently lubricated motor.

2.4 COILS

- A. Coils shall be treated with additional Polyurethane, Metallic Pigmented Coating capable of meeting the following, basis of design is Protecall:
 - a. ASTM B117 Salt Spray
 - b. ASTM D2794
- B. Supply-Air Refrigerant Coil:
 - 1. Aluminum-plate fin and seamless copper tube in steel casing.
 - 2. Polymer strip shall prevent all copper coil from contacting steel coil frame or condensate pan.
 - 3. Coil Split: Interlaced.
 - 4. Condensate Drain Pan: Galvanized steel with corrosion-resistant coating formed with pitch and drain connections complying with ASHRAE 62.1-2019
- C. Outdoor-Air Refrigerant Coil (RTU-1):
 - 1. Aluminum-plate fin and seamless copper tube in steel casing.
 - 2. Polymer strip shall prevent all copper coil from contacting steel coil frame or condensate pan.
 - 3. Coil Split: Interlaced.
 - 4. Condensate Drain Pan: Galvanized steel with corrosion-resistant coating formed with pitch and drain connections complying with ASHRAE 62.1-2019
- D. Modulating Hot Gas Reheat (HGRH) Coil:

1. Located at the leaving air side of the evaporator coil pre-piped and circuited with a low-pressure switch.

2.5 REFRIGERANT CIRCUIT COMPONENTS

- A. Number of Refrigerant Circuits: One or Two for larger units.
- B. Compressor: Semi-hermetic, reciprocating, mounted on vibration isolators; with internal overcurrent and high-temperature protection, internal pressure relief, and crankcase heater.
- C. Refrigeration Specialties:
 - 1. Refrigerant: R-410A.
 - 2. Expansion valve with replaceable thermostatic element.
 - 3. Refrigerant filter/dryer.
 - 4. Manual-reset high-pressure safety switch.
 - 5. Automatic-reset low-pressure safety switch.
 - 6. Minimum off-time relay.
 - 7. Automatic-reset compressor motor thermal overload.
 - 8. Brass service valves installed in compressor suction and liquid lines.
 - 9. Hot Gas Reheat Coil and all associated accessories.

2.6 AIR FILTRATION

- A. Minimum arrestance according to ASHRAE 52.1, and a minimum efficiency reporting value (MERV) according to ASHRAE 52.2 but no less than listed below:
 - 1. Pleated: 13.

2.7 GAS FURNACE

- A. Description: Factory assembled, piped, and wired; complying with ANSI Z21.47/CSA 2.3 and NFPA 54.
 - 1. CSA Approval: Designed and certified by and bearing label of CSA.
- B. Burners: Stainless steel.
 - 1. Fuel: Natural gas.
 - 2. Ignition: Electronically controlled electric spark or hot-surface igniter with flame sensor.
- C. Heat-Exchanger and Drain Pan: Stainless steel.
- D. Venting: Gravity vented.
- E. Gas Valve Train: Single-body, regulated, redundant, 24-V ac gas valve assembly containing pilot solenoid valve, pilot filter, pressure regulator, pilot shutoff, and manual shutoff.

2.8 DAMPERS

- A. Outdoor-Air Damper: Linked damper blades, for 0 to 100 percent outdoor air, with manual motorized damper filter.
- B. Outdoor- and Return-Air Mixing Dampers: Parallel- or opposed-blade galvanized-steel dampers mechanically fastened to cadmium plated for galvanized-steel operating rod in reinforced cabinet. Connect operating rods with common linkage and interconnect linkages so dampers operate simultaneously.
 - 1. Damper Motor: Modulating with adjustable minimum position.
 - 2. Relief-Air Damper: Gravity actuated or motorized, as required by ASHRAE/IESNA 90.1-2019, with bird screen and hood.

2.9 ELECTRICAL POWER CONNECTION

A. Provide for single connection of power to unit with unit-mounted disconnect switch accessible from outside unit and control-circuit transformer with built-in overcurrent protection.

2.10 CONTROLS

- A. Control sequence of operation is listed on the drawings. Sequence is to be met by manufacturer's on-board controller.
- B. Basic Unit Controls:
 - 1. Wall-mounted thermostat or sensor with the following features:
 - a. Heat-cool-off switch.
 - b. Fan on-auto switch.
 - c. Fan-speed switch.
 - d. Manual Automatic changeover.
 - e. Adjustable deadband.
 - f. Exposed set point.
 - g. Exposed indication.
 - h. Degree F Degree C indication.
 - i. Unoccupied-period-override push button.
 - 2. Wall-mounted humidistat or sensor with the following features:
 - a. Concealed set point.
 - b. Concealed indication.
 - 3. Scheduled Operation: Occupied and unoccupied periods on seven 365-day clock with a minimum of four programmable periods per day.
 - 4. Unoccupied Period:
 - a. Heating Setback: 10 deg F.
 - b. Cooling Setback: 15 deg F.
 - c. Override Operation: Two hours.
 - 5. Supply Fan Operation:

- a. Occupied Periods: Run fan continuously.
- b. Unoccupied Periods: Cycle fan to maintain setback temperature.
- 6. Refrigerant Circuit Operation:
 - a. Occupied Periods: Cycle or stage compressors to match compressor output to cooling load to maintain room temperature and humidity. Cycle condenser fans to maintain maximum hot-gas pressure.
 - b. Unoccupied Periods: Compressors off.
- 7. Gas Furnace Operation:
 - a. Occupied Periods: Stage/Modulate burner to maintain temperature.
 - b. Unoccupied Periods: Cycler burner to maintain setback temperature.
- 8. Economizer Outdoor-Air Damper Operation:
 - a. Occupied Periods: Open to listed percent fixed minimum intake, and maximum 100 percent of the fan capacity to comply with ASHRAE Cycle II. Controller shall permit air-side economizer operation when outdoor air is less than 58 deg F (15 deg C). Use mixed-air temperature and select between outdoor-air and return-air enthalpy to adjust mixing dampers. Start relief-air fan with end switch on outdoor-air damper. During economizer cycle operation, lock out cooling.
 - b. Unoccupied Periods: Close outdoor-air damper and open return-air damper.
- C. Interface Requirements for HVAC Instrumentation and Control System:
 - 1. Provide BACnet Card

2.11 ACCESSORIES

- A. Duplex, 115-V, ground-fault-interrupter outlet with 15-A overcurrent protection. Include transformer if required.
- B. Coil guards of painted, galvanized-steel wire.
- C. Hail guards of galvanized steel, painted to match casing.
- D. Concentric diffuser with white louvers and polished aluminum return grilles, insulated diffuser box with mounting flanges, and interior transition.
- E. Lockable thermostat & humidistat covers shall be included for public locations.

2.12 ROOF CURBS

- A. Materials: Galvanized steel with corrosion-protection coating, watertight gaskets, and factory-installed wood nailer; complying with NRCA standards.
 - 1. Curb Insulation and Adhesive: Comply with NFPA 90A or NFPA 90B.
 - a. Materials: ASTM C 1071, Type I or II.
 - b. Thickness: 1-1/2 inch

- 2. Application: Factory applied with adhesive and mechanical fasteners to the internal surface of curb.
 - a. Liner Adhesive: Comply with ASTM C 916, Type I.
 - b. Mechanical Fasteners: Galvanized steel, suitable for adhesive attachment, mechanical attachment, or welding attachment to duct without damaging liner when applied as recommended by manufacturer and without causing leakage in cabinet.
 - c. Liner materials applied in this location shall have air-stream surface coated with a temperature-resistant coating or faced with a plain or coated fibrous mat or fabric depending on service air velocity.
 - d. Liner Adhesive: Comply with ASTM C 916, Type I.
- B. Curb Height: 14 inches.

PART 3 - EXECUTION

3.1 INSTALLATION

- 1. Minimum Deflection: ¹/₄ inch (6 mm).
- A. Roof Curb: Install on roof structure or concrete base, level and secure, according to ARI Guideline B. Install RTUs on curbs and coordinate roof penetrations and flashing with roof construction specified in Division 07 Section "Roof Accessories." Secure RTUs to upper curb rail, and secure curb base to roof framing or concrete base with anchor bolts.
- B. Unit Support: Install unit level on structural pilings. Coordinate wall penetrations and flashing with wall construction. Secure RTUs to structural support with anchor bolts.
- C. Install condensate drain, minimum connection size, with trap and indirect connection to nearest roof drain via a stone splash block located near the unit.
- D. Duct installation requirements are specified in other Division 23 Sections. Drawings indicate the general arrangement of ducts. The following are specific connection requirements:
 - 1. Install ducts to termination at top of roof curb.
 - 2. Remove roof decking only as required for passage of ducts. Do not cut out decking under entire roof curb.
 - 3. Connect supply ducts to RTUs with flexible duct connectors specified in Division 23 Section "Air Duct Accessories."
 - 4. Install return-air duct continuously through roof structure.

3.2 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections. Report results in writing.
- B. Perform tests and inspections and prepare test reports.

- 1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing. Report results in writing.
- C. Tests and Inspections:
 - 1. After installing RTUs and after electrical circuitry has been energized, test units for compliance with requirements.
 - 2. Inspect for and remove shipping bolts, blocks, and tie-down straps.
 - 3. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
 - 4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- D. Remove and replace malfunctioning units and retest as specified above.

3.3 CLEANING AND ADJUSTING

- A. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to two visits to site during normal occupancy hours for this purpose.
- B. After completing system installation and testing, adjusting, and balancing RTU and airdistribution systems, clean filter housings and install new filters.

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes split-system air-conditioning and heat pump units consisting of separate evaporator-fan and compressor-condenser components. Units are designed for exposed or concealed mounting, and may be connected to ducts.

1.2 SUBMITTALS

- A. Product Data: For each unit indicated. Include performance data in terms of capacities, outlet velocities, static pressures, sound power characteristics, motor requirements, and electrical characteristics.
- B. Operation and maintenance data.

1.3 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- B. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1-2019, Section 5 "Systems and Equipment" and Section 7 "Construction and Startup."
- C. ASHRAE/IESNA 90.1-2019 Compliance: Applicable requirements in ASHRAE/IESNA 90.1-2019, Section 6 "Heating, Ventilating, and Air-Conditioning."

1.4 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace split-system air-conditioning units that fail in materials and workmanship within five years from date of Substantial Completion.

PART 2 - PRODUCTS

- 2.1 MANUFACTURERS
 - A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Carrier Air Conditioning; Div. of Carrier Corp.
 - 2. Lennox Industries Inc.
 - 3. Mitsubishi Electric Sales Canada, Inc.
 - 4. Mitsubishi Electronics America, Inc.; HVAC Division.
 - 5. Mitsubishi Heavy Industries America, Inc.; Air-Conditioning & Refrigeration Division, Inc.
 - 6. Sanyo Fisher (U.S.A.) Corp.
 - 7. Trane Co. (The); Unitary Products Group.
 - 8. York International Corp.

2.2 EVAPORATOR-FAN UNIT

- A. Concealed Unit Chassis: Galvanized steel with flanged edges, removable panels for servicing, and insulation on back of panel.
 - 1. Insulation: Faced, glass-fiber duct liner.
 - 2. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1-2019.
- B. Refrigerant Coil: Copper tube, with mechanically bonded aluminum fins, complying with ARI 210/240, and with thermal-expansion valve.
- C. Evaporator Fan: Forward-curved, double-width wheel of galvanized steel; directly connected to motor.
- D. Fan Motor: Multispeed.
- E. Filters: 1 inch (25 mm) thick, in fiberboard frames.

2.3 AIR-COOLED, COMPRESSOR-CONDENSER UNIT

- A. Casing steel, finished with baked enamel, with removable panels for access to controls, weep holes for water drainage, and mounting holes in base. Provide brass service valves, fittings, and gage ports on exterior of casing.
- B. Compressor: Hermetically sealed scroll type with crankcase heater and mounted on vibration isolation. Compressor motor shall have thermal- and current-sensitive overload devices, start capacitor, relay, and contactor.
- C. Refrigerant Coil: Copper tube, with mechanically bonded aluminum fins, complying with ARI 210/240, and with liquid subcooler.
- D. Fan: Aluminum-propeller type, directly connected to motor.
- E. Motor: Permanently lubricated, with integral thermal-overload protection.
- F. Low Ambient Kit, as scheduled.

2.4 ACCESSORIES

A. Thermostat: Low voltage with subbase to control compressor and evaporator fan.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install evaporator-fan components using manufacturer's standard mounting devices securely fastened to building structure.
- B. Install ground-mounted, compressor-condenser components on 4-inch thick, reinforced concrete base; 4 inches larger on each side than unit.
- C. Install roof-mounted, compressor-condenser components on equipment supports. Anchor units to supports with removable, cadmium-plated fasteners.

3.2 CONNECTIONS

- A. Connect precharged refrigerant tubing to component's quick-connect fittings. Install tubing to allow access to unit.
- B. Install piping adjacent to unit to allow service and maintenance.

3.3 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust field-assembled components and equipment installation, including connections, and to assist in field testing.
- B. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
- C. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation. Remove malfunctioning units, replace with new components, and retest.
- D. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes cabinet unit heaters with centrifugal fans and electric-resistance heating coils.

1.2 SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include rated capacities, operating characteristics, furnished specialties, and accessories.
- B. Shop Drawings:
 - 1. Include plans, elevations, sections, and details.
 - 2. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
 - 3. Include location and size of each field connection.
 - 4. Include details of anchorages and attachments to structure and to supported equipment.
 - 5. Include equipment schedules to indicate rated capacities, operating characteristics, furnished specialties, and accessories.
 - 6. Indicate location and arrangement of piping valves and specialties.
 - 7. Indicate location and arrangement of integral controls.
 - 8. Wiring Diagrams: Power, signal, and control wiring.
- C. Samples for Verification: Finish colors for each type of cabinet unit heater indicated with factory-applied color finishes.
- D. Operation and Maintenance Data: For cabinet unit heaters to include in emergency, operation, and maintenance manuals.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - 1. Airtherm; a Mestek company.
 - 2. Berko; Marley Engineered Products.
 - 3. Carrier Corporation; a unit of United Technologies Corp.
 - 4. Chromalox, Inc.
 - 5. Markel Products; TPI Corporation.
 - 6. Marley Engineered Products.
 - 7. QMark; Marley Engineered Products.
 - 8. Trane.

2.2 DESCRIPTION

- A. Factory-assembled and -tested unit complying with AHRI 440.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- C. Comply with UL 2021.

2.3 PERFORMANCE REQUIREMENTS

- A. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 5 "Systems and Equipment" and Section 7 "Construction and Startup."
- B. ASHRAE/IESNA 90.1 Compliance: Applicable requirements in ASHRAE/IESNA 90.1, Section 6 "Heating, Ventilating, and Air-Conditioning."

2.4 COILS

- A. Electric-Resistance Heating Coil: Nickel-chromium heating wire, free from expansion noise and hum, mounted in ceramic inserts in galvanized-steel housing; with fuses in terminal box for overcurrent protection and limit controls for high-temperature protection. Terminate elements in stainless-steel machine-staked terminals secured with stainless-steel hardware.
- 2.5 CONTROLS
 - A. Fan and Motor Board: Removable.
 - 1. Fan: Forward curved, high static, double width, centrifugal, directly connected to motor; thermoplastic or painted-steel wheels and aluminum, painted-steel, or galvanized-steel fan scrolls.
 - 2. Wiring Terminations: Connect motor to chassis wiring with plug connection.
 - B. Electrical Connection: Factory-wired motors and controls for a single field connection.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas to receive cabinet unit heaters for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Examine roughing-in for piping and electrical connections to verify actual locations before unit-heater installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install wall boxes in finished wall assembly; seal and weatherproof.
- B. Install cabinet unit heaters to comply with NFPA 90A.

- C. Suspend cabinet unit heaters from structure with elastomeric hangers. Vibration isolators are specified.
- D. Install wall-mounted thermostats and switch controls in electrical outlet boxes at heights to match lighting controls. Verify location of thermostats and other exposed control sensors with Drawings and room details before installation.

3.3 CONNECTIONS

- A. Comply with safety requirements in UL 1995.
- B. Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems."
- C. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

3.4 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections with the assistance of a factory-authorized service representative:
 - 1. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
 - 2. Operate electric heating elements through each stage to verify proper operation and electrical connections.
 - 3. Test and adjust controls and safety devices. Replace damaged and malfunctioning controls and equipment.
- B. Units will be considered defective if they do not pass tests and inspections.
- C. Prepare test and inspection reports.

3.5 ADJUSTING

A. Adjust initial temperature set points.

3.6 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain cabinet unit heaters.

PART 1 GENERAL

1.1 SUMMARY

- A. This section applies to all work specified in Divisions 26 and 28.
- B. Provide all required materials, labor, equipment, installation, fabrication, and testing required for a complete, safe, and fully operational system. System shall include all required materials and features whether specified or shown on drawings or not to comply with applicable codes and authorities having jurisdiction.
- C. The electrical installation shall be made in strict conformance with the latest edition and supplements in force at the time of bid opening of the 2017 National Electrical Code, the Rules and Regulations of the New Jersey Uniform Construction Code, the applicable Standards of the National Fire Protection Association, and applicable requirements of the Occupational Safety and Health Act of the United States Department of Labor. All materials and equipment employed shall be approved by and bear the label of Underwriters' Laboratories, Inc., where such labeling is made available by any manufacturer for said materials or equipment. All codes and regulations applicable shall be considered as jointly governing and the requirements of either and all will prevail. If it occurs that Drawings conflict with any applicable code, then this Contractor shall immediately bring same to attention of Architect or his representative for resolution.

1.2 DESCRIPTION OF DOCUMENTS

- A. The Drawings are generally diagrammatic and indicate the general design and arrangement of the proposed work. Do not scale drawings for the exact location of equipment and work. The exact routing of circuits and final location of all the electrical equipment, lighting fixtures, and other systems, unless specifically dimensioned on the Drawings, shall be subject to building and structural conditions, grid systems, and work of other trades involved in the construction, and subject to the approval of the Architect. The Contractor shall familiarize himself with the Contract Documents and shall be responsible for the final location of his particular equipment to suit field conditions encountered and to avoid interferences with other trades' work, without extra cost to the Owner or the Architect. The Contractor shall visit the job site to determine the job conditions. The Architect reserves the right to make minor changes in outlet and equipment locations at any time prior to rough-in of the electrical work without incurring any additional costs.
- B. Where sizes are not provided for material and equipment, the material and equipment shall be sized in accordance with the latest addition of the National Electrical Code and in accordance with the manufacturer's recommendations.

1.3 DEFINITIONS

- A. EPDM: Ethylene-propylene-diene terpolymer rubber.
- B. NBR: Acrylonitrile-butadiene rubber.
- C. The term "finished space" shall mean any space designated for the general or specific use of the occupants.
- D. The term "concealed space" shall mean all furred spaces, pipe chases, spaces above finished ceilings, crawl spaces, and other areas not generally accessible to the occupants.

- E. The term "electrical space" as used in this division of the specifications shall mean any space designated primarily for the installation of electrical equipment.
- F. "Provide" Furnish and install the specific item, equipment, and/or system.
- G. "Furnish" Supply the specific item, equipment, and/or system.
- H. "Install" Set in position and adjust for use the specific item, equipment, and/or system unless otherwise specifically noted to be installed by others.
- I. "Concealed" Hidden from sight in walls, chases, furred spaces, above ceilings, underground, in concrete, etc.
- J. "Exposed" Not hidden from sight.
- K. "Work" Labor and installation, including materials, equipment, and systems required for completion of all portions of the project.

1.4 CODES AND STANDARDS

A. Following is a list of abbreviations for codes and standards which are referred to in the Specifications. Where such reference is made, the code or standard becomes a part of these Specifications as if the code or standard were included herein. Reference is always to the latest edition of the code or standard unless otherwise specifically noted.

ANSI - American National Standards Institute, Inc. NFPA - National Fire Protection Association ASTM - American Society for Testing and Materials NBS - National Bureau of Standards NEMA - National Electrical Manufacturers Association UL - Underwriters' Laboratories, Inc. NEC - National Electrical Code NESC - National Electrical Safety Code IPCEA - Insulated Power Cable Engineers Assn. IEEE - Institute of Electrical and Electronics Engineers OSHA - Occupational Safety and Health Act IES - Illuminating Engineering Society JIC - Joint Industrial Council

1.5 GUARANTEES AND WARRANTIES

- A. This Contractor shall guarantee all equipment, apparatus, materials, and workmanship entering into the Contract to be the best of its respective kind and shall replace all parts at his expense which are defective within one year from final acceptance of the work by the Architect. Items of equipment which may have longer guarantees shall have warranties and guarantees completed, in order, and in effect at the time of final acceptance of the work by the Architect. This Contractor shall furnish all such warranties and guarantees at the time of final acceptance of the work.
- B. All work that is not installed in accordance with the Contract Documents shall be repaired or replaced at the direction of the Architect.

1.6 SUBMITTAL

- A. Submittals shall be made in accordance with Submittals paragraph in Division 1.
- B. Submittal data shall include specification data, such as metal gauges, finishes, optional accessories; even though such equipment and materials may be as specified. In addition, the submittal data shall include performance (certification) data, wiring diagrams where applicable, accurate dimensional data, and a recommended spare parts list. Outline or dimensional drawings alone are not acceptable.
- C. No roughing-in or connections shall be done until approved equipment submittals are in the hands of the Contractor. It shall be this Contractor's responsibility to obtain approved drawings and to make all connections in the neatest and most workmanlike manner possible. This Contractor shall coordinate with all other Contractors having any connections or roughing-in to the equipment.
- D. In general, normal catalog information (with the particular items underlined or otherwise denoted as being the submitted item) will be accepted as submittal data. Installation, operating and maintenance instructions must be that information specifically applicable to the items furnished, which is ordinarily supplied with the equipment to the Owner, for any modifications indicated. Wiring diagrams must be correct for the application. Generalized wiring diagrams, showing alternate methods of connection, will not be acceptable unless all unrelated sections are marked out. Submittal data sheets which indicate several different model numbers, figure numbers, optional accessories, or installation arrangements shall be clearly marked to indicate the specific items of equipment being furnished. Samples and certificates shall be furnished as requested. Submittal data must be complete for each piece of equipment; piecemeal data will not be processed.
- E. It shall be noted that acceptance of shop drawings by the Architect applies only to general design, arrangement, type, capacity, and quality. Such acceptance does not relieve the Contractor of the responsibility for furnishing the proper equipment.
- F. Corrections or comments made on the submittals during the Architect's review do not relieve the Contractor from compliance with the Drawings and Specifications. The Architect's review of submittals is only for general conformance with design concept and general compliance with the information given in the Contract Documents. The Contractor's responsibility includes, but is not limited to, conforming, and correlating all quantities and dimensions, selecting fabrication processes and techniques of construction, coordinating his work with that of all other trades, and performing his work in a safe and satisfactory manner.
- G. Product Data: For sleeve seals and access panels.

1.7 SUBSTITUTIONS

A. When this Contractor requests approval of substitute materials and/or equipment, except where under formal alternate proposal, it shall be understood that such substitution, if approved, will be made without cost to the Owner and Architect, regardless of changes. In all cases where substitutions affect other trades, the Contractor offering such substitutions shall reimburse all affected contractors for all necessary changes in their work.

1.8 OPERATION AND MAINTENANCE MANUALS

- A. Operation and maintenance data shall be submitted in accordance with the requirements of Division "GENERAL REQUIREMENTS".
- B. Furnish owner with three (3) bound sets of the O&M manuals at completion of project. The manuals shall be furnished by the manufacturer of each item of equipment or system. Each set is to be bound separately in a loose leaf binder. Manuals shall include Contractor's Name and telephone numbers that can be called for service calls. The standard manufacturer's data shall be supplemented by such special instructions as may be necessary for the particular application. Also, include the following in the manuals:

All project stamped acceptable shop drawings and copies of all certificates. Lubrication schedules and procedures Spare parts list, indicate all items that should be maintained at the site by owner. Maintenance and trouble-shooting suggestions for equipment. Non-Lien Affidavits Wiring Diagrams Certification of owner instruction of system and equipment Record drawings Preventative Maintenance Task Form

- C. The operating instructions shall integrate each piece of equipment in any one system into a numbered step-by-step sequence of operation.
- D. The parts list shall consist of a complete list of replacement items with all component parts numbered for each piece of mechanical or electrical equipment and shall include directions for ordering said replacement items.
- E. Maintenance procedure shall outline required routine maintenance for all equipment and systems and instructions for repair of the equipment.
- F. The Contractor shall, with the aid of his equipment suppliers, fill out the Owner's Preventative Maintenance Task Form. The completed Preventative Maintenance Task Form shall be included in the final copies of the O&M manuals.

1.9 RECORD DRAWINGS

A. This Contractor shall submit to the Owner one (1) reproducible sepia copy, one (1) print Record Drawings. Drawings shall be identified with the Contractor's name, the date, and title "RECORD DRAWINGS" on the paper copies.

1.10 REMOVALS AND RELOCATIONS

- A. Perform all removal work required. Prepare remaining surfaces to receive new scheduled or specified materials. Finish surfaces to match adjacent if no additional work is scheduled or specified.
- B. Remove existing systems, materials, and equipment which are made obsolete, or which interfere with the construction. Reinstall any such systems, materials, and equipment which are required to complete the Project.
- C. Where existing systems, materials, or equipment are removed or revised, all conduit and wire which are no longer in service shall be removed. When outlets are covered up or are otherwise rendered inaccessible, all wiring shall be removed to the source. If a circuit that

must remain in service is interrupted, it shall be reconnected by the most inconspicuous means so that it remains operational, with the same capacity as before. All building surfaces damaged, and openings left by removal of boxes, conduit, or other equipment shall be repaired. All holes left in junction boxes, switches, panels, and other equipment shall be closed.

- D. Where new openings are cut and concealed conduits or other electrical items are encountered, they shall be removed or relocated as required. Where conduit to be removed stubs through floors, walls, and ceilings, such conduit shall be removed to the point where the finished surfaces can be patched so that no evidence of the former installation remains.
- E. All devices, fixtures, equipment, and material determined by the Owner to be salvageable shall remain the property of the Owner and shall be stored at the location on the premises designed by the Owner. All other items and debris shall be disposed of by the Contractor.

1.11 PROJECT CONDITIONS

- A. Interruption of Existing Electrical Services: Do not interrupt electric service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electric service according to requirements indicated:
 - 1. Notify Architect no fewer than seven days in advance of proposed interruption of electrical services.
 - 2. Prior to making revisions to the existing services, the Contractor shall make certain that all items are thoroughly prepared. The actual work shall be accomplished at off-peak time as arranged with the Owner and Architect. Once the work is started, it shall be prosecuted to its completion to keep downtime to a minimum. The Contractor shall be prepared to temporarily feed the existing service in the event it becomes impossible to finish the scheduled work on time.
 - 3. The Contractor shall prepare a procedure for all work which will interrupt service to the Owner's equipment. This procedure shall include a step-by-step schedule that the Contractor proposes to follow in the performance of the work and the time involved in each step. The procedure shall be submitted to the Architect for approval at least two weeks in advance of the performance of the work.
 - 4. Indicate method of providing temporary electrical service. Contractor is responsible for providing all temporary electrical services.
 - 5. Do not proceed with interruption of electrical service without Architect's written permission.
 - 6. Comply with NFPA 70E.

1.12 COORDINATION

- A. Coordinate arrangement, mounting, and support of electrical equipment:
 - 1. To allow maximum possible headroom unless specific mounting heights that reduce headroom are indicated.
 - 2. To provide for ease of disconnecting the equipment with minimum interference to other installations.
 - 3. To allow right of way for piping and conduit installed at required slope.
 - 4. So connecting raceways, cables, wireways, and cable trays will be clear of obstructions and of the working and access space of other equipment.
- B. Coordinate installation of required supporting devices and set sleeves in cast-in-place concrete, masonry walls, and other structural components as they are constructed.

- C. Coordinate location of access panels and doors for electrical items that are behind finished surfaces or otherwise concealed. Access doors and panels are specified in Division 08 Section "Access Doors and Frames".
- D. Coordinate sleeve selection and application with selection and application of firestopping specified in Division 07 Section "Penetration Firestopping".
- E. The Contractor shall coordinate with all other contractors in locating conduit, light fixtures, boxes, sleeves, and equipment in order to avoid conflict with all other trades' work. No extra compensation will be allowed to cover the cost of relocating light fixtures, conduit, boxes, sleeves, or other electrical equipment found encroaching on space required by others.

1.13 ABBREVIATIONS

A. Abbreviations may be used and indicated throughout the Specifications and Drawings, and will conform to the following list:

A or AMP	AMPERES, OR AMPACITY
AFF	ABOVE FINISHED FLOOR
С	CONDUIT
СВ	CIRCUIT BREAKER
CKT	CIRCUIT
COMB	COMBINATION
CU	COPPER
EC	ELECTRICAL CONTRACTOR
EM	ON EMERGENCY CIRCUIT
EMT	ELECTRICAL METALLIC TUBING
FDS	FUSIBLE DISCONNECT SWITCH
GC	GENERAL CONTRACTOR
G	GREEN GROUNDING CONDUCTOR
GND	GROUND
HP	HORSEPOWER
JB	JUNCTION BOX
KVA	KILOVOLT AMPERES
KW	KILOWATTS
MC	MECHANICAL CONTRACTOR
MCC	MOTOR CONTROL CENTER
MTR	MOTOR
NEC	NATIONAL ELECTRICAL CODE
NEMA	NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION
NIC	NOT IN THIS CONTRACT
NL	NIGHT LIGHT
Ø	PHASE
PNL	PANEL
PVC	POLYVINYLCHLORIDE
RM	ROOM
STD	STANDARD

PART 2 PRODUCTS

2.1 GENERAL

- A. Material and equipment shall be furnished as specified in this section and each individual electrical section of these Specifications and shall be in strict accordance with applicable ANSI, NBS, ASTM, NESC, NEMA, IEEE, IPCEA, UL, NEC, OSHA and NFPA standards, codes, and specifications. Applicable codes, standards, and manufacturers' products referred to in these Specifications shall establish minimum requirements for materials and equipment furnished for this installation.
- B. When two or more articles of the same material or equipment are required, they shall be of the same manufacturer.
- C. New material and equipment shall be provided for the entire project, unless noted otherwise.
- 2.2 Concrete shall be 3000 psi and shall comply with the requirements of Division "CONCRETE".
- 2.3 Compacted aggregate subbase shall conform to ASTM C33, gradation 57.
- 2.4 Reinforcing steel, welded wire fabric, forms, and curing compounds shall comply with the requirements of Division "CONCRETE". The minimum reinforcement shall be 6 x 6 10/10 welded wire fabric.
- 2.5 GROUT
 - A. Nonmetallic, Shrinkage-Resistant Grout: ASTM C 1107, factory-packaged, nonmetallic aggregate grout, noncorrosive, nonstaining, mixed with water to consistency suitable for application and a 30-minute working time.
- 2.6 Bolting shall be carbon steel conforming to ASTM A-307 with heavy hexagonal nuts.
- 2.7 Angles, Channels, Beams, Bars and Rods shall be steel conforming to ASTM A-36 as applicable.

2.8 ACCESS PANELS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following, or an approved equal:
 - 1. Nystrom
 - 2. Inland-Ryerson
 - 3. Karp Associates
 - 4. Or approved equal
- B. Fire rated access panels shall be a prime steel door and frame assembly with flush lock release and interior latch release.
- C. Panel shall have a $1\frac{1}{2}$ hour B rating.
- D. Access panels shall be nominal 16 inch by 16 inch, unless noted otherwise.

2.9 SLEEVES FOR RACEWAYS AND CABLES

- A. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized steel, plain ends.
- B. Sleeves for Rectangular Openings: Galvanized sheet steel.
 - 1. Minimum Metal Thickness:
 - a. For sleeve cross-section rectangle perimeter less than 50 inches and no side more than 16 inches, thickness shall be 0.052 inch.
 - b. For sleeve cross-section rectangle perimeter equal to, or more than, 50 inches and 1 or more sides equal to, or more than, 16 inches, thickness shall be 0.138 inch.

2.10 SLEEVE SEALS

- A. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and raceway or cable.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following, or an approved equal:
 - a. Advance Products & Systems, Inc.
 - b. Calpico, Inc.
 - c. Metraflex Co.
 - d. Pipeline Seal and Insulator, Inc.
 - e. Or approved equal.
 - 2. Sealing Elements: EPDM interlocking links shaped to fit surface of cable or conduit. Include type and number required for material and size of raceway or cable.
 - 3. Pressure Plates: Include two for each sealing element.
 - 4. Connecting Bolts and Nuts: Stainless steel of length required to secure pressure plates to sealing elements. Include one for each sealing element.

PART 3 EXECUTION

3.1 COMMON REQUIREMENTS FOR ELECTRICAL INSTALLATION

- A. Comply with NECA 1.
- B. Measure indicated mounting heights to bottom of unit for suspended items and to center of unit for wall-mounting items.
- C. Headroom Maintenance: If mounting heights or other location criteria are not indicated, arrange, and install components and equipment to provide maximum possible headroom consistent with these requirements.
- D. Equipment: Install to facilitate service, maintenance, and repair or replacement of components of both electrical equipment and other nearby installations. Connect in such a way as to facilitate future disconnecting with minimum interference with other items in the vicinity.
- E. Right of Way: Give to piping systems installed at a required slope.

- F. Any electrical box, device, conduit, or enclosure installed in any fire rated column, wall, or ceiling shall not reduce the fire rating of said column or wall. The Contractor providing the device, box, conduit, or enclosure shall provide the required material to maintain the fire rating of the column, wall, or ceiling.
- G. At penetrations of fire walls provide fire barrier penetration sealing system in conformance with Section FIRESTOPPING. The seal shall also be provided at all floor penetrations in a multi-story building. The sealing system shall have a 3 hour rating when tested in accordance with the provisions of ASTM E-119. Installation of penetration sealing systems shall be in accordance with manufacturer's instructions.
- H. Provide cover plates where conduit and raceways pass through floor, ceiling, or walls and are exposed in finished rooms. Flanges shall fit snugly and shall be sized to cover the openings. All escutcheons shall be chromium plated wing type with fastening screws.

3.2 SLEEVE INSTALLATION FOR ELECTRICAL PENETRATIONS

- A. Electrical penetrations occur when raceways, cables, wireways, or cable trays penetrate concrete slabs, concrete or masonry walls, or fire-rated floor and wall assemblies.
- B. Concrete Slabs and Walls: Install sleeves for penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of slabs and walls.
- C. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.
- D. Fire-Rated Assemblies: Install sleeves for penetrations of fire-rated floor and wall assemblies unless openings compatible with firestop system used are fabricated during construction of floor or wall.
- E. Cut sleeves to length for mounting flush with both surfaces of walls.
- F. Extend sleeves installed in floors 2 inches above finished floor level.
- G. Size pipe sleeves to provide 1/4-inch annular clear space between sleeve and raceway or cable, unless indicated otherwise.
- H. Seal space outside of sleeves with grout for penetrations of concrete and masonry
 - 1. Promptly pack grout solidly between sleeve and wall so no voids remain. Tool exposed surfaces smooth; protect grout while curing.
- I. Interior Penetrations of Non-Fire-Rated Walls and Floors: Seal annular space between sleeve and raceway or cable, using joint sealant appropriate for size, depth, and location of joint. Comply with requirements in Division 07 Section "Joint Sealants.".
- J. Fire-Rated-Assembly Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at raceway and cable penetrations. Install sleeves and seal raceway and cable penetration sleeves with firestop materials. Comply with requirements in Division 07 Section "Penetration Firestopping."
- K. Roof-Penetration Sleeves: Seal penetration of individual raceways and cables with flexible boot-type flashing units applied in coordination with roofing work.

- L. Aboveground, Exterior-Wall Penetrations: Seal penetrations using steel pipe sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.
- M. Underground, Exterior-Wall Penetrations: Install cast-iron pipe sleeves. Size sleeves to allow for 1-inch annular clear space between raceway or cable and sleeve for installing mechanical sleeve seals.

3.3 SLEEVE-SEAL INSTALLATION

- A. Install to seal exterior wall penetrations.
- B. Use type and number of sealing elements recommended by manufacturer for raceway or cable material and size. Position raceway or cable in center of sleeve. Assemble mechanical sleeve seals and install in annular space between raceway or cable and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

3.4 FIRESTOPPING

A. Apply firestopping to penetrations of fire-rated floor and wall assemblies for electrical installations to restore original fire-resistance rating of assembly. Firestopping materials and installation requirements are specified in Division 07 Section "Penetration Firestopping."

3.5 EQUIPMENT CONNECTION AND WIRING

- A. Unless specifically noted otherwise on the Drawings or elsewhere in the Specifications, all wiring, and all equipment connections shall be provided by the Electrical Contractor, including equipment requiring electrical services furnished under other sections of the Specifications or by the Owner.
- B. The Electrical Contractor shall furnish and install all disconnect switches, NEC circuit protection, motor controllers, relays, and devices as required for all equipment to provide complete and operable electrical systems, unless the items are specifically noted elsewhere as being provided with, or as part of, the equipment.
- C. Electrical Contractor shall verify horsepower, voltage, phase, starting requirements, quantity of wires, and wattage of all equipment which requires electrical connections before equipment purchase or rough-in, and shall install feeders, branch circuits, and motor starting equipment and protection which are suitable in all respects for connection to, and operation with, the equipment furnished. Exact location of all equipment which requires electrical connection shall be verified with the equipment installer before rough-in.

3.6 EQUIPMENT INSTALLATION

- A. All equipment shall be installed at locations indicated and oriented so as to be easily accessible.
- B. Assembly and installation of equipment shall be in strict accordance with manufacturer's installation instructions. Equipment shall be securely anchored in place. Care shall be exercised to correctly orient equipment before securing in place.
- C. Equipment Pads and Grouting

- 1. Electrical Contractor shall furnish and install concrete pads for all equipment requiring same provided by Electrical Contractor.
- 2. Floor-mounted equipment such as switchboards and transformers shall be provided with a suitable concrete pad. Each pad shall have suitable hold-down bolts in pipe sleeves, of sufficient number to properly secure the apparatus. Hold-down bolts shall be located by template prepared from actual measurement of the equipment or from certified drawings furnished by the Equipment Manufacturer. Hold-down bolts shall be set in wrought iron pipe sleeves 3/4 inch larger than the bolts to facilitate alignment of equipment.
- 3. Pads, unless otherwise directed, shall extend 4 inches above the finished floor and shall be securely anchored to floor so that vibration or stresses cannot cause lateral movement. Unless noted otherwise, install dowel rods on 18 inch centers around full perimeter of base.
- 4. Where grouting is required, equipment shall be set to level by use of wedges where no jack screws are provided. After grout has set up, the supporting jack screws or wedges shall be removed, and the holes left by removal of the wedges shall be dry packed.
- 5. Maintain minimum clearances and workspace at equipment according to manufacturer's written instructions and NFPA 70.
- D. Equipment Mounting
 - 1. All equipment with moving parts shall be mounted on vibration supports suitable for the purpose of minimizing noise and vibration transmission unless otherwise specified, and in addition, shall be isolated from external connections such as piping and raceways by means of flexible connectors, vibration absorbers, or other approved means.
- E. Platforms and Supporting Stands
 - 1. Each piece of equipment or apparatus suspended from the ceiling or mounted above the floor level shall be provided with suitable structural support, pipe stand, platform, or carrier in accordance with the best recognized practice and as approved by the Architect.
 - 2. Such supporting or mounting means shall be provided by this Contractor for all equipment furnished by him.
 - 3. Structural members of the building shall not be overloaded by such equipment.
- F. Cutting, Fitting, and Patching
 - 1. The Electrical Contractor shall do all cutting and drilling of masonry, steel, wood, or iron work and all fitting necessary for the proper installation of all electrical equipment and materials included in the Specifications or governed thereby.
 - 2. No cutting or drilling of the structure, of any kind, shall be done without first obtaining permission from the Architect. All cutting and drilling shall be done under the supervision of the Contractor in strict accordance with instructions furnished by the Architect.
 - 3. All patching and finishing shall be done by workmen skilled in the trades involved.

3.7 TRENCHING AND BACKFILLING

A. Trenching and backfilling shall be accomplished in accordance with the requirements of Division "SITEWORK" and with the following.

- B. Underground Electrical Services shall be installed in trenching dug specifically for such services. Layout the trench routing using stakes and flags. Do not proceed with excavation until the layout is approved by the Architect.
- C. The trench shall be dug so that the service shall be laid to the alignment and depth required, and it shall be excavated only so far in advance of installation as can be completed in one day. The width of the trench shall be ample to permit the service to be laid and the backfill to be placed and compacted as specified. The minimum trench width shall be four inches. The minimum trench depth shall be twenty-four inches.
- D. Materials to be excavated shall include earth, rock, or any other material encountered within the limits of trench excavation. No adjustment in the contract price will be made on account of the presence or absence of shale, sandstone, masonry, rock, or other material. The Contractor shall familiarize himself with existing site conditions by examination of the actual site and Contract Documents.
- E. All excavated material shall be piled in a manner which will not endanger the work, and which will avoid obstructing sidewalks and driveways. In general, excavated material shall be piled on the high side of the trench to form a dam to prevent surface water from entering the trench.
- F. The Contractor may use trench digging machinery or employ hand methods but shall employ hand methods in locating underground utilities.
- G. All excavated materials not required or not suitable for backfill shall be disposed of by the Contractor.
- H. Sheeting and shoring shall be placed as necessary for the protection of the work and for the safety of personnel.
- I. The trench bottom shall be accurately graded to provide a uniform surface for the type of bedding specified. Stones shall be removed as necessary to avoid point bearing.
- J. Whenever wet or otherwise unstable material that is incapable of properly supporting the conduit, duct, or structure is encountered in the bottom of the excavation, such material shall be over excavated to a depth to allow for construction of a stable bedding.
- K. Any over depth excavation shall be backfilled with materials specified for backfilling the lower portions of trenches.
- L. The first six inches of trench depth above the utility shall be backfilled by hand with sand. One hundred percent of this sand shall pass a 3/4 inch screen. Ninety-five percent shall pass a No. 4 screen, and not over eight percent shall pass a No. 100 screen. Tamp this backfill thoroughly, taking care not to disturb the conduit or injure the conduit coating. For the remaining trench depth, the backfill shall be earth or granular material, except that the material may contain stones, rock, concrete, or masonry materials (but no cinders), with a maximum dimension of 4 inches, providing the voids in such coarse material are completely filled with earth or granular material. In the event that sufficient material for trench backfill is not available from trenching or other excavation, the Contractor shall supply and place the requisite additional material.
- M. Backfill shall be thoroughly compacted with an approved mechanical tamper, or, if the soil is of a granular nature, by puddling with hose and long pipe nozzle after the trench is backfilled, provided that under pavements and other surfacing, the backfill shall be compacted solidly in layers not more than 6 inches thick, measured loose, with mechanical tampers.

- N. Compaction requirements All fill and backfill shall be compacted to the following percent of the maximum density obtained in accordance with ASTM D-1557, Method D (Modified Proctor). Moisture contents shall range from 1% below to 4% above optimum.
 - 1. Below base of footings 98%
 - 2. Beneath slabs on grade 95%
 - 3. Beneath sidewalks and pavement 95%
 - 4. Backfill against basement walls minimum compacting required to achieve reasonable consolidation (approximately 80%).
 - 5. Lawns and planting areas 88%
- O. In lawn or planting areas, the top 12 inches of backfill shall be topsoil.
- P. PERMITS, CERTIFICATES, LAWS AND ORDINANCES
 - 1. The Electrical Contractor shall, at his own expense, procure all certificates and licenses required of him by law for the execution of his work. He shall comply with all Federal, State, and local laws, ordinances, rules, and regulations relating to the performance of the work. Refer to front end specification sections for permit requirements.
 - 2. Following completion, a certificate of approval shall be secured from the local code enforcement authority and delivered to the Architect.

Q. INSPECTION

1. The Electrical Contractor shall, at his own expense, furnish electrical inspection as required by the local code enforcing agency, when applicable. The Contractor shall notify the Electrical Inspector in writing upon the start of the job and a copy of the notice shall be sent to the Architect. The Contractor shall furnish certificates of final approval by the Electrical Inspection Bureau and final payment shall be withheld until he has presented the Architect with the aforementioned certificates of approval.

R. PAINTING

- 1. Refinish surfaces marred or damaged by electrical work to original or specified condition.
- 2. Replace marred or discolored factory, multiple coat, baked on finish surfaces. Minor inconspicuous scratches may be "touched-up". Provide one spray can of each color of touch-up painted used to the Owner.
- 3. The following items do not require painting.
 - a. Equipment with a factory baked on finish.
 - b. Receptacle and switch cover plates.
 - c. Faceplates of instruments, equipment, and control panels.

PART 1 GENERAL

1.1 SUMMARY

- A. This Section includes the following:
 - 1. Building wires and cables rated 600 V and less.
 - 2. Connectors, splices, and terminations rated 600 V and less.
- B. Related Sections include the following:
 - 1. Division 01 Section "Construction Waste Management."
 - 2. Division 26 Sections:
 - a. "Common Work Results for Electrical"
 - b. "Identification for Electrical Systems"

1.2 DEFINITIONS

- A. EPDM: Ethylene-propylene-diene terpolymer rubber.
- B. NBR: Acrylonitrile-butadiene rubber.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Qualification Data: For testing agency.
- C. Field quality-control test reports.

1.4 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- B. Comply with NFPA 70.

1.5 COORDINATION

A. Set sleeves in cast-in-place concrete, masonry walls, and other structural components as they are constructed.

PART 2 PRODUCTS

- 2.1 CONDUCTORS AND CABLES
 - A. Manufacturers: Subject to compliance with requirements, provide products by one of the following, or an approved equal:
 - 1. American Insulated Wire Corp.; a Leviton Company.
 - 2. General Cable Corporation.
 - 3. Senator Wire & Cable Company.
 - 4. Southwire Company.
- 5. Carol Cable.
- 6. Or approved equal.
- B. Copper Conductors: Comply with NEMA WC 70.
- C. Conductor Insulation: Comply with NEMA WC 70 for Types THHN-THWN and XHHW.
- D. Multiconductor cabling: Comply with NEMA WC 70 for metal clad cable, Type MC with ground conductor.
- 2.2 CONNECTORS AND SPLICES
 - 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, or an approved equal:
 - 1. AFC Cable Systems, Inc.
 - 2. Hubbell Power Systems, Inc.
 - 3. O-Z/Gedney; EGS Electrical Group LLC.
 - 4. 3M; Electrical Products Division.
 - 5. Tyco Electronics Corp.
 - 6. Or approved equal.
 - C. Description: Factory-fabricated connectors and splices of size, ampacity rating, material, type, and class for application and service indicated.

PART 3 EXECUTION

3.1 CONDUCTOR MATERIAL APPLICATIONS

- A. Feeders: Copper. Solid or stranded for No. 10 AWG and smaller; stranded for No. 8 AWG and larger. Minimum conductor size shall be No. 12 AWG.
- B. Branch Circuits: Copper. Solid or stranded for No. 10 AWG and smaller; stranded for No. 8 AWG and larger. Minimum conductor size shall be No. 12 AWG.
- C. Control Circuits: Copper. Solid or stranded for No. 10 AWG and smaller. Minimum conductor size shall be No. 14 AWG.

3.2 CONDUCTOR INSULATION AND WIRING METHODS

- A. Service Entrance: Type THHN-THWN, single conductors in raceway.
- B. Exposed Feeders: Type THHN-THWN, single conductors in raceway.
- C. Feeders Concealed in Ceilings, Walls, Partitions, and Crawlspaces: Type THHN-THWN, single conductors in raceway.
- D. Feeders Concealed below Slabs-on-Grade, and Underground: Type THHN-THWN, single conductors in raceway. <u>Feeders shall not be encased within floor slabs.</u>
- E. Exposed Branch Circuit: Type THHN-THWN, single conductors in raceway.

- F. Branch Circuits Concealed in Ceilings, Walls, and Partitions: Type THHN-THWN, single conductors in raceway. Metal clad cabling may be used for wiring within room from ceiling down to wall device. Metal clad cabling shall not be used for homeruns or from room to room.
- G. Branch Circuits Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THHN-THWN, single conductors in raceway. Branch circuits shall not be encased in floor slabs.
- H. Class 1 Control Circuits: Type THHN-THWN, in raceway.
- I. Class 2 Control Circuits: Type THHN-THWN, in raceway.

3.3 INSTALLATION OF CONDUCTORS AND CABLES

- A. Conceal cables in finished walls, ceilings, and floors, unless otherwise indicated.
- B. 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.
- C. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables or raceway.
- D. Install exposed cables parallel and perpendicular to surfaces of exposed structural members and follow surface contours where possible.
- E. Support cables according to Division 26 Section "Hangers and Supports for Electrical Systems".
- F. Identify and color-code conductors and cables according to Division 26 Section "Identification for Electrical Systems".
- G. Metal clad cabling shall be secured at intervals not exceeding 6 foot and shall be secured within 12 inches of every box, cabinet, fitting, or other termination. Metal clad cable shall be supported by listed cable ties, steps, hangers, or other similar fittings designed for such use. Metal clad cables shall not be supported from ceiling supports or from twisted support wires.
- H. Provide anti short bushings at all metal clad cable terminations.
- I. No wiring shall be pulled until construction is such that there is no danger of moisture entering open raceways. Protect all openings with caps or plugs until final connections are made. Conduit shall be swabbed clean before pulling conductors.
- J. No thermoplastic conductors shall be pulled through raceways at ambient temperatures below 33°F.
- K. All insulated bushings shall be installed before pulling conductors.
- L. All wiring in panel gutters, pull boxes, and other accessible enclosures shall be tied and bundled with cable ties.
- M. When channels of LED fixtures are used as a raceway, Type THHN conductors shall be used throughout the fixtures as the branch circuit.

- N. Wiring shall be installed continuously between terminal points indicated or dictated by field conditions without intermediate splices or taps unless specifically authorized by the Architect. Splices shall be made only in junction or terminal boxes.
- O. Feeder cables shall be spliced only at tap points. Splices of any other nature shall not be permitted.
- P. Conductors shall not be subject to pulling tension in excess of 50 percent of yield strength of conductor. Pulling lugs shall be attached to conductor with a sleeve or grip over the cable sheath to prevent slipping the insulation.
- Q. Where terminals and splices are taped with insulation tape, apply a minimum of two layers of electrical tape, half-lapped.

3.4 CONNECTIONS

- A. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.
- B. Make splices and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.
 - All joints between conductors shall be made with wire connectors. Splices shall be in boxes and shall be accessible. Branch circuit conductors #10 AWG and smaller shall be spliced together using properly sized and listed spring type insulated conductors (i.e., wire nut). Conductors #8 AWG and larger shall be spliced using a non-insulated compression type sleeve or split-bolt connector with tape covering. Splices in handholes and below grade applications shall be waterproof epoxy type.
- C. Wiring at Outlets: Install conductor at each outlet, with at least 6 inches of slack.

3.5 FIRESTOPPING

A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly according to Division 07 Section "Penetration Firestopping".

3.6 FIELD QUALITY CONTROL

- A. Perform tests and inspections and prepare test reports.
- B. Tests and Inspections:
 - 1. After installing conductors and cables and before electrical circuitry has been energized, test feeder conductors for compliance with requirements.
 - 2. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
- C. Test Reports: Prepare a written report to record the following:
 - 1. Test procedures used.
 - 2. Test results that comply with requirements.

- 3. Test results that do not comply with requirements and corrective action taken to achieve compliance with requirements.
- D. Remove and replace malfunctioning units and retest as specified above.

END OF SECTION

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes grounding systems and equipment, plus the following special applications:
 - 1. Underground distribution grounding.
- B. Related sections include the following:
 - 1. Division 01 Section "Construction Waste Management."
 - 2. Division 26 Section:
 - a. "Common Work Results for Electrical"

1.2 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Informational Submittals: Plans showing dimensioned as-built locations of grounding features specified in "Field Quality Control" Article, including the following:
 - 1. Test wells.
 - 2. Ground rods.
 - 3. Ground rings.
 - 4. Grounding arrangements and connections for separately derived systems.
- C. Qualification Data: For qualified testing agency and testing agency's field supervisor.
- D. Field quality-control reports.
- E. Operation and Maintenance Data: For grounding to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 01 Section "Operation and Maintenance Data," include the following:
 - 1. Instructions for periodic testing and inspection of grounding features at test wells grounding connections for separately derived systems.
 - a. Tests shall determine if ground-resistance or impedance values remain within specified maximums, and instructions shall recommend corrective action if values do not.
 - b. Include recommended testing intervals.

1.3 QUALITY ASSURANCE

- A. Testing Agency Qualifications: Member company of NETA or an NRTL.
 - 1. Testing Agency's Field Supervisor: Currently certified by NETA to supervise onsite testing.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. Comply with UL 467 for grounding and bonding materials and equipment.

PART 2 PRODUCTS

- 2.1 CONDUCTORS
 - A. Insulated Conductors: Copper wire or cable insulated for 600 V unless otherwise required by applicable Code or authorities having jurisdiction.
 - B. Bare Copper Conductors:
 - 1. Solid Conductors: ASTM B 3.
 - 2. Stranded Conductors: ASTM B 8.
 - 3. Tinned Conductors: ASTM B 33.
 - 4. Bonding Cable: 28 kcmil, 14 strands of No. 17 AWG conductor, 1/4 inch in diameter.
 - 5. Bonding Conductor: No. 4 or No. 6 AWG, stranded conductor.
 - 6. Bonding Jumper: Copper tape, braided conductors terminated with copper ferrules; 1-5/8 inches wide and 1/16 inch thick.
 - 7. Tinned Bonding Jumper: Tinned-copper tape, braided conductors terminated with copper ferrules; 1-5/8 inches wide and 1/16 inch thick.
 - C. Grounding Bus: Predrilled rectangular bars of annealed copper, 1/4 by 2 inches in cross section, with 9/32-inch drilled and tapped holes spaced 1-1/8 inches apart. Stand-off insulators for mounting shall comply with UL 891 for use in switchboards, 600 V. Lexan or PVC, impulse tested at 5000 V.

2.2 CONNECTORS

- A. Listed and labeled by an NRTL acceptable to authorities having jurisdiction for applications in which used and for specific types, sizes, and combinations of conductors and other items connected.
- B. Bolted Connectors for Conductors and Pipes: Copper or copper alloy, pressure type with at least two bolts.
 - 1. Pipe Connectors: Clamp type, sized for pipe.
- C. Welded Connectors: Exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.

2.3 GROUNDING ELECTRODES

A. Ground Rods: Copper-clad steel, sectional type; 3/4 inch by 10 feet in diameter.

PART 3 EXECUTION

- 3.1 APPLICATIONS
 - A. Conductors: Install solid copper conductor for No. 8 AWG and smaller, and stranded conductors for No. 6 AWG and larger unless otherwise indicated.
 - B. Underground Grounding Conductors: Install bare tinned-copper conductor, No. 3/0 AWG minimum.

- 1. Bury at least 24 inches below grade.
- C. Grounding Bus: Install in electrical and IT equipment areas, and elsewhere as indicated.
 - 1. Install bus on insulated spacers 1 inch minimum from wall, 6 inches above finished floor unless otherwise indicated.
- D. Conductor Terminations and Connections:
 - 1. Pipe and Equipment Grounding Conductor Terminations: Bolted connectors.
 - 2. Underground Connections: Welded connectors except at test wells and as otherwise indicated.
 - 3. Connections to Ground Rods at Test Wells: Bolted connectors.
 - 4. Connections to Structural Steel: Welded connectors.

3.2 GROUNDING UNDERGROUND DISTRIBUTION SYSTEM COMPONENTS

A. Comply with IEEE C2 grounding requirements.

3.3 EQUIPMENT GROUNDING

- A. Install insulated equipment grounding conductors with all feeders and branch circuits.
- B. Air-Duct Equipment Circuits: Install insulated equipment grounding conductor to ductmounted electrical devices operating at 120 V and more, including air cleaners, heaters, dampers, humidifiers, and other duct electrical equipment. Bond conductor to each unit and to air duct and connected metallic piping.
- C. Heat-Tracing Cables: Install a separate insulated equipment grounding conductor to each electric heat-tracing cable. Bond conductor to heater units, piping, connected equipment, and components.
- D. Signal and Communication Equipment: In addition to grounding and bonding required by NFPA 70, provide a separate grounding system complying with requirements in TIA/ATIS J-STD-607-A.
 - 1. For telephone, alarm, voice and data, and other communication equipment, provide No. 4 AWG minimum insulated grounding conductor in raceway from grounding electrode system to each service location, terminal cabinet, wiring closet, and central equipment location.
 - 2. Service and Central Equipment Locations and Wiring Closets: Terminate grounding conductor on a 1/4-by-4-by-12-inch grounding bus.
 - 3. Terminal Cabinets: Terminate grounding conductor on cabinet grounding terminal.
- E. Switchboards and Panelboards: Provide ground bushing on each incoming feeder conduit and connect to equipment ground bus.
- F. Transformers: The neutral of each transformer shall be grounded by a separate grounding conductor connected to the grounding transformer.

3.4 INSTALLATION

A. Grounding Conductors: Route along shortest and straightest paths possible unless otherwise indicated or required by Code. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.

- B. Ground Rods: Drive rods until tops are 2 inches below finished floor or final grade unless otherwise indicated.
 - 1. Interconnect ground rods with grounding electrode conductor below grade and as otherwise indicated. Make connections without exposing steel or damaging coating if any.
 - 2. For grounding electrode system, install at least three rods spaced at least one-rod length from each other and located at least the same distance from other grounding electrodes, and connect to the service grounding electrode conductor.
- C. Test Wells: Ground rod driven through drilled hole in bottom of handhole.
 - 1. Test Wells: Install at least one test well for each service unless otherwise indicated. Install at the ground rod electrically closest to service entrance. Set top of test well flush with finished grade or floor.
- D. Bonding Straps and Jumpers: Install in locations accessible for inspection and maintenance except where routed through short lengths of conduit.
 - 1. Bonding to Structure: Bond straps directly to basic structure, taking care not to penetrate any adjacent parts.
 - 2. Bonding to Equipment Mounted on Vibration Isolation Hangers and Supports: Install bonding so vibration is not transmitted to rigidly mounted equipment.
 - 3. Use exothermic-welded connectors for outdoor locations; if a disconnect-type connection is required, use a bolted clamp.
- E. Grounding and Bonding for Piping:
 - 1. Metal Water Service Pipe: Install insulated copper grounding conductors, in conduit, from building's main service equipment, or grounding bus, to main metal water service entrances to building. Connect grounding conductors to main metal water service pipes; use a bolted clamp connector or bolt a lug-type connector to a pipe flange by using one of the lug bolts of the flange. Where a dielectric main water fitting is installed, connect grounding conductor on street side of fitting. Bond metal grounding conductor conduit or sleeve to conductor at each end.
 - 2. Water Meter Piping: Use braided-type bonding jumpers to electrically bypass water meters. Connect to pipe with a bolted connector.
 - 3. Bond each aboveground portion of gas piping system downstream from equipment shutoff valve.
- F. Bonding Interior Metal Ducts: Bond metal air ducts to equipment grounding conductors of associated fans, blowers, electric heaters, and air cleaners. Install tinned bonding jumper to bond across flexible duct connections to achieve continuity.
- G. Grounding for Steel Building Structure: Install a driven ground rod at base of each corner column and at intermediate exterior columns at distances not more than 60 feet apart.
- H. UFER Ground (Concrete Encased Grounding Electrode): Fabricate according to NFPA 70; use a minimum of 20 feet of bare copper conductor not smaller than No. 4 AWG.

3.5 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- B. Perform the following tests and inspections and prepare test reports.

- 1. After installing grounding system but before permanent electrical circuits have been energized, test for compliance with requirements.
- 2. Inspect physical and mechanical condition. Verify tightness of accessible, bolted, electrical connections with a calibrated torque wrench according to manufacturer's written instructions.
- 3. Test completed grounding system at each location where a maximum groundresistance level is specified, at service disconnect enclosure grounding terminal, at ground test wells, and at individual ground rods. Make tests at ground rods before any conductors are connected.
 - a. Measure ground resistance no fewer than two full days after last trace of precipitation and without soil being moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural ground resistance.
 - b. Perform tests by fall-of-potential method according to IEEE 81.
- 4. Prepare dimensioned Drawings locating each test well, ground rod and ground-rod assembly, and other grounding electrodes. Identify each by letter in alphabetical order, and key to the record of tests and observations. Include the number of rods driven and their depth at each location and include observations of weather and other phenomena that may affect test results. Describe measures taken to improve test results.
- C. Grounding system will be considered defective if it does not pass tests and inspections.
- D. Prepare test and inspection reports.
- E. Report measured ground resistances that exceed the following values:
 - 1. Power and Lighting Equipment or System with Capacity of 500 kVA and Less: 10 ohms.
 - 2. Power and Lighting Equipment or System with Capacity of 500 to 1000 kVA: 5 ohms.
 - 3. Power and Lighting Equipment or System with Capacity More Than 1000 kVA: 3 ohms.
 - 4. Pad-Mounted Equipment: 5 ohms.
- F. Excessive Ground Resistance: If resistance to ground exceeds specified values, notify Architect promptly and include recommendations to reduce ground resistance.

END OF SECTION

PART 1 GENERAL

1.1 SUMMARY

- A. This Section includes the following:
 - 1. Hangers and supports for electrical equipment and systems.
 - 2. Construction requirements for concrete bases.
- B. Related Sections include the following:
 - 1. Division 01 Section "Construction Waste Management."

1.2 DEFINITIONS

- A. EMT: Electrical metallic tubing.
- B. IMC: Intermediate metal conduit.
- C. RMC: Rigid metal conduit.

1.3 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Design supports for multiple raceways, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
- B. Design supports for multiple raceways capable of supporting combined weight of supported systems and its contents.
- C. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.
- D. Rated Strength: Adequate in tension, shear, and pullout force to resist maximum loads calculated or imposed for this Project, with a minimum structural safety factor of five times the applied force.

1.4 SUBMITTALS

- A. Product Data: For the following:
 - 1. Steel slotted support systems.
 - 2. Nonmetallic slotted support systems.
- B. Shop Drawings: Signed and sealed by a qualified professional engineer. Show fabrication and installation details and include calculations for the following:
 - 1. Trapeze hangers. Include Product Data for components.
 - 2. Steel slotted channel systems. Include Product Data for components.
 - 3. Nonmetallic slotted channel systems. Include Product Data for components.
 - 4. Equipment supports.
- C. Welding certificates.

1.5 QUALITY ASSURANCE

- A. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code Steel".
- B. Comply with NFPA 70.

1.6 COORDINATION

- A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 03.
- B. Coordinate installation of roof curbs, equipment supports, and roof penetrations. These items are specified in Division 07.

PART 2 PRODUCTS

- 2.1 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS
 - A. Steel Slotted Support Systems: Comply with MFMA-4, factory-fabricated components for field assembly.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following, or an approved equal:
 - a. Allied Tube & Conduit.
 - b. Cooper B-Line, Inc.; a division of Cooper Industries.
 - c. ERICO International Corporation.
 - d. GS Metals Corp.
 - e. Thomas & Betts Corporation.
 - f. Unistrut; Tyco International, Ltd.
 - g. Wesanco, Inc.
 - h. Or approved equal.
 - 2. Metallic Coatings: Hot-dip galvanized after fabrication and applied according to MFMA-4.
 - 3. Nonmetallic Coatings: Manufacturer's standard PVC, polyurethane, or polyester coating applied according to MFMA-4.
 - 4. Painted Coatings: Manufacturer's standard painted coating applied according to MFMA-4.
 - 5. Channel Dimensions: Selected for applicable load criteria.
 - B. Raceway and Cable Supports: As described in NECA 1 and NECA 101.
 - C. Conduit and Cable Support Devices: Steel and malleable-iron hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.
 - D. Support for Conductors in Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug or plugs for non-armored electrical conductors or cables in riser conduits. Plugs shall have number, size, and shape of conductor gripping pieces as required to suit individual conductors or cables supported. Body shall be malleable iron.
 - E. Structural Steel for Fabricated Supports and Restraints: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.

- F. Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following:
 - 1. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete, steel, or wood, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.
 - a. Manufacturers: Subject to compliance with requirements, provide products by one of the following, or an approved equal:
 - 1) Hilti Inc.
 - 2) ITW Ramset/Red Head; a division of Illinois Tool Works, Inc.
 - MKT Fastening, LLC.
 - 4) Simpson Strong-Tie Co., Inc.; Masterset Fastening Systems Unit.
 - 5) Or approved equal.
 - 2. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated steel, for use in hardened portland cement concrete with tension, shear, and pullout capacities appropriate for supported loads and building materials in which used.
 - a. Manufacturers: Subject to compliance with requirements, provide products by one of the following, or an approved equal:
 - 1) Cooper B-Line, Inc.; a division of Cooper Industries.
 - 2) Empire Tool and Manufacturing Co., Inc.
 - 3) Hilti Inc.
 - 4) ITW Ramset/Red Head; a division of Illinois Tool Works, Inc.
 - 5) MKT Fastening, LLC.
 - 6) Or approved equal.
 - 3. Concrete Inserts: Steel or malleable-iron, slotted support system units similar to MSS Type 18; complying with MFMA-4 or MSS SP-58.
 - 4. Clamps for Attachment to Steel Structural Elements: MSS SP-58, type suitable for attached structural element.
 - 5. Through Bolts: Structural type, hex head, and high strength. Comply with ASTM A 325.
 - 6. Toggle Bolts: All-steel springhead type.
 - 7. Hanger Rods: Threaded steel.

2.2 FABRICATED METAL EQUIPMENT SUPPORT ASSEMBLIES

- A. Description: Welded or bolted, structural-steel shapes, shop or field fabricated to fit dimensions of supported equipment.
- B. Materials: Comply with requirements in Division 05 Section "Metal Fabrications" 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 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.
 - 2. Whenever possible, conduit shall be top mounted.
 - 3. Each conduit shall be individually clamped to supports.
 - 4. Parallel runs of conduit shall be grouped and fastened to walls with wall brackets of steel channel or knee-braced angles.
- D. Spring-steel clamps designed for supporting single conduits without bolts may be used for 1-1/2-inch and smaller raceways serving branch circuits and communication systems above suspended ceilings and for fastening raceways to trapeze supports.
- E. Where conduit runs vertically, approved riser clamps, brackets, or other means shall be utilized to support conduit at 8 foot center-to-center, maximum.
- F. Single runs of conduit shall be fastened to walls with one-hole straps or conduit clamps and to beams and trusses with beam clamps.
- G. Peforated band iron, piano wire, or steel wire hangers will not be permitted as conduit hangers or supports. Conduit shall not be hung from wire supporting ceiling grid systems.

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, RMC may be supported by openings through structure members, as permitted in NFPA 70.
- C. Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb.
- D. Mounting and Anchorage of Surface-Mounted Equipment and Components: Anchor and fasten electrical items and their supports to building structural elements by the following methods unless otherwise indicated by code:
 - 1. To Wood: Fasten with lag screws or through bolts.
 - 2. To New Concrete: Bolt to concrete inserts.
 - 3. To Masonry: Approved toggle-type bolts on hollow masonry units and expansion anchor fasteners on solid masonry units.
 - 4. To Existing Concrete: Expansion anchor fasteners.
 - 5. Instead of expansion anchors, powder-actuated driven threaded studs provided with lock washers and nuts may be used in existing standard-weight concrete 4 inches (100 mm) thick or greater. Do not use for anchorage to lightweight-aggregate concrete or for slabs less than 4 inches thick.
 - 6. To Steel: Welded threaded studs complying with AWS D1.1/D1.1M, with lock washers and nuts.

- 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 by means that meet seismic-restraint strength and anchorage requirements.
- 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 05 Section "Metal Fabrications" for sitefabricated metal supports.
- B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor electrical materials and equipment.
- C. Field Welding: Comply with AWS D1.1/D1.1M.

3.4 CONCRETE BASES

- A. Construct concrete bases of dimensions indicated but not less than 4 inches (100 mm) larger in both directions than supported unit, and so anchors will be a minimum of 10 bolt diameters from edge of the base.
- B. Use 3000-psi, 28-day compressive-strength concrete. Concrete materials, reinforcement, and placement requirements are specified in Division 03 Section "Cast-in-Place Concrete".
- C. Anchor equipment to concrete base.
 - 1. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - 2. Install anchor bolts to elevations required for proper attachment to supported equipment.
 - 3. Install anchor bolts according to anchor-bolt manufacturer's written instructions.

3.5 PAINTING

- A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.
 - 1. Apply paint by brush or spray to provide minimum dry film thickness of 2.0 mils.
- B. Touchup: Comply with requirements in Division 09 Painting Sections for cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal.
- C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END OF SECTION

PART 1 GENERAL

1.1 SUMMARY

- A. This Section includes raceways, fittings, boxes, enclosures, and cabinets for electrical wiring.
- B. Related Sections include the following:
 - 1. Division 01 Section "Construction Waste Management".
 - 2. Division 26 Section "Underground Ducts and Raceways for Electrical Systems" for exterior ductbanks, and underground utility construction.
 - 3. Division 26 Section "Common Work Results for Electrical".
 - 4. Division 26 Section "Hangers and Supports for Electrical Systems" for raceway and box supports.

1.2 DEFINITIONS

- A. EMT: Electrical metallic tubing.
- B. ENT: Electrical nonmetallic tubing.
- C. EPDM: Ethylene-propylene-diene terpolymer rubber.
- D. FMC: Flexible metal conduit.
- E. IMC: Intermediate metal conduit.
- F. LFMC: Liquidtight flexible metal conduit.
- G. LFNC: Liquidtight flexible nonmetallic conduit.
- H. NBR: Acrylonitrile-butadiene rubber.
- I. RNC: Rigid nonmetallic conduit.

1.3 SUBMITTALS

- A. Product Data: For conduit, boxes, wireways and fittings, hinged-cover enclosures, and cabinets.
- B. Shop Drawings: For the following raceway components. Include plans, elevations, sections, details, and attachments to other work.
 - 1. Custom enclosures and cabinets.
- C. Qualification Data: For professional engineer and testing agency.
- D. Source quality-control test reports.

1.4 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Comply with NFPA 70.

PART 2 PRODUCTS

- 2.1 METAL CONDUIT AND TUBING
 - A. Available Manufacturers: Subject to compliance with requirements, provide products by one of the following, or an approved equal:
 - 1. AFC Cable Systems, Inc.
 - 2. Alflex Inc.
 - 3. Allied Tube & Conduit; a Tyco International Ltd. Co.
 - 4. Anamet Electrical, Inc.; Anaconda Metal Hose.
 - 5. Electri-Flex Co.
 - 6. Manhattan/CDT/Cole-Flex.
 - 7. Maverick Tube Corporation.
 - 8. O-Z Gedney; a unit of General Signal.
 - 9. Wheatland Tube Company.
 - 10. Or approved equal.
 - B. Rigid Steel Conduit: ANSI C80.1.
 - C. IMC: ANSI C80.6.
 - D. EMT: ANSI C80.3.
 - E. FMC: Zinc-coated steel.
 - F. LFMC: Flexible steel conduit with PVC jacket.
 - G. Fittings for Conduit (Including all Types and Flexible and Liquidtight), EMT, and Cable: NEMA FB 1; listed for type and size raceway with which used, and for application and environment in which installed.
 - 1. Conduit Fittings for Hazardous (Classified) Locations: Comply with UL 886.
 - 2. Fittings for EMT: Steel compression type. <u>Set screw and indention type fittings</u> <u>are not allowed.</u>
 - 3. Fittings for rigid steel conduit shall be threaded.
 - 4. Expansion fittings shall be galvanized ductile or malleable iron. Rigid conduit expansion fittings shall be DZ/Gedney type AX or approved equal. EMT fittings shall be DZ/Gedney type TX with compression fitting or approved equal.
 - H. Joint Compound for Rigid Steel Conduit or IMC: Listed for use in cable connector assemblies and compounded for use to lubricate and protect threaded raceway joints from corrosion and enhance their conductivity.

2.2 NONMETALLIC CONDUIT AND TUBING

- A. Available Manufacturers: Subject to compliance with requirements, provide products by one of the following, or an approved equal:
 - 1. AFC Cable Systems, Inc.
 - 2. Anamet Electrical, Inc.; Anaconda Metal Hose.
 - 3. Arnco Corporation.
 - 4. CANTEX Inc.

- 5. CertainTeed Corp.; Pipe & Plastics Group.
- 6. Condux International, Inc.
- 7. ElecSYS, Inc.
- 8. Electri-Flex Co.
- 9. Lamson & Sessions; Carlon Electrical Products.
- 10. Manhattan/CDT/Cole-Flex.
- 11. RACO; a Hubbell Company.
- 12. Thomas & Betts Corporation.
- 13. Or approved equal.
- B. RNC: NEMA TC 2, Type EPC-40-PVC, unless otherwise indicated.
- C. LFNC: UL 1660.
- D. Fittings for RNC: NEMA TC 3; match to conduit or tubing type and material.
- E. Fittings for LFNC: UL 514B.

2.3 METAL WIREWAYS

- A. Available Manufacturers: Subject to compliance with requirements, provide products by one of the following, or an approved equal:
 - 1. Cooper B-Line, Inc.
 - 2. Hoffman.
 - 3. Square D; Schneider Electric.
 - 4. Or approved equal.
- B. Description: Sheet metal sized and shaped as indicated, NEMA 250, Type 1, unless otherwise indicated.
- C. Fittings and Accessories: Include couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.
- D. Wireway Covers: Hinged type unless otherwise indicated.
- E. Finish: Manufacturer's standard enamel finish.

2.4 BOXES, ENCLOSURES AND CABINETS

- A. Available Manufacturers: Subject to compliance with requirements, provide products by one of the following, or an approved equal:
 - 1. Cooper Crouse-Hinds; Div. of Cooper Industries, Inc.
 - 2. EGS/Appleton Electric.
 - 3. Erickson Electrical Equipment Company.
 - 4. Hoffman.
 - 5. Hubbell Incorporated; Killark Electric Manufacturing Co. Division.
 - 6. O-Z/Gedney; a unit of General Signal.
 - 7. RACO; a Hubbell Company.
 - 8. Robroy Industries, Inc.; Enclosure Division.
 - 9. Scott Fetzer Co.; Adalet Division.
 - 10. Spring City Electrical Manufacturing Company.
 - 11. Thomas & Betts Corporation.

- 12. Walker Systems, Inc.; Wiremold Company (The).
- 13. Woodhead, Daniel Company; Woodhead Industries, Inc. Subsidiary.
- 14. Or approved equal.
- B. Sheet Metal Outlet and Device Boxes: NEMA OS 1.
- C. Cast-Metal Outlet and Device Boxes: NEMA FB 1, ferrous alloy, Type FD, with gasketed cover.
- D. Nonmetallic Outlet and Device Boxes: NEMA OS 2.
- E. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.
- F. Cast-Metal Access, Pull, and Junction Boxes: NEMA FB 1, galvanized, cast iron with gasketed cover.
- G. Stainless Steel Outlet and Devices Boxes: ASTM A351, CF8M
- H. Hinged-Cover Enclosures: NEMA 250, Type 1, with continuous-hinge cover with flush latch, unless otherwise indicated.
 - 1. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.
 - 2. Nonmetallic Enclosures: Plastic.
- I. Cabinets:
 - 1. NEMA 250, Type 1, galvanized-steel box with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel.
 - 2. Hinged door in front cover with flush latch and concealed hinge.
 - 3. Key latch to match panelboards.
 - 4. Metal barriers to separate wiring of different systems and voltage.
 - 5. Accessory feet where required for freestanding equipment.

PART 3 EXECUTION

- 3.1 RACEWAY APPLICATION
 - A. Outdoors: Apply raceway products as specified below, unless otherwise indicated:
 - 1. Exposed Conduit: Rigid steel conduit.
 - 2. Concealed Conduit, Aboveground: Rigid steel conduit or EMT.
 - 3. Underground Conduit: RNC, Type EPC-40-PVC, direct buried, unless noted otherwise.
 - 4. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC.
 - 5. Boxes and Enclosures, Aboveground: NEMA 250, Type 3R. Cast malleable iron with threaded hubs and vellumoid gasket.
 - B. Comply with the following indoor applications, unless otherwise indicated:
 - 1. Exposed in non-inmate areas, Not Subject to Physical Damage: EMT or rigid metal conduit.
 - 2. Exposed and Subject to Severe Physical Damage: Rigid steel conduit or IMC.
 - 3. Concealed in Ceilings and Interior Walls and Partitions: EMT.

- 4. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): FMC, except use LFMC in damp or wet locations.
- 5. Damp or Wet Locations: Rigid steel conduit or IMC.
- 6. Boxes and Enclosures: NEMA 250, Type 1 except use NEMA 250, type 4, stainless steel in damp or wet conditions.
 - a. Minimum outlet box depth shall be 2 1/8 inches.
 - b. Four inch octagonal outlet boxes shall be provided for wall and ceiling mounted fixtures. Outlet boxes shall be provided with fixture studs as required for mounting fixture. Swivel aligners shall be provided for all suspended fixtures.
 - c. Four inch square outlet boxes shall be provided for switches and convenience outlet boxes. A 4 inch by 2 1/8 inch handy box may be used for these devices when only one raceway enters the outlet box.
 - d. Four inch square outlet boxes shall be provided for voice outlets, data outlets, and other special system outlets unless larger outlet boxes are specified elsewhere.
 - e. Square cornered boxes shall be provided in block and brick wall construction.
- 7. Boxes and enclosures in inmate areas: NEMA 250, Type 1. Cast malleable iron with threaded hubs and vellumoid gasket.
- C. Minimum Raceway Size: 1/2-inch trade size.
- D. Raceway Fittings: Compatible with raceways and suitable for use and location.
 - 1. Rigid and Intermediate Steel Conduit: Use threaded rigid steel conduit fittings, unless otherwise indicated.

3.2 INSTALLATION

- A. Comply with NECA 1 for installation requirements applicable to products specified in Part 2 except where requirements on Drawings or in this Article are stricter.
- B. Keep raceways at least 12 inches away from parallel runs of flues and uninsulated steam or hot-water pipes, 6 inches if crossing. Where lines are insulated, conduit parallel or crossing shall be at least 2 inches away. Install horizontal raceway runs above water and steam piping.
- C. Complete raceway installation before starting conductor installation. All conduit shall be swabbed and cleaned before pulling wire.
- D. Support raceways as specified in Division 26 Section "Hangers and Supports for Electrical Systems". Conduit shall be securely fastened in place within 3 feet of each outlet box, junction box, cabinet, or fitting and shall be supported at least every 10 feet. No conduit shall be supported by the equipment to which it is connected.
- E. Arrange stub-ups so curved portions of bends are not visible above the finished slab.
- F. Install no more than the equivalent of three 90-degree bends in any conduit run except for communications conduits, for which fewer bends are allowed.

- G. Conceal conduit and EMT within finished walls, ceilings, and floors, unless otherwise indicated.
- H. Do not embed raceways in slabs.
- I. Threaded Conduit Joints, Exposed to Wet, Damp, Corrosive, or Outdoor Conditions: Apply listed compound to threads of raceway and fittings before making up joints. Follow compound manufacturer's written instructions.
- J. Raceway Terminations at Locations Subject to Moisture or Vibration: Use insulating bushings to protect conductors, including conductors smaller than No. 4 AWG.
- K. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 200-lb tensile strength. Leave at least 12 inches of slack at each end of pull wire.
- L. Install raceway sealing fittings at suitable, approved, and accessible locations and fill them with listed sealing compound. For concealed raceways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install raceway sealing fittings at the following points:
 - 1. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
 - 2. Where otherwise required by NFPA 70.
- M. Flexible Conduit Connections: Use maximum of 72 inches of flexible conduit for equipment subject to vibration, noise transmission, or movement; and for transformers and motors.
 - 1. Use LFMC in damp or wet locations subject to severe physical damage.
 - 2. Use LFMC or LFNC in damp or wet locations not subject to severe physical damage.
- N. Recessed Boxes in Masonry Walls: Saw-cut opening for box in center of cell of masonry block and install box flush with surface of wall.
- O. Metallic conduit systems shall be electrically continuous in their entirety.
- P. All conduit shall be capped before concrete is poured.
- Q. Outlet boxes shall be provided for all devices. Pull boxes and junction boxes shall be provided at all points of splicing and tapping.
- R. Boxes shall not be installed back-to-back in any wall but shall be staggered at least 12 inches apart.
- S. Boxes and supports shall be fastened to wood with wood screws or screw-type nails of equal holding strength with bolts and expansion shields on concrete or brick, with toggle bolts on hollow masonry block and with screws or welded studs on steel work.
- T. Threaded studs driven in by powder charge and provided with lock washers and nuts, or nail-type nylon anchors, may be used in lieu of wood screws, expansion shields or machine screws.

- U. Outlet boxes in lay-in ceilings shall be supported by bar hangers anchored to the ceiling construction.
- V. Connections between outlet boxes on the opposite sides of a wall shall be made with conduit employing the use of two 90 degree bends from box to box.
- W. All boxes shall be accessible.
- X. Conduit shall be run with smooth, easy bends. Exposed conduit shall be run parallel or perpendicular to walls, ceilings, beams, and columns. Concealed conduit may be run at angles other than parallel or perpendicular to building lines but shall be grouped in a neat and workmanlike manner. Dissimilar angles and crisscross arrangement will not be acceptable.
- Y. Conduit bends and elbows shall be long-sweep, large radii when required by cable manufacturer.
- Z. Utilize grounding/bonding jumpers with u-bolt connections and tinned copper braid at expansion fittings.
- AA. Raceways that pass through insulated metal panels shall be sealed around penetration.

3.3 INSTALLATION OF UNDERGROUND CONDUIT

- A. Direct-Buried Conduit:
 - 1. Excavate trench bottom to provide firm and uniform support for conduit.
 - 2. Install backfill as specified.
 - 3. After installing conduit, backfill and compact. Start at tie-in point, and work toward end of conduit run, leaving conduit at end of run free to move with expansion and contraction as temperature changes during this process. Firmly hand tamp backfill around conduit to provide maximum supporting strength. After placing controlled backfill to within 12 inches of finished grade, make final conduit connection at end of run and complete backfilling with normal compaction as specified.
 - 4. Install manufactured duct elbows for stub-ups at equipment and at building entrances through the floor, unless otherwise indicated. Encase elbows for stub-up ducts throughout the length of the elbow.
 - 5. Install manufactured rigid steel conduit elbows for stub-ups at equipment and at building entrances through the floor.
 - a. Couple steel conduits to ducts with adapters designed for this purpose and encase coupling with 3 inches of concrete.
 - b. For stub-ups at equipment mounted on outdoor concrete bases, extend steel conduit horizontally a minimum of 60 inches from edge of equipment pad or foundation. Install insulated grounding bushings on terminations at equipment.
 - 6. Warning Tape: Bury magnetic warning tape approximately 12 inches above directburied conduits, as specified in Division 26 Section "Underground Ducts and Raceways for Electrical Systems".

3.4 FIRESTOPPING

A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly. Firestopping materials and installation requirements are specified in Division 07 Section "Penetration Firestopping".

3.5 PROTECTION

- A. Provide final protection and maintain conditions that ensure coatings, finishes, and cabinets are without damage or deterioration at time of Substantial Completion.
 - 1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
 - 2. Repair damage to PVC or paint finishes with matching touchup coating recommended by manufacturer.

END OF SECTION

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 aluminum cable trays and accessories.
- B. This section covers and applies to all work specified in Division 26, 27 and 28.
- C. Related sections include the following:
 - 1. Division 7 Section "Penetration Firestopping".
 - 2. Division 26 Sections:
 - a. "Common Work Results for Electrical"
 - b. "Grounding and Bonding for Electrical Systems"
 - c. "Hangers and Supports for Electrical Systems"

1.3 SUBMITTALS

- A. Product Data: Include data indicating dimensions and finishes for each type of cable tray indicated.
- B. Shop Drawings: For each type of cable tray.
 - 1. Show fabrication and installation details of cable tray, including plans, elevations, and sections of components and attachments to other construction elements. Designate components and accessories, including clamps, brackets, hanger rods, splice-plate connectors, expansion-joint assemblies, straight lengths, and fittings.
- C. Field quality-control reports.
- D. Operation and Maintenance Data: For cable trays to include in emergency, operation, and maintenance manuals.

1.4 QUALITY ASSURANCE

- A. Source Limitations: Obtain cable tray components 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 intended use.
- C. Comply with NFPA 70.
- 1.5 DELIVERY, STORAGE AND HANDLING
 - A. Store indoors to prevent water or other foreign materials from staining or adhering to cable tray. Unpack and dry wet materials before storage.

PART 2 - PRODUCTS

2.1 CABLE RUNWAY

- A. Manufactures: Subject to compliance with requirements, provide products by one of the following:
 - 1. Chatsworth
- B. Materials and Finishes:
 - 1. 1.5 inches high x 0.4 inches wide tubular steel with 0.065 inch wall thickness.
 - 2. 1.5 inch wide cross members welded between the rack stringers on 12 inch intervals.
 - 3. Finishes: Powder coat paint in black.
- C. Fittings:
 - 1. Cable Runway Splices: Mechanically connect rack sections and turns together end-to-end to form a continuous pathway for cables. Finish to match ladder rack.
 - 2. Cable Runway Supports: Sized to match the width of runway that is supported. Finish to match runway.
 - 3. Pathway Dividers: 6.8 inch high x 1.5 inch wide x 2.2 inch deep.
 - 4. Cross Radius Drop and Stinger Radius Drop: 0.060 inch thick steel, 4.6 inches high x 6.1 inches.
 - 5. Cable retaining posts.
 - 6. Cable runway protective end caps.
- 2.2 WARNING SIGNS
 - A. Lettering: 1-1/2-inch-high, black letters on yellow background with legend "WARNING! NOT TO BE USED AS WALKWAY, LADDER, OR SUPPORT FOR LADDERS OR PERSONNEL".
 - B. Materials and fastening are specified in Division 26 Section "Identification for Electrical Systems".
- 2.3 SOURCE QUALITY CONTROL
 - A. Perform design and production tests according to NEMA VE 1.

PART 3 - EXECUTION

3.1 CABLE TRAY INSTALLATION

- A. Comply with recommendations in NEMA VE 2. Install as a complete system, including all necessary fasteners, hold-down clips, splice-plate support systems, barrier strips, hinged horizontal and vertical splice plates, elbows, reducers, tees, and crosses.
- B. Remove burrs and sharp edges from cable trays.
- C. Fasten cable tray supports to building structure and install seismic restraints.

- 1. Design each fastener and support to carry load indicated by seismic requirements and to comply with seismic-restraint according to Division 26 Section "Vibration and Seismic Controls for Electrical Systems".
- 2. Place supports so that spans do not exceed maximum spans on schedules.
- 3. Construct supports from channel members, threaded rods, and other appurtenances furnished by cable tray manufacturer. Arrange supports in trapeze or wall-bracket form as required by application.
- 4. Support bus assembly to prevent twisting from eccentric loading.
- 5. Locate and install supports according to NEMA VE 1.
- D. Make connections to equipment with flanged fittings fastened to cable tray and to equipment. Support cable tray independent of fittings. Do not carry weight of cable tray on equipment enclosure.
- E. Install expansion connectors where cable tray crosses building expansion joint and in cable tray runs that exceed dimensions recommended in NEMA VE 1. Space connectors and set gaps according to applicable standard.
- F. Make changes in direction and elevation using standard fittings.
- G. Make cable tray connections using standard fittings.
- H. Seal penetrations through fire and smoke barriers according to Division 07 Section "Penetration Firestopping".
- I. Sleeves for Future Cables: Install capped sleeves for future cables through firestopsealed cable tray penetrations of fire and smoke barriers.
- J. Workspace: Install cable trays with enough space to permit access for installing cables.
- K. After installation of cable trays is completed, install warning signs in visible locations on or near cable trays.
- L. Cable Runway: Provide protective end caps on all exposed ends. Provide cable retaining posts on stingers edges. Provide radius drops where cables exit cable runway.

3.2 CABLE INSTALLATION

- A. Install cables only when cable tray installation has been completed and inspected.
- B. Fasten cables on horizontal runs with cable clamps or cable ties as recommended by NEMA VE 2. Tighten clamps only enough to secure the cable, without indenting the cable jacket. Install cable ties with a tool that includes an automatic pressure-limiting device.
- C. On vertical runs, fasten cables to tray every 18 inches. Install intermediate supports when cable weight exceeds the load-carrying capacity of the tray rungs.

3.3 CONNECTIONS

- A. Ground cable trays according to manufacturer's written instructions.
- B. Install an insulated equipment grounding conductor with cable tray, in addition to those required by NFPA 70.

3.4 FIELD QUALITY CONTROL

- A. After installing cable trays and after electrical circuitry has been energized, survey for compliance with requirements. Perform the following field quality-control survey:
 - 1. Visually inspect cable insulation for damage. Correct sharp corners, protuberances in cable tray, vibration, and thermal expansion and contraction conditions, which may cause or have caused damage.
 - 2. Verify that the number, size, and voltage of cables in cable tray do not exceed that permitted by NFPA 70. Verify that communication or data-processing circuits are separated from power circuits by barriers.
 - 3. Verify that there is no intrusion of such items as pipe, hangers, or other equipment that could damage cables.
 - 4. Remove deposits of dust, industrial process materials, trash of any description, and any blockage of tray ventilation.
 - 5. Visually inspect each cable tray joint and each ground connection for mechanical continuity. Check bolted connections between sections for corrosion. Clean and retorque in suspect areas.
 - 6. Check for missing or damaged bolts, bolt heads, or nuts. When found, replace with specified hardware.
 - 7. Perform visual and mechanical checks for adequacy of cable tray grounding; verify that all takeoff raceways are bonded to cable tray.
- B. Report results in writing.

3.5 PROTECTION

- A. Protect installed cable trays.
 - 1. Repair damage to galvanized finishes with zinc-rich paint recommended by cable tray manufacturer.
 - 2. Repair damage to PVC or paint finishes with matching touchup coating recommended by cable tray manufacturer.
 - 3. Install temporary protection for cables in open trays to protect exposed cables from falling objects or debris during construction. Temporary protection for cables and cable tray can be constructed of wood or metal materials until the risk of damage is over.

END OF SECTION

PART 1 GENERAL

1.1 SUMMARY

- A. This Section includes the following:
 - 1. Conduit, ducts, and duct accessories for direct-buried and concrete-encased duct banks.
 - 2. Handholes and pull boxes.
- B. Related sections include the following:
 - 1. Division 26 Section "Common Work Results for Electrical Systems"

1.2 DEFINITION

A. RNC: Rigid nonmetallic conduit.

1.3 SUBMITTALS

- A. Product Data: For the following:
 - 1. Duct-bank materials, including separators and miscellaneous components.
 - 2. Ducts and conduits and their accessories, including elbows, end bells, bends, fittings, and solvent cement.
 - 3. Accessories for handholes and pull boxes.
 - 4. Warning tape.
 - 5. Handholes.
- B. Product Certificates: For concrete and steel used in precast concrete pull boxes and handholes, as required by ASTM C 858.
- C. Qualification Data: For professional engineer and testing agency.
- D. Source quality-control test reports.
- E. Field quality-control test reports.

1.4 QUALITY ASSURANCE

- A. Testing Agency Qualifications: Qualified according to ASTM E 329 for testing indicated.
- B. Comply with ANSI C2.
- C. Comply with NFPA 70.
- 1.5 DELIVERY, STORAGE AND HANDLING
 - A. Deliver ducts to Project site with ends capped. Store nonmetallic ducts with supports to prevent bending, warping, and deforming. Nonmetallic conduit shall be protected from the direct rays of the sun.
 - B. Store handholes at Project site as recommended by manufacturer to prevent physical damage. Arrange so identification markings are visible.

C. Lift and support handholes units only at designated lifting or supporting points.

1.6 PROJECT CONDITIONS

- A. Interruption of Existing Electrical and Communication Service: Do not interrupt electrical or communication service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide any required temporary communication service according to requirements indicated:
 - 1. Notify Architect no fewer than seven days in advance of proposed interruption of communication service.
 - 2. Do not proceed with interruption of communication service without Architect's written permission.

1.7 COORDINATION

- A. Coordinate layout and installation of ducts, handholes, and pull boxes with final arrangement of other utilities, site grading, and surface features as determined in the field.
- B. Coordinate elevations of ducts and duct-bank entrances into handholes with final locations and profiles of ducts and duct banks as determined by coordination with other utilities, underground obstructions, and surface features. Revise locations and elevations from those indicated as required to suit field conditions and to ensure that duct runs drain to handholes, and as approved by Architect.

PART 2 PRODUCTS

- 2.1 CONDUIT
 - A. Rigid Steel Conduit: Galvanized. Comply with ANSI C80.1.
 - B. RNC: NEMA TC 2, Type EPC-40-PVC, UL 651, with matching fittings by same manufacturer as the conduit, complying with NEMA TC 3 and UL 514B.

2.2 NONMETALLIC DUCTS AND DUCT ACCESSORIES

- 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. Cantex, Inc.
 - 2. CertainTeed Corp.; Pipe & Plastics Group.
 - 3. IPEX Inc.
 - 4. Lamson & Sessions; Carlon Electrical Products.
 - 5. Or Approved Equal.
- B. Underground Plastic Utilities Duct: NEMA TC 6 & 8, Type DB-60-PVC, ASTM F 512, with matching fittings by the same manufacturer as the duct, complying with NEMA TC 9.
- C. Duct Accessories:
 - 1. Duct Separators: Factory-fabricated rigid PVC interlocking spacers, sized for type and sizes of ducts with which used, and selected to provide minimum duct

spacings indicated while supporting ducts during concreting or backfilling. Solid plane type spacers are not acceptable.

- 2. Warning Tape:
 - a. Tape:
 - 1) Recommended by manufacturer for the method of installation and suitable to identify and locate underground utility lines.
 - 2) Printing on tape shall be permanent and shall not be damaged by burial operations.
 - 3) Tape material and ink shall be chemically inert, and not subject to degrading when exposed to acids, alkalis, and other destructive substances commonly found in soils.
 - b. Color and Printing:
 - 1) Comply with ANSI Z535.1 through ANSI Z535.5.
 - 2) Inscriptions for Tapes: COMMUNICATIONS CABLE for
 - communications ducts and ELECTRIC for electric ducts.
 - 3) Communications tape shall be orange and electric shall be red.
 - c. Tag:
 - 1) Detectable three-layer laminate, consisting of a printed pigmented polyolefin film, a solid aluminum-foil core, and a clear protective film that allows inspection of the continuity of the conductive core, bright-colored, compounded for direct-burial service.
 - 2) Overall Thickness: 5 mils.
 - 3) Foil Core Thickness: 0.35 mil.
 - 4) Weight: 28 lb/1000 sq. ft.
 - 5) 3-Inch (75-mm) Tensile According to ASTM D 882: 70 lbf, and 4600 psi.

2.3 HANDHOLES AND PULL BOXES OTHER THAN PRECAST CONCRETE

- A. Description: Comply with SCTE 77.
 - 1. Color: Gray.
 - 2. Configuration: Units shall be designed for flush burial and have open bottom unless otherwise indicated.
 - 3. Cover: Weatherproof, secured by tamper-resistant locking devices and having structural load rating consistent with enclosure.
 - 4. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.
 - 5. Cover Legend: Molded lettering,
 - a. "ELECTRIC."
 - b. Tier level number, indicating that the unit complies with the structural load test for that tier according to SCTE 77.
 - 6. Direct-Buried Wiring Entrance Provisions: Knockouts equipped with insulated bushings or end-bell fittings, retained to suit box material, sized for wiring indicated, and arranged for secure, fixed installation in enclosure wall.
 - 7. Duct Entrance Provisions: Duct-terminating fittings shall mate with entering ducts for secure, fixed installation in enclosure wall.
 - 8. Handholes 12 inches wide by 24 inches long and larger shall have factory-installed inserts for cable racks and pulling-in irons.

- B. Polymer Concrete Handholes and Pull Boxes with Polymer Concrete Cover: Molded of sand and aggregate, bound together with a polymer resin, and reinforced with steel or fiberglass or a combination of the two. Handholes and pull boxes shall comply with the requirements of SCTE 7 Tier 15 and Tier 22 loading.
 - 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. Armorcast Products Company.
 - b. Carson Industries LLC.
 - c. CDR Systems Corporation.
 - d. Hubbell Power Systems; Lenoir City Division.
 - e. NewBasis.
 - f. Or Approved Equal.

2.4 SOURCE QUALITY CONTROL

A. Test and inspect precast concrete utility structures according to ASTM C 1037.

PART 3 EXECUTION

3.1 UNDERGROUND DUCT APPLICATION

- A. Underground Ducts for Electric: RNC, NEMA Type EPC-40-PVC in concrete-encased duct bank, unless otherwise indicated.
- 3.2 UNDERGROUND ENCLOSURE APPLICATION
 - A. Handholes and Pull Boxes:
 - 1. Do not place unit in roadways or other deliberate traffic path.
 - 2. Units in Driveway, Parking Lot, and Off-Roadway Locations, Subject to Occasional, Nondeliberate Loading by Heavy Vehicles: Polymer concrete, SCTE 77, Tier 15 or Tier 22 structural load rating.
 - 3. Units in Sidewalk and Similar Applications with a Safety Factor for Nondeliberate Loading by Vehicles: Polymer concrete units, SCTE 77, Tier 15 or Tier 22 structural load rating.
 - 4. Units Subject to Light-Duty Pedestrian Traffic Only: Polymer concrete units, SCTE 77, Tier 15 or Tier 22 structural load rating.

3.3 EARTHWORK

- A. Excavation and Backfill: Comply with Division 02 "Sitework".
- B. Restore surface features at areas disturbed by excavation and reestablish original grades, unless otherwise indicated. Replace removed sod immediately after backfilling is completed.
- C. Restore areas disturbed by trenching, storing of dirt, cable laying, and other work. Restore vegetation and include necessary topsoiling, fertilizing, liming, seeding, sodding, sprigging, and mulching.
- D. Cut and patch existing pavement in the path of underground ducts and utility structures.

3.4 DUCT INSTALLATION

- A. Curves and Bends: Use 5-degree angle couplings for small changes in direction. Use manufactured long sweep bends minimum of 48 inches, both horizontally and vertically, at other locations, unless otherwise indicated.
- B. Joints: Use solvent-cemented joints in ducts and fittings and make watertight according to manufacturer's written instructions. Stagger couplings so those of adjacent ducts do not lie in same plane.
- C. Duct Entrances to Polymer Concrete Handholes: Use end bells, spaced approximately 10 inches o.c. for 5-inch ducts, and vary proportionately for other duct sizes.
 - 1. Begin change from regular spacing to end-bell spacing 10 feet (3 m) from the end bell without reducing duct line slope and without forming a trap in the line.
 - 2. Direct-Buried Duct Banks: Install an expansion and deflection fitting in each conduit in the area of disturbed earth adjacent to handhole.
 - 3. Grout end bells into structure walls from both sides to provide watertight entrances.
- D. Sealing: Provide temporary closure at terminations of ducts that have cables pulled. Seal spare ducts at terminations. Use sealing polyethylene plugs to withstand at least 15-psig hydrostatic pressure.
- E. Pulling Cord: Install 100-lbf-test nylon cord in all ducts provided, including spares.
- F. Concrete-Encased Ducts: Support ducts on duct separators.
 - 1. Separator Installation: Space separators close enough to prevent sagging and deforming of ducts, with not less than 4 spacers per 20 feet of duct. Secure separators to earth and to ducts to prevent floating during concreting. Stagger separators approximately 6 inches between tiers. Tie entire assembly together using fabric straps.
 - 2. Concreting Sequence: Pour each run of envelope between terminations in one continuous operation.
 - a. Start at one end and finish at the other, allowing for expansion and contraction of ducts as their temperature changes during and after the pour. Use expansion fittings installed according to manufacturer's written recommendations or use other specific measures to prevent expansion-contraction damage.
 - b. If more than one pour is necessary, terminate each pour in a vertical plane and install 3/4-inch reinforcing rod dowels extending 18 inches into concrete on both sides of joint near corners of envelope.
 - 3. Pouring Concrete: Spade concrete carefully during pours to prevent voids under and between conduits and at exterior surface of envelope. Do not allow a heavy mass of concrete to fall directly onto ducts. Use a plank to direct concrete down sides of bank assembly to trench bottom. Allow concrete to flow to center of bank and rise up in middle, uniformly filling all open spaces. Power driven agitating equipment specifically designed for duct bank applications shall be used.
 - 4. Forms: Use walls of trench to form side walls of duct bank where soil is selfsupporting and concrete envelope can be poured without soil inclusions; otherwise, use forms.
 - 5. Minimum Space between Ducts: 3 inches between ducts and exterior envelope wall, 1.5 inches between ducts for like services.

- 6. Depth: Install top of duct bank at least 24 inches below grade, unless otherwise indicated.
- 7. Provide pulling eyes opposite each duct entry.
- 8. Warning Tape: Bury warning tape approximately 12 inches above all concreteencased ducts and duct banks. Align tape parallel to and within 3 inches of the centerline of duct bank. Provide an additional warning tape for each 12-inch increment of duct-bank width over a nominal 18 inches. Space additional tapes 12 inches apart, horizontally.

3.5 INSTALLATION OF HANDHOLES AND PULL BOXES

- A. Install handholes and pull boxes level and plumb and with orientation and depth coordinated with connecting ducts to minimize bends and deflections required for proper entrances. Use pull box extension if required to match depths of ducts, and seal joint between box and extension as recommended by the manufacturer.
- B. Unless otherwise indicated, support units on a level 6-inch-thick bed of crushed stone or gravel, graded from 1/2-inch sieve to No. 4 sieve and compacted to same density as adjacent undisturbed earth.
- C. Elevation: Set so cover surface will be flush with finished grade.
- D. Install handholes and pull boxes with bottom below the frost line, below grade.
- E. Install removable hardware, including pulling eyes, cable stanchions, cable arms, and insulators, as required for installation and support of cables and conductors and as indicated. Retain arm lengths to be long enough to provide spare space for future cables, but short enough to preserve adequate working clearances in the enclosure.
- F. Field-cut openings for ducts and conduits according to enclosure manufacturer's written instructions. Cut wall of enclosure with a tool designed for material to be cut. Size holes for terminating fittings to be used, and seal around penetrations after fittings are installed.
- G. For enclosures installed in asphalt paving and subject to occasional, nondeliberate, heavy-vehicle loading, form and pour a concrete ring encircling, and in contact with, enclosure and with top surface screeded to top of box cover frame. Bottom of ring shall rest on compacted earth.
 - 1. Concrete: 3000 psi, 28-day strength, complying with Division 03 Section "Cast-in-Place Concrete", with a troweled finish.
 - 2. Dimensions: 10 inches wide by 12 inches deep.

3.6 GROUNDING

- A. Comply with IEEE C2 grounding requirements.
- 3.7 FIELD QUALITY CONTROL
 - A. Perform the following tests and inspections and prepare test reports:
 - 1. Demonstrate capability and compliance with requirements on completion of installation of underground ducts.
 - 2. At the completion of construction of ductbank, pull an aluminum or wood mandrel and brush or pig through all conduits in the presence of Owner's Representative to verify accessibility and cleanliness of conduit systems. If obstructions are

indicated, remove obstructions and retest. Mandrel shall be equal to 80 percent fill of duct.

- 3. Test grounding to ensure electrical continuity of grounding and bonding connections. Measure and report ground resistance.
- B. Correct deficiencies and retest as specified above to demonstrate compliance.

3.8 CLEANING

A. Pull leather-washer-type duct cleaner, with graduated washer sizes, through full length of ducts. Follow with rubber duct swab for final cleaning and to assist in spreading lubricant throughout ducts.

END OF SECTION

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Identification for raceways.
 - 2. Identification for conductors and communication and control cables.
 - 3. Underground-line warning tape.
 - 4. Warning labels and signs including arc flash labeling.
 - 5. Instruction signs.
 - 6. Equipment identification labels.
 - 7. Miscellaneous identification products.
- B. Related Sections include the following:
 - 1. Division 01 Section "Construction Waste Management"

1.2 SUBMITTALS

- A. Product Data: For each electrical identification product indicated.
- B. Samples: For each type of label and sign to illustrate size, colors, lettering style, mounting provisions, and graphic features of identification products.
- C. Identification Schedule: An index of nomenclature of electrical equipment and system components used in identification signs and labels.

1.3 QUALITY ASSURANCE

- A. Comply with NFPA 70.
- B. Comply with NFPA 70E.
- C. Comply with 29 CFR 1910.144 and 29 CFR 1910.145.
- D. Comply with ANSI Z535 for arc flash labels.
- E. Comply with OSHA requirements for electrical labeling.

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 Operation and Maintenance Manual; and with those required by codes, standards, and 29 CFR 1910.145. Use consistent designations throughout Project.
- B. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.
- C. Coordinate installation of identifying devices with location of access panels and doors.
- D. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2 PRODUCTS

2.1 CONDUCTOR IDENTIFICATION MATERIALS

- A. Color-Coding Conductor Tape: Colored, self-adhesive vinyl tape not less than 3 mils thick by 1 to 2 inches wide.
- B. Marker Tapes: Vinyl or vinyl-cloth, self-adhesive wraparound type, with circuit identification legend machine printed by thermal transfer or equivalent process.

2.2 WARNING LABELS AND SIGNS

- A. Comply with NFPA 70 and 29 CFR 1910.145.
- B. Self-Adhesive Warning Labels: Factory-printed, multicolor, pressure-sensitive adhesive labels, configured for display on front cover, door, or other access to equipment unless otherwise indicated.
- C. Baked-Enamel Warning Signs:
 - 1. Preprinted aluminum signs punched or drilled for fasteners, with colors, legend, and size required for application.
 - 2. 1/4-inch grommets in corners for mounting.
 - 3. Nominal size, 7 by 10 inches.
- D. Metal-Backed, Butyrate Warning Signs:
 - 1. Weather-resistant, nonfading, preprinted, cellulose-acetate butyrate signs with 0.0396-inch (1-mm) galvanized-steel backing; and with colors, legend, and size required for application.
 - 2. 1/4-inch grommets in corners for mounting.
 - 3. Nominal size, 10 by 14 inches.
- E. Warning label and sign shall include, but are not limited to, the following legends:
 - 1. Multiple Power Source Warning: "DANGER ELECTRICAL SHOCK HAZARD EQUIPMENT HAS MULTIPLE POWER SOURCES".
 - Workspace Clearance Warning: "WARNING OSHA REGULATION AREA IN FRONT OF ELECTRICAL EQUIPMENT MUST BE KEPT CLEAR FOR 36 INCHES".

2.3 INSTRUCTION SIGNS

- A. Engraved, laminated acrylic or melamine plastic, minimum 1/16 inch thick for signs up to 20 sq. inches and 1/8 inch thick for larger sizes.
 - 1. Engraved legend with black letters on white face.
 - 2. Punched or drilled for mechanical fasteners.
 - 3. Framed with mitered acrylic molding and arranged for attachment at applicable equipment.
- B. Adhesive Film Label: Machine printed, in black, by thermal transfer or equivalent process. Minimum letter height shall be 3/8 inch.

2.4 EQUIPMENT IDENTIFICATION LABELS

- A. Self-Adhesive, Engraved, Laminated Acrylic or Melamine Label: Adhesive backed.
 - 1. Equipment Label Text Height: Equipment name 3/16 inch; all other text 1/8 inch.
 - 2. Equipment Label Minimum Size: 2 inch by 4 inch.
 - 3. Equipment Label (other than automatic transfer switches) shall identify equipment name, equipment ampere and voltage ratings, and circuit feeding equipment.
 - 4. Labels for equipment shall be white letters on black background.
- B. Stenciled Legend: In nonfading, waterproof black ink.

2.5 CABLE TIES

- A. General-Purpose Cable Ties: Fungus inert, self extinguishing, one piece, self locking, Type 6/6 nylon.
 - 1. Minimum Width: 3/16 inch.
 - 2. Tensile Strength at 73 deg F, According to ASTM D 638: 12,000 psi.
 - 3. Temperature Range: Minus 40 to plus 185 deg F.
 - 4. Color: Black except where used for color-coding.
- B. UV-Stabilized Cable Ties: Fungus inert, designed for continuous exposure to exterior sunlight, self extinguishing, one piece, self locking, Type 6/6 nylon.
 - 1. Minimum Width: 3/16 inch.
 - 2. Tensile Strength at 73 deg F, According to ASTM D 638: 12,000 psi.
 - 3. Temperature Range: Minus 40 to plus 185 deg F.
 - 4. Color: Black.
- C. Plenum-Rated Cable Ties: Self extinguishing, UV stabilized, one piece, self locking.
 - 1. Minimum Width: 3/16 inch.
 - 2. Tensile Strength at 73 deg F, According to ASTM D 638: 7000 psi.
 - 3. UL 94 Flame Rating: 94V-0.
 - 4. Temperature Range: Minus 50 to plus 284 deg F.
 - 5. Color: Black.

2.6 MISCELLANEOUS IDENTIFICATION PRODUCTS

- A. Paint: Comply with requirements in Division 09 painting Sections for paint materials and application requirements. Select paint system applicable for surface material and location (exterior or interior).
- B. Fasteners for Labels and Signs: Self-tapping, stainless-steel screws, or stainless-steel machine screws with nuts and flat and lock washers.

PART 3 EXECUTION

- 3.1 INSTALLATION
 - A. Verify identity of each item before installing identification products.
 - B. Location: Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment.
- C. Apply identification devices to surfaces that require finish after completing finish work.
- D. Self-Adhesive Identification Products: Clean surfaces before application, using materials and methods recommended by manufacturer of identification device.
- E. Attach signs and plastic labels that are not self-adhesive type with mechanical fasteners appropriate to the location and substrate.
- F. Metal Tags: Secure tight to surface of conductor or cable at a location with high visibility and accessibility.
- G. Cable Ties: For attaching tags. Use general-purpose type, except as listed below:
 - 1. Outdoors: UV-stabilized nylon.
 - 2. In Spaces Handling Environmental Air: Plenum rated.
- H. Underground-Line Warning Tape: During backfilling of trenches install continuous underground-line warning tape directly above line at 6 to 8 inches below finished grade. Use multiple tapes where width of multiple lines installed in a common trench or concrete envelope exceeds 16 inches overall.

3.2 IDENTIFICATION SCHEDULE

- A. Power-Circuit Conductor Identification, 600 V or Less: For conductors in pull and junction boxes, and handholes, use color-coding conductor tape to identify the phase.
 - 1. Color-Coding for Phase and Voltage Level Identification, 600 V or Less: Use colors listed below for ungrounded service, feeder, and branch-circuit conductors.
 - a. Color shall be factory applied or field applied for sizes larger than No. 8 AWG, if authorities having jurisdiction permit.
 - b. Colors for 208/120-V Circuits:
 - 1) Phase A: Black.
 - 2) Phase B: Red.
 - 3) Phase C: Blue.
 - c. Colors for 480/277-V Circuits:
 - 1) Phase A: Brown.
 - 2) Phase B: Orange.
 - 3) Phase C: Yellow.
 - d. Field-Applied, Color-Coding Conductor Tape: Apply in half-lapped turns for a minimum distance of 6 inches from terminal points and in boxes where splices or taps are made. Apply last two turns of tape with no tension to prevent possible unwinding. Locate bands to avoid obscuring factory cable markings.
- B. Power-Circuit Conductor Identification, more than 600 V: For conductors in vaults, pull and junction boxes, manholes, and handholes, use stamped brass metal tags. Secure with self locking cabling tie fastener.
- C. Install instructional sign including the color-code for grounded and ungrounded conductors using adhesive-film-type labels.

- D. Conductors to Be Extended in the Future: Attach write-on tags to conductors and list source.
- E. Auxiliary Electrical Systems Conductor Identification: Identify field-installed alarm, control, and signal connections.
 - 1. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, and pull points. Identify by system and circuit designation.
 - 2. Use system of marker tape designations that is uniform and consistent with system used by manufacturer for factory-installed connections.
 - 3. Coordinate identification with Project Drawings, manufacturer's wiring diagrams, and the Operation and Maintenance Manual.
- F. Locations of Underground Lines: Identify with underground-line warning tape for power, lighting, communication, and control wiring and optical fiber cable.
 - 1. Install underground-line warning tape for cables in raceway.
- G. Warning Labels for Indoor Cabinets, Boxes, and Enclosures for Power and Lighting: Self-adhesive warning labels.
 - 1. Comply with 29 CFR 1910.145.
 - 2. Identify system voltage with black letters on an orange background.
 - 3. Apply to exterior of door, cover, or other access.
 - 4. For equipment with multiple power or control sources, apply to door or cover of equipment including, but not limited to, the following:
 - a. Power transfer switches.
 - b. Controls with external control power connections.
- H. Operating Instruction Signs: Install instruction signs to facilitate proper operation and maintenance of electrical systems and items to which they connect. Install instruction signs with approved legend where instructions are needed for system or equipment operation.
- I. Equipment Identification Labels: On each unit of equipment, install unique designation label that is consistent with wiring diagrams, schedules, and the Operation and Maintenance Manual. Apply labels to disconnect switches and protection equipment, central or master units, control panels, control stations, terminal cabinets, and racks of each system. Systems include power, lighting, control, communication, signal, monitoring, and alarm systems unless equipment is provided with its own identification.
 - 1. Labeling Instructions:
 - a. Elevated Components: Increase sizes of labels and letters to those appropriate for viewing from the floor.
 - b. Unless provided with self-adhesive means of attachment, fasten labels with appropriate mechanical fasteners that do not change the NEMA or NRTL rating of the enclosure.
 - 2. Equipment to Be Labeled:
 - a. Panelboards: Typewritten directory of circuits in the location provided by panelboard manufacturer. Panelboard identification shall be self-adhesive, engraved, laminated acrylic or melamine label.

- b. Enclosures and electrical cabinets.
- c. Access doors and panels for concealed electrical items.
- d. Switchboards.
- e. Transformers: Label that includes tag designation shown on Drawings for the transformer, feeder, and panelboards or equipment supplied by the secondary.
- f. Enclosed switches.
- g. Enclosed controllers.
- h. Push-button stations.
- i. Contactors.
- j. Remote-controlled switches and control devices.
- k. Monitoring and control equipment.

END OF SECTION

PART 1 GENERAL

1.1 COMMISSIONING AGENCY

- A. System Verification involves all parties to the design and construction process, including the electrical (Division 26) contractor, as many HVAC system components require electrical power and controls in order to operate as specified.
- 1.2 CONTRACTOR RESPONSIBILITY
 - A. The electrical contractor is responsible for assuring that systems verifications for electrical systems as it applies to Division 21, 22, 23, 26, and 28 specifications, individually and collectively.

PART 2 PRODUCTS (Not Used)

PART 3 EXECUTION (Not Used)

END OF SECTION

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Photoelectric switches.
 - 2. Standalone daylight-harvesting switching and dimming controls.
 - 3. Indoor occupancy and vacancy sensors.
 - 4. Switchbox-mounted occupancy sensors.
 - 5. Digital timer light switches.
 - 6. High-bay occupancy sensors.
 - 7. Extreme temperature occupancy sensors.
 - 8. Outdoor motion sensors.
 - 9. Lighting contactors.
 - 10. Emergency shunt relays.
- B. Related Requirements:
 - 1. Section 262726 "Wiring Devices" for wall-box dimmers, non-networkable wallswitch occupancy sensors, and manual light switches.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings:
 - 1. Show installation details for the following:
 - a. Occupancy sensors.
 - b. Vacancy sensors.
 - 2. Interconnection diagrams showing field-installed wiring.
 - 3. Include diagrams for power, signal, and control wiring.

1.3 INFORMATIONAL SUBMITTALS

- A. Installation Drawings: Lighting plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:
 - 1. Location of devices.
 - 2. Wiring requirements.
- B. Field quality-control reports.
- C. Sample Warranty: For manufacturer's warranties.

1.4 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For each type of lighting control device to include in operation and maintenance manuals.
- B. Software and Firmware Operational Documentation:

- 1. Software operating and upgrade manuals.
- 2. Program Software Backup: On USB media. Provide names, versions, and website addresses for locations of installed software.
- 3. Device address list.
- 4. Printout of software application and graphic screens.

1.5 WARRANTY

- A. Manufacturer's Warranty: Manufacturer and Installer agree to repair or replace lighting control devices that fail(s) in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Faulty operation of lighting control software.
 - b. Faulty operation of lighting control devices.
 - 2. Warranty Period: Two year(s) from date of Substantial Completion.

PART 2 PRODUCTS

2.1 LIGHTING CONTROL

- A. Basis-of-Design Product: Subject to compliance with requirements, provide Acuity Controls, nLight and sensor switch lighting controls or comparable product by one of the following:
 - 1. Wattstopper.
 - 2. Lutron.
 - 3. Or approved equal.

2.2 DAYLIGHT-HARVESTING DIMMING CONTROLS

- A. System Description: Sensing daylight and electrical lighting levels, the system adjusts the indoor electrical lighting levels. As daylight increases, the lights are dimmed.
 - 1. Lighting control set point is based on two lighting conditions:
 - a. When no daylight is present (target level).
 - b. When significant daylight is present.
 - 2. System programming is done with two hand-held, remote-control tools.
 - a. Initial setup tool.
 - b. Tool for occupants to adjust the target levels by increasing the set point up to 25 percent, or by minimizing the electric lighting level.
- B. Ceiling-Mounted Dimming Controls: Solid-state, light-level sensor unit, with separate power pack, to detect changes in indoor lighting levels that are perceived by the eye.
- C. Electrical Components, Devices, and Accessories:
 - 1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

- 2. Sensor Output: 0- to 10-V dc to operate luminaires. Sensor is powered by controller unit.
- 3. Light-Level Sensor Set-Point Adjustment Range: 20 to 60 fc (120 to 640 lux).

2.3 POWER PACK RELAYS

- A. Power Pack: Dry contacts rated for 20-A LED load at 120- and 277-V ac, for 13-A tungsten at 120-V ac, and for 1 hp at 120-V ac. Sensor has 24-V dc, 150-mA, Class 2 power source, as defined by NFPA 70.
 - 1. LED status lights to indicate load status.
 - 2. Plenum rated.
- B. Power Pack: Digital controller capable of accepting 2 RJ45 inputs with one or two outputs rated for 20-A incandescent or LED load at 120- and 277-V ac, for 16-A LED at 120- and 277-V ac, and for 1 hp at 120-V ac. Sensor has 24-V dc Class 2 power source, as defined by NFPA 70.
 - 1. With integral current monitoring
 - a. Compatible with digital addressable lighting interface.
 - 1) Plenum rated.

2.4 INDOOR OCCUPANCY AND VACANCY SENSORS

- A. General Requirements for Sensors:
 - 1. Ceiling-mounted, solid-state indoor occupancy and vacancy sensors.
 - 2. Passive infrared or dual technology type with passive infrared and either ultrasonic or microphonic as indicated.
 - 3. Separate power pack.
 - 4. Hardwired connection to switch.
 - 5. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
 - 6. Operation:
 - a. Occupancy Sensor: Unless otherwise indicated, turn lights on when coverage area is occupied, and turn them off when unoccupied; with a time delay for turning lights off, adjustable over a minimum range of 1 to 15 minutes.
 - b. Vacancy Sensor: Unless otherwise indicated, lights are manually turned on and sensor turns lights off when the room is unoccupied; with a time delay for turning lights off, adjustable over a minimum range of 1 to 15 minutes.
 - c. Combination Sensor: Unless otherwise indicated, sensor shall be programmed to turn lights on when coverage area is occupied and turn them off when unoccupied, or to turn off lights that have been manually turned on; with a time delay for turning lights off, adjustable over a minimum range of 1 to 15 minutes.
 - 7. Sensor Output: Contacts rated to operate the connected relay, complying with UL 773A Sensor is powered from the power pack.
 - 8. Power: Line voltage or low voltage, as indicated.
 - 9. Mounting:

- a. Sensor: Suitable for mounting in any position on a standard outlet box.
- b. Relay: Externally mounted through a 1/2-inch (13-mm) knockout in a standard electrical enclosure.
- c. Time-Delay and Sensitivity Adjustments: Recessed and concealed behind hinged door.
- 10. Indicator: Digital display, to show when motion is detected during testing and normal operation of sensor.
- 11. Bypass Switch: Override the "on" function in case of sensor failure.
- B. PIR Type: Wall or Ceiling mounted, as indicated; detect occupants in coverage area by their heat and movement.
 - 1. Detector Sensitivity: Detect occurrences of 6-inch- (150-mm-) minimum movement of any portion of a human body that presents a target of not less than 36 sq. in. (232 sq. cm).
 - 2. Detection Coverage (Room, Ceiling Mounted): Detect occupancy anywhere in a circular area of 1000 sq. ft. (93 sq. m) when mounted on a 96-inch- (2440-mm-) high ceiling.
 - 3. Detection Coverage (Corridor, Ceiling Mounted): Detect occupancy within 90 feet (27.4 m) when mounted on a 10-foot- (3-m-) high ceiling.
 - 4. Detection Coverage (Room, Wall Mounted): Detect occupancy anywhere within a 180-degree pattern centered on the sensor over an area of1000 square feet (110 square meters) when mounted 48 inches (1200 mm) above finished floor.
- C. Ultrasonic Type: Wall or Ceiling mounted, as indicated; detect occupants in coverage area through pattern changes of reflected ultrasonic energy.
 - 1. Detector Sensitivity: Detect a person of average size and weight moving not less than 12 inches (305 mm) in either a horizontal or a vertical manner at an approximate speed of 12 inches/s (305 mm/s).
 - 2. Detection Coverage (Small Room): Detect occupancy anywhere within a circular area of 600 sq. ft. (56 sq. m) when mounted on a 96-inch- (2440-mm-) high ceiling.
 - 3. Detection Coverage (Standard Room): Detect occupancy anywhere within a circular area of 1000 sq. ft. (93 sq. m) when mounted on a 96-inch- (2440-mm-) high ceiling.
 - 4. Detection Coverage (Large Room): Detect occupancy anywhere within a circular area of 2000 sq. ft. (186 sq. m) when mounted on a 96-inch- (2440-mm-) high ceiling.
 - 5. Detection Coverage (Corridor): Detect occupancy anywhere within 90 feet (27.4 m) when mounted on a 10-foot- (3-m-) high ceiling in a corridor not wider than 14 feet (4.3 m).
 - 6. Detection Coverage (Room, Wall Mounted): Detect occupancy anywhere within a 180-degree pattern centered on the sensor over an area of 1000 square feet (110 square meters) when mounted84 inches (2100 mm) above finished floor.
- D. Dual-Technology Type: Wall or Ceiling mounted, as indicated; detect occupants in coverage area using PIR and ultrasonic detection methods. The particular technology or combination of technologies that control on-off functions is selectable in the field by operating controls on unit.
 - 1. Sensitivity Adjustment: Separate for each sensing technology.
 - 2. Detector Sensitivity: Detect occurrences of 6-inch- (150-mm-) minimum movement of any portion of a human body that presents a target of not less than 36 sq. in.

(232 sq. cm) and detect a person of average size and weight moving not less than 12 inches (305 mm) in either a horizontal or a vertical manner at an approximate speed of 12 inches/s (305 mm/s).

- 3. Detection Coverage (Standard Room): Detect occupancy anywhere within a circular area of 1000 sq. ft. (93 sq. m) when mounted on a 96-inch- (2440-mm-) high ceiling.
- 4. Detection Coverage (Room, Wall Mounted): Detect occupancy anywhere within a 180-degree pattern centered on the sensor over an area of 1000 square feet (110 square meters) when mounted48 inches (1200 mm) above finished floor.

2.5 SWITCHBOX-MOUNTED OCCUPANCY SENSORS

- A. General Requirements for Sensors: Automatic-wall-switch occupancy sensor with manual on-off switch, suitable for mounting in a single gang switchbox, using hardwired connection.
 - 1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
 - 2. Occupancy Sensor Operation: Unless otherwise indicated, turn lights on when coverage area is occupied, and turn lights off when unoccupied; with a time delay for turning lights off, adjustable over a minimum range of 1 to 15 minutes.
 - 3. Operating Ambient Conditions: Dry interior conditions, 32 to 120 deg F (0 to 49 deg C).
 - 4. Switch Rating: Not less than 800-VA LED load at 120 V, 1200-VA LED load at 277 V, and 800-W incandescent.
- B. Wall-Switch Sensor:
 - 1. Standard Range: 180-degree field of view, field adjustable from 180 to 40 degrees; with a minimum coverage area of 900 sq. ft. (84 sq. m).
 - 2. Sensing Technology: PIR Dual technology PIR and ultrasonic, as indicated.
 - 3. Switch Type: SP, field-selectable automatic "on," or manual "on," automatic "off."
 - 4. Capable of controlling load in three-way application.
 - 5. Voltage: Match the circuit voltage.
 - 6. Ambient-Light Override: Concealed, field-adjustable, light-level sensor from 10 to 150 fc (108 to 1600 lux). The switch prevents the lights from turning on when the light level is higher than the set point of the sensor.
 - 7. Concealed, field-adjustable, "off" time-delay selector at up to 30 minutes.
 - 8. Concealed, "off" time-delay selector at 30 seconds and 5, 10, and 20 minutes.
 - 9. Adaptive Technology: Self-adjusting circuitry detects and memorizes usage patterns of the space and helps eliminate false "off" switching.
 - 10. Color: Gray to match wiring devices in Section 26 27 26.
 - 11. Faceplate: Stainless steel.

2.6 DIGITAL TIMER LIGHT SWITCH

- A. Description: Combination digital timer and conventional switch lighting control unit. Switchbox-mounted, backlit LCD display, with selectable time interval in 10 or 20 minute increments.
 - 1. Rated 960 W at 120-V ac for tungsten lighting, 10 A at 120-V ac or 10 amps at 277-V ac for LED, and 1/4 horsepower at 120-V ac.
 - 2. Integral relay for connection to BAS.
 - 3. Voltage: Match the circuit voltage.

- 4. Color: Gray to match wiring devices in Section 26 27 26.
- 5. Faceplate: Stainless steel.

2.7 LIGHTING CONTACTORS

- A. Manufacturers: Subject to compliance with requirements, provide product from one of the following manufacturers:
 - 1. Square D.
 - 2. Eaton.
 - 3. Siemens.
 - 4. General Electric.
 - 5. Or approved equal.
- B. Description: Electrically operated and electrically held, combination-type lighting contactors with nonfused disconnect, complying with NEMA ICS 2 and UL 508.
 - 1. Current Rating for Switching: Listing or rating consistent with type of load served, including tungsten filament, inductive, and high-inrush ballast (ballast with 15 percent or less THD of normal load current).
 - 2. Fault Current Withstand Rating: Equal to or exceeding the available fault current at the point of installation.
 - 3. Enclosure: Comply with NEMA 250.
 - 4. Provide with control and pilot devices as indicated on Drawings, matching the NEMA type specified for the enclosure.

2.8 EMERGENCY SHUNT RELAY

- A. Description: NC, electrically held relay, arranged for wiring in parallel with manual or automatic switching contacts; complying with UL 924.
 - 1. Coil Rating: Match circuit voltage.

2.9 CONDUCTORS AND CABLES

- A. Power Wiring to Supply Side of Remote-Control Power Sources: Not smaller than No. 12 AWG. Comply with requirements in Section 260519 "Low-Voltage Electrical Power Conductors and Cables."
- B. Classes 2 and 3 Control Cable: Multiconductor cable with stranded-copper conductors not smaller than No. 18 AWG. Comply with requirements in Section 260519 "Low-Voltage Electrical Power Conductors and Cables."
- C. Class 1 Control Cable: Multiconductor cable with stranded-copper conductors not smaller than No. 14 AWG. Comply with requirements in Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine lighting control devices before installation. Reject lighting control devices that are wet, moisture damaged, or mold damaged.

- B. Examine walls and ceilings for suitable conditions where lighting control devices will be installed.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 SENSOR INSTALLATION

- A. Comply with NECA 1.
- B. Coordinate layout and installation of ceiling-mounted devices with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, smoke detectors, fire-suppression systems, and partition assemblies.
- C. Install and aim sensors in locations to achieve not less than 90-percent coverage of areas indicated. Do not exceed coverage limits specified in manufacturer's written instructions.

3.3 CONTACTOR INSTALLATION

- A. Comply with NECA 1.
- B. Mount electrically held lighting contactors with elastomeric isolator pads to eliminate structure-borne vibration unless contactors are installed in an enclosure with factory-installed vibration isolators.

3.4 WIRING INSTALLATION

- A. Comply with NECA 1.
- B. Wiring Method: Comply with Section 260519 "Low-Voltage Electrical Power Conductors and Cables." Minimum conduit size is 1/2 inch (13 mm).
- C. Wiring within Enclosures: Comply with NECA 1. Separate power-limited and nonpowerlimited conductors according to conductor manufacturer's written instructions.
- D. Size conductors according to lighting control device manufacturer's written instructions unless otherwise indicated.
- E. Splices, Taps, and Terminations: Make connections only on numbered terminal strips in junction, pull, and outlet boxes; terminal cabinets; and equipment enclosures.

3.5 IDENTIFICATION

- A. Identify components and power and control wiring according to Section 260553 "Identification for Electrical Systems."
 - 1. Identify controlled circuits in lighting contactors.
 - 2. Identify circuits or luminaires controlled by photoelectric and occupancy sensors at each sensor.
- B. Label time switches and contactors with a unique designation.

3.6 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.
- B. Perform the following tests and inspections with the assistance of a factory-authorized service representative:
 - 1. Operational Test: After installing time switches and sensors, and after electrical circuitry has been energized, start units to confirm proper unit operation.
 - 2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- C. Lighting control devices will be considered defective if they do not pass tests and inspections.
- D. Prepare test and inspection reports.

3.7 ADJUSTING

- A. Occupancy Adjustments: When requested within 12 months from date of Substantial Completion, provide on-site assistance in adjusting lighting control devices to suit actual occupied conditions. Provide up to two visits to Project during other-than-normal occupancy hours for this purpose.
 - 1. For occupancy and motion sensors, verify operation at outer limits of detector range. Set time delay to suit Owner's operations.
 - 2. For daylighting controls, adjust set points and deadband controls to suit Owner's operations.
 - 3. Align high-bay occupancy sensors using manufacturer's laser aiming tool.

3.8 SOFTWARE SERVICE AGREEMENT

- A. Technical Support: Beginning at Substantial Completion, service agreement shall include software support for two years.
- B. Upgrade Service: At Substantial Completion, update software to latest version. Install and program software upgrades that become available within two years from date of Substantial Completion. Upgrading software shall include operating system and new or revised licenses for using software.
 - 1. Upgrade Notice: At least 30 days to allow Owner to schedule and access the system and to upgrade computer equipment if necessary.

3.9 DEMONSTRATION

- A. Coordinate demonstration of products specified in this Section with demonstration requirements for low-voltage, programmable lighting control systems specified in Section 260943.23 "Relay-Based Lighting Controls."
- B. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain lighting control devices.

END OF SECTION

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes: Lighting control panels using mechanically held relays for switching.

1.2 DEFINITIONS

- A. BAS: Building automation system.
- B. DDC: Direct digital control.
- C. IP: Internet protocol.
- D. Monitoring: Acquisition, processing, communication, and display of equipment status data, metered electrical parameter values, power quality evaluation data, event and alarm signals, tabulated reports, and event logs.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for control modules, power distribution components, relays, manual switches and plates, and conductors and cables.
 - 2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.
 - 3. Sound data including results of operational tests of central dimming controls.
 - 4. Operational documentation for software and firmware.
- B. Shop Drawings: For each relay panel and related equipment.
 - 1. Include dimensioned plans, elevations, sections, and details. Show tabulations of installed devices, equipment features, and ratings.
 - 2. Detail enclosure types and details for types other than NEMA 250, Type 1.
 - 3. Detail wiring partition configuration, current, and voltage ratings.
 - 4. Short-circuit current rating of relays.
 - 5. Address Drawing: Reflected ceiling plan and floor plans, showing connected luminaires, address for each luminaire, and luminaire groups. Base plans on construction plans, using the same legend, symbols, and schedules.
 - 6. Point List and Data Bus Load: Summary list of all control devices, sensors, ballasts, and other loads. Include percentage of rated connected load and device addresses.
 - 7. Wire Termination Diagrams and Schedules: Coordinate nomenclature and presentation with Drawings and block diagram. Differentiate between manufacturer-installed and field-installed wiring.
 - 8. Block Diagram: Show interconnections between components specified in this Section and devices furnished with power distribution system components. Indicate data communication paths and identify networks, data buses, data gateways, concentrators, and other devices to be used. Describe characteristics of network and other data communication lines.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For testing agency.
- B. Field quality-control reports.
- C. Software licenses and upgrades required by and installed for operation and programming of digital and analog devices.
- D. Sample Warranty: For manufacturer's special warranty.

1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For lighting controls to include in emergency, operation, and maintenance manuals.
- B. Software and Firmware Operational Documentation:
 - 1. Software operating and upgrade manuals.
 - 2. Program Software Backup: On USB drive.
 - 3. Device address list.
 - 4. Printout of software application and graphic screens.
 - 5. Testing and adjusting of panic and emergency power features.

1.6 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Lighting Control Relays: Equal to 10 percent of amount installed for each size indicated, but no fewer than two.

1.7 QUALITY ASSURANCE

- A. Testing Agency Qualifications: Accredited by NETA.
 - 1. Testing Agency's Field Supervisor: Certified by NETA to supervise on-site testing.
- 1.8 DELIVERY, STORAGE, AND HANDLING
 - A. Handle and prepare panels for installation according to NECA 407.
- 1.9 WARRANTY
 - A. Special Warranty: Manufacturer agrees to repair or replace components of standalone multipreset modular dimming controls that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Damage from transient voltage surges.
 - 2. Warranty Period: Cost to repair or replace any parts for two years from date of Substantial Completion.

3. Extended Warranty Period: Cost of replacement parts (materials only, f.o.b. the nearest shipping point to Project site), for eight years, that failed in service due to transient voltage surges.

PART 2 PRODUCTS

2.1 SYSTEM DESCRIPTION

- A. Sequence of Operations: Input signal from field-mounted manual switches, or digital signal sources, shall open or close one or more lighting control relays in the lighting control panels. Any combination of inputs shall be programmable to any number of control relays.
- B. Surge Protective Device: Factory installed as an integral part of control components or field-mounted surge suppressors complying with UL 1449, SPD Type 2.
- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- D. Comply with 47 CFR 15, Subparts A and B, for Class A digital devices.
- E. Comply with UL 916.

2.2 LIGHTING CONTROL RELAY PANELS

- A. Manufacturers: Subject to compliance with requirements, provide product from one of the following:
 - 1. Acuity Controls (ARP Relay Panel).
 - 2. Wattstopper.
 - 3. Lutron.
 - 4. Or approved equal.
- B. Description: Standalone lighting control panel using mechanically latched relays to control lighting and appliances.
- C. Lighting Control Panel:
 - 1. A single enclosure with incoming lighting branch circuits, control circuits, switching relays, and on-board timing and control unit.
 - 2. A vertical barrier separating branch circuits from control wiring.
 - 3. Panel shall be networkable with other control panels through network connection.
- D. Control Unit: Contain the power supply and electronic control for operating and monitoring individual relays.
 - 1. Timing Unit:
 - a. 365-day calendar, astronomical clock, and automatic adjustments for daylight savings and leap year.
 - b. Clock configurable for 12-hour (A.M./P.M.) or 24-hour format.
 - c. Four independent schedules, each having 24 time periods.
 - d. Schedule periods settable to the minute.

- e. Day-of-week, day-of-month, day-of-year with one-time or repeating capability.
- f. 10 special date periods.
- 2. Sequencing Control with Override:
 - a. Automatic sequenced on and off switching of selected relays at times set at the timing unit, allowing timed overrides from external switches.
 - b. Sequencing control shall operate relays one at a time, completing the operation of all connected relays in not more than 10 seconds.
 - c. Override control shall allow any relay connected to it to be switched on or off by a field-deployed manual switch or by an automatic switch, such as an occupancy sensor.
 - d. Override control "blink warning" shall warn occupants approximately five minutes before actuating the off sequence.
- 3. Nonvolatile memory shall retain all setup configurations. After a power failure, the controller shall automatically reboot and return to normal system operation, including accurate time of day and date.
- E. Relays: Electrically operated, mechanically held single-pole switch, rated at 20 A at 277 V. Short-circuit current rating shall be not less than 14 kA. Control shall be three-wire, 24-V ac.
- F. Power Supply: NFPA 70, Class 2, sized for connected equipment, plus 20 percent spare capacity. Powered from a dedicated branch circuit of the panelboard that supplies power to the line side of the relays, sized to provide control power for the local panel-mounted relays, bus system, low-voltage inputs, field-installed occupancy sensors, and photo sensors.
- G. Operator Interface:
 - 1. Integral alphanumeric keypad and digital display, and intuitive drop-down menus to assist in programming.
 - 2. Log and display relay on-time.
 - 3. Connect relays to one or more time and sequencing schemes.

2.3 MANUAL SWITCHES AND PLATES

- A. Push-Button Switches: Modular, momentary contact, three wire, for operating one or more relays and to override automatic controls.
 - 1. Match color and style specified in Section 262726 "Wiring Devices."
 - 2. Integral green LED pilot light to indicate when circuit is on.
 - 3. Internal white LED locator light to illuminate when circuit is off.
- B. Wall Plates: Single and multigang plates as specified in Section 262726 "Wiring Devices."
- C. Legend: Engraved or permanently silk-screened on wall plate where indicated. Use designations indicated on Drawings.

2.4 FIELD-MOUNTED SIGNAL SOURCES

- A. Daylight Harvesting Switching Controls: Comply with Section 260923 "Lighting Control Devices." Control power may be taken from the lighting control panel, and signal shall be compatible with the relays.
- B. Indoor Occupancy Sensors: Comply with Section 260923 "Lighting Control Devices." Control power may be taken from the lighting control panel, and signal shall be compatible with the relays.

2.5 CONDUCTORS AND CABLES

- A. Power Wiring to Supply Side of Class 2 Power Source: Not smaller than No. 12 AWG. Comply with requirements in Section 260519 "Low-Voltage Electrical Power Conductors and Cables."
- B. Classes 2 and 3 Control Cables: Multiconductor cable with copper conductors not smaller than No. 18 AWG. Comply with requirements in Section 260519 "Low-Voltage Electrical Power Conductors and Cables."
- C. Class 1 Control Cables: Multiconductor cable with copper conductors not smaller than No. 14 AWG. Comply with requirements in Section 260519 "Low-Voltage Electrical Power Conductors and Cables."
- D. Twisted-Pair Data Cable: Category 5e. Comply with requirements in Section 271513 "Communications Copper Horizontal Cabling."

PART 3 EXECUTION

3.1 EXAMINATION

- A. Receive, inspect, handle, and store panels according to NECA 407.
- B. Examine panels before installation. Reject panels that are damaged or rusted or have been subjected to water saturation.
- C. Examine elements and surfaces to receive panels for compliance with installation tolerances and other conditions affecting performance of the Work.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 WIRING INSTALLATION

- A. Comply with NECA 1.
- B. Wiring Method: Install cables in raceways and j-hooks except within consoles, cabinets, desks, and counters. Conceal raceway and cables except in unfinished spaces.
 - 1. Install plenum cable in environmental airspaces, including plenum ceilings.
 - Comply with requirements for raceways and boxes specified in Section 260533 "Raceways and Boxes for Electrical Systems."
- C. Wiring Method: Conceal conductors and cables in accessible ceilings, walls, and floors where possible.

D. Wiring within Enclosures: Bundle, lace, and train conductors to terminal points with no excess and without exceeding manufacturer's limitations on bending radii. Install lacing bars and distribution spools.

3.3 PANEL INSTALLATION

- A. Comply with NECA 1.
- B. Install panels and accessories according to NECA 407.
- C. Mount top of trim 72 inches above finished floor unless otherwise indicated.
- D. Mount panel cabinet plumb and rigid without distortion of box.
- E. Install filler plates in unused spaces.

3.4 IDENTIFICATION

- A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."
- B. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs complying with Section 260553 "Identification for Electrical Systems."
- C. Create a directory to indicate loads served by each relay; incorporate Owner's final room designations. Obtain approval before installing. Use a PC or typewriter to create directory; handwritten directories are unacceptable.
- D. Lighting Control Panel Nameplates: Label each panel with a nameplate complying with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

3.5 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.
- B. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- C. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.
- D. Perform tests and inspections with the assistance of a factory-authorized service representative.
- E. Tests and Inspections:
 - 1. Perform each visual and mechanical inspection and electrical test for low-voltage air circuit breakers described below and low-voltage surge arrestors. Certify compliance with manufacturer's test parameters.
 - a. Circuit-Breaker Tests:
 - 1) Compare nameplate with Drawings and Specifications.

- 2) Inspect physical and mechanical conditions.
- 3) Inspect anchorage and alignment.
- 4) Verify that the units are clean.
- 5) Operate the circuit breaker to ensure smooth operation.
- 6) Inspect bolted electrical connections for high resistance using one or more of the following methods:
 - a) A low-resistance ohmmeter.
 - b) Verify tightness of bolted electrical connections by calibrated torque wrench.
 - c) Thermographic survey.
- 7) Inspect operating mechanism, contacts, and arc chutes in unsealed units.
- 8) Perform adjustments for final protective device settings according to the overcurrent protective device coordination study. Comply with requirements in Section 260573 "Overcurrent Protective Device Coordination Study."
- 9) Perform insulation resistance tests for one minute on each pole, phase-to-phase, and phase-to-ground with the circuit breaker closed and across each pole using manufacturer's published data.
- 10) Perform a contact/pole-resistance test.
- 11) Perform insulation-resistance tests on control wiring with respect to ground. Applied potential shall be 500-V dc for 300-V rated cable and 1000-V dc for 600-V rated cable. Test duration shall be for one minute. Follow manufacturer's written instructions for solid-state units.
- 12) Determine long-time pickup and delay by primary current injection.
- 13) Determine short-time pickup and delay by primary current injection.
- 14) Determine ground-fault pickup and time delay by primary current injection.
- 15) Determine instantaneous pickup by primary current injection.
- 16) Test functions of the trip unit by means of secondary injection.
- 17) Perform minimum pickup voltage tests on shunt trip and close coils according to manufacturer's published data.
- 18) Verify correct operation of auxiliary features such as trip and pickup indicators, zone interlocking, electrical close and trip operation, trip-free, anti-pump function, and trip unit battery condition. Reset trip logs and indicators.
- 19) Verify operation of charging mechanism.
- b. Surge Arrestor Tests:
 - 1) Compare nameplate with the Contract Documents.
 - 2) Inspect physical and mechanical conditions.
 - 3) Inspect anchorage, alignment, grounding, and clearances.
 - 4) Verify that the units are clean.
 - 5) Inspect bolted electrical connections for high resistance using one or more of the following methods:
 - a) Low-resistance ohmmeter.
 - b) Verify tightness of bolted electrical connections by calibrated torque wrench.
 - 6) Verify that the ground lead on each device is individually attached to a ground bus or ground electrode.

- 7) Perform an insulation-resistance test on each arrestor, phase terminal-to-ground using voltage according to manufacturer written instructions.
- 8) Comply with requirements in Section 260526 "Grounding and Bonding for Electrical Systems" for grounding tests.
- 2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
- F. Lighting control panel will be considered defective if it does not pass tests and inspections.
- G. Prepare test and inspection reports, including a certified report that identifies lighting control panels and describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations made after remedial action.

3.6 STARTUP SERVICE

- A. Engage a factory-authorized service representative to perform startup service.
 - 1. Complete installation and startup checks according to manufacturer's written instructions.
 - 2. Confirm correct communications wiring, initiate communications between panels, and program the lighting control system according to approved configuration schedules, time-of-day schedules, and input override assignments.

3.7 ADJUSTING

A. Occupancy Adjustments: When requested within 12 months from date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to two visits to Project during other-than-normal occupancy hours for this purpose.

3.8 SOFTWARE SERVICE AGREEMENT

- A. Technical Support: Beginning at Substantial Completion, service agreement shall include software support for two years.
- B. Upgrade Service: At Substantial Completion, update software to latest version. Install and program software upgrades that become available within two years from date of Substantial Completion. Upgrading software shall include operating system and new or revised licenses for using software.
 - 1. Upgrade Notice: At least 30 days to allow Owner to schedule and access the system and to upgrade computer equipment if necessary.

3.9 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain the control unit and operator interface.

END OF SECTION

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Distribution panelboards.
 - 2. Lighting and appliance branch-circuit panelboards.
- B. Related sections include the following:
 - 1. Division 01 Section "Demonstration and Training".
 - 2. Division 01 Section "Construction Waste Management".
 - 3. Division 26 Sections:
 - a. "Common Work Results for Electrical"
 - b. "Low Voltage Electrical Power Conductors and Cables".
 - c. "Grounding and Bonding for Electrical Systems"
 - d. "Identification for Electrical Systems".

1.2 DEFINITIONS

A. SVR: Suppressed voltage rating.

1.3 SUBMITTALS

- A. Product Data: For each type of panelboard, switching and overcurrent protective device, transient voltage suppression device, accessory, and component indicated. Include dimensions and manufacturers' technical data on features, performance, electrical characteristics, ratings, and finishes.
- B. Shop Drawings: For each panelboard and related equipment.
 - 1. Include dimensioned plans, elevations, sections, and details. Show tabulations of installed devices, equipment features, and ratings.
 - 2. Detail enclosure types and details for types other than NEMA 250, Type 1.
 - 3. Detail bus configuration, current, and voltage ratings.
 - 4. Short-circuit current rating of panelboards and overcurrent protective devices.
 - 5. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.
 - 6. Include wiring diagrams for power, signal, and control wiring.
 - 7. Include time-current coordination curves for each type and rating of overcurrent protective device included in panelboards. Submit on translucent log-log graft paper; include selectable ranges for each type of overcurrent protective device.
- C. Qualification Data: For qualified testing agency.
- D. Field Quality-Control Reports:
 - 1. Test procedures used.
 - 2. Test results that comply with requirements.
 - 3. Results of failed tests and corrective action taken to achieve test results that comply with requirements.

- E. Panelboard Schedules: For installation in panelboards. Submit final versions after load balancing.
- F. Operation and Maintenance Data: For panelboards and components to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 01 Section "Operation and Maintenance Data," include the following:
 - 1. Manufacturer's written instructions for testing and adjusting overcurrent protective devices.
 - 2. Time-current curves, including selectable ranges for each type of overcurrent protective device that allows adjustments.

1.4 QUALITY ASSURANCE

- A. Testing Agency Qualifications: Member company of NETA or an NRTL.
 - 1. Testing Agency's Field Supervisor: Currently certified by NETA to supervise onsite testing.
- B. Source Limitations: Obtain panelboards, overcurrent protective devices, components, and accessories from single source from single manufacturer.
- C. Product Selection for Restricted Space: Drawings indicate maximum dimensions for panelboards including clearances between panelboards and adjacent surfaces and other items. Comply with indicated maximum dimensions.
- D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- E. Comply with NEMA PB 1.
- F. Comply with NFPA 70.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Handle and prepare panelboards for installation according to NEMA PB 1.

1.6 PROJECT CONDITIONS

- A. Environmental Limitations:
 - 1. Do not deliver or install panelboards until spaces are enclosed and weathertight, wet work in spaces is complete and dry, work above panelboards is complete, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

1.7 COORDINATION

A. Coordinate layout and installation of panelboards and components with other construction that penetrates walls or is supported by them, including electrical and other types of equipment, raceways, piping, encumbrances to workspace clearance requirements, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

1.8 EXTRA MATERIALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Keys: Two spares for each type of panelboard cabinet lock.

PART 2 PRODUCTS

- 2.1 GENERAL REQUIREMENTS FOR PANELBOARDS
 - A. Fabricate and test panelboards according to IEEE 344 to withstand seismic forces defined in Division 26 Section "Vibration and Seismic Controls for Electrical Systems".
 - B. Enclosures: Flush- or surface-mounted cabinets as indicated.
 - 1. Rated for environmental conditions at installed location.
 - a. Indoor Dry and Clean Locations: NEMA 250, Type 1.
 - 2. Front: Secured to box with concealed trim clamps. For surface-mounted fronts, match box dimensions; for flush-mounted fronts, overlap box.
 - 3. Hinged Front Cover: Entire front trim hinged to box and with standard door within hinged trim cover.
 - 4. Finishes:
 - a. Panels and Trim: Steel, factory finished immediately after cleaning and pretreating with manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat.
 - b. Back Boxes: Galvanized steel.
 - 5. Directory Card: Inside panelboard door, mounted in metal frame with transparent protective cover.
 - C. Incoming Mains Location: Contractor shall be responsible for coordinating feed location.
 - D. Phase, Neutral and Ground Buses:
 - 1. Material: Hard-drawn copper, 98 percent conductivity.
 - 2. Equipment Ground Bus: Adequate for feeder and branch-circuit equipment grounding conductors; bonded to box.
 - 3. Isolated Ground Bus: Adequate for branch-circuit isolated ground conductors; insulated from box.
 - E. Conductor Connectors: Suitable for use with conductor material and sizes.
 - 1. Main and Neutral Lugs: Mechanical type.
 - 2. Ground Lugs and Bus-Configured Terminators: Mechanical type.
 - 3. Feed-Through Lugs: Mechanical type, suitable for use with conductor material. Locate at opposite end of bus from incoming lugs or main device.
 - 4. Subfeed (Double) Lugs: Mechanical type suitable for use with conductor material. Locate at same end of bus as incoming lugs or main device.
 - F. Future Devices: Mounting brackets, bus connections, filler plates, and necessary appurtenances required for future installation of devices.

- G. Panelboard Short-Circuit Current Rating: Fully rated to interrupt symmetrical short-circuit current available at terminals as determined by fault current study. The minimum interrupting ratings for circuits breakers shall be 10,000 RMS symmetrical amperes for 208Y/120 volt panelboards and 14,000 RMS symmetrical amperes for 480Y/277 volt panelboards. Series rated panelboards are not acceptable.
- H. Protective device selection shall be based on the results of the coordination study.

2.2 LIGHTING AND APPLIANCE BRANCH-CIRCUIT PANELBOARDS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide Square D; a brand of Schneider Electric (NQ or NF) or comparable product by one of the following:
 - 1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
 - 2. General Electric Company; GE Consumer & Industrial Electrical Distribution.
 - 3. Siemens Energy & Automation, Inc.
 - 4. Or approved equal.
- B. Panelboards: NEMA PB 1, lighting and appliance branch-circuit type.
- C. Mains: Circuit breaker or lugs only as indicated.
- D. Branch Overcurrent Protective Devices: Bolt-on circuit breakers, replaceable without disturbing adjacent units.
- E. Doors: Door-in-door feature with continuous hinges; secured with flush latch with tumbler lock; keyed alike.

2.3 DISCONNECTING AND OVERCURRENT PROTECTIVE DEVICES

- A. Available Manufacturers: Subject to compliance with requirements, provide products by one of the following, or an approved equal:
 - 1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
 - 2. General Electric Company; GE Consumer & Industrial Electrical Distribution.
 - 3. Siemens Energy & Automation, Inc.
 - 4. Square D; a brand of Schneider Electric.
 - 5. Or approved equal.
- B. Molded-Case Circuit Breaker (MCCB): Comply with UL 489, with interrupting capacity to meet available fault currents.
 - 1. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads, and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.
 - 2. Electronic Trip Circuit Breakers: Microprocessor based trip system with true rms sensing, field-replaceable rating plug or field-replicable electronic trip; and the following field-adjustable settings:
 - a. Instantaneous trip.
 - b. Long- and short-time pickup levels.
 - c. Long- and short-time time adjustments.
 - d. Ground-fault pickup level, time delay, and I²t response, (where indicated on drawings).

- 3. GFCI Circuit Breakers: Single- and two-pole configurations with Class A ground-fault protection (6-mA trip).
- 4. Ground-Fault Equipment Protection (GFEP) Circuit Breakers: Class B ground-fault protection (30-mA trip).
- 5. Molded-Case Circuit-Breaker (MCCB) Features and Accessories:
 - a. Standard frame sizes, trip ratings, and number of poles.
 - b. Lugs: Mechanical style, suitable for number, size, trip ratings, and conductor materials.
 - c. Ground-Fault Protection: Integrally mounted relay and trip unit with adjustable pickup and time-delay settings, push-to-test feature, and ground-fault indicator.
 - d. Shunt Trip: 120-V trip coil energized from separate circuit, set to trip at 55 percent of rated voltage.
 - e. Multipole units enclosed in a single housing or factory assembled to operate as a single unit.
 - f. Handle Padlocking Device: Fixed attachment, for locking circuit-breaker handle in on or off position.
 - g. Handle Clamp: Loose attachment, for holding circuit-breaker handle in on position.

2.4 INSTRUMENTATION

- A. Instrument Transformers: IEEE C57.13, NEMA EI 21.1, and the following:
 - 1. Potential Transformers: IEEE C57.13; 120 V, 60 Hz, tapped secondary; disconnecting type with integral fuse mountings. Burden and accuracy shall be consistent with connected metering and relay devices.
 - 2. Current Transformers: IEEE C57.13; 5 A, 60 Hz, secondary; bushing type; single secondary winding and secondary shorting device. Burden and accuracy shall be consistent with connected metering and relay devices.
 - 3. Control-Power Transformers: Dry type, mounted in separate compartments for units larger than 3 kVA.
 - 4. Current Transformers for Neutral and Ground-Fault Current Sensing: Connect secondary wiring to ground overcurrent relays, via shorting terminals, to provide selective tripping of main and tie circuit breaker. Coordinate with feeder circuit-breaker, ground-fault protection.
- B. Multifunction Digital-Metering Monitor: Microprocessor-based unit suitable for three- or four-wire systems and with the following features:
 - 1. Switch-selectable digital display of the following values with maximum accuracy tolerances as indicated:
 - a. Phase Currents, Each Phase: Plus or minus 1 percent.
 - b. Phase-to-Phase Voltages, Three Phase: Plus or minus 1 percent.
 - c. Phase-to-Neutral Voltages, Three Phase: Plus or minus 1 percent.
 - d. Megawatts: Plus or minus 2 percent.
 - e. Megavars: Plus or minus 2 percent.
 - f. Power Factor: Plus or minus 2 percent.
 - g. Frequency: Plus or minus 0.5 percent.
 - h. Accumulated Energy, Megawatt Hours: Plus or minus 2 percent; accumulated values unaffected by power outages up to 72 hours.
 - i. Megawatt Demand: Plus or minus 2 percent; demand interval programmable from five to 60 minutes.
 - j. Contact devices to operate remote impulse-totalizing demand meter.

- 2. Mounting: Display and control unit flush or semiflush mounted in instrument compartment door.
- 3. Communication module suitable for remote monitoring of metering quantities and function through Ethernet and through building management system (BMS).
- 4. Integral web server.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Receive, inspect, handle and store panelboards according to of NECA 407 and NEMA PB 1.1.
- B. Examine panelboards before installation. Reject panelboards that are damaged or rusted or have been subjected to water saturation.
- C. Examine elements and surfaces to receive panelboards for compliance with installation tolerances and other conditions affecting performance of the Work.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install panelboards and accessories according to NECA 407 and NEMA PB 1.1.
- B. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from panelboards.
- C. Lighting and Appliance Panels: 72 inches above finished floor unless otherwise indicated.
- D. Mount panelboard cabinet plumb and rigid without distortion of box. Mount recessed panelboards with fronts uniformly flush with wall finish and mating with back box.
- E. Install overcurrent protective devices and controllers not already factory installed.
 - 1. Set field-adjustable, circuit-breaker trip ranges.
- F. Install filler plates in unused spaces.
- G. Recessed Panels: Stub four ³/₄ inch empty conduits from panelboard into accessible ceiling space or space designated to be ceiling space in the future.
- H. Arrange conductors in gutters into groups and bundle and wrap with wire ties after completing load balancing.
- I. Comply with NECA 1.
- J. Circuit breakers rated below 200 amps may be electronic trip type or thermal magnetic type circuit breakers. Electronic trip type may be provided to allow greater selective coordination. Circuit breakers rated above 200 amps shall be electronic trip type. Circuit breakers rated above 1200 amp shall be 100% rated. Circuit breakers rated 1000 amps or more and connected to the 480Y/277 volt system shall have integral ground fault pick-up, time delay, and I²t response.

3.3 IDENTIFICATION

- A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs complying with Division 26 Section "Identification for Electrical Systems".
- B. Create a directory to indicate installed circuit loads after balancing panelboard loads; incorporate Owner's final room designations. Obtain approval before installing. Use a computer or typewriter to create directory; handwritten directories are not acceptable.
- C. Panelboard Nameplates: Label each panelboard with a nameplate complying with requirements for identification specified in Division 26 Section "Identification for Electrical Systems".
- D. Device Nameplates: Label each branch circuit device in distribution panelboards with a nameplate complying with requirements for identification specified in Division 26 Section "Identification for Electrical Systems".

3.4 FIELD QUALITY CONTROL

- A. Acceptance Testing Preparation:
 - 1. Test insulation resistance for each panelboard bus, component, connecting supply, feeder and control circuit.
 - 2. Test continuity of each circuit.
- B. Tests and Inspections:
 - 1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
 - 2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
- C. Panelboards will be considered defective if they do not pass tests and inspections.
- D. Prepare test and inspection reports, including a certified report that identifies panelboards included. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

3.5 ADJUSTING

- A. Adjust moving parts and operable component to function smoothly and lubricate as recommended by manufacturer.
- B. Load Balancing: After Substantial Completion, but not more than 60 days after Final Acceptance, measure load balancing and make circuit changes.
 - 1. Measure as directed during period of normal system loading.
 - 2. Perform load-balancing circuit changes outside normal occupancy/working schedule of the facility and at time directed. Avoid disrupting critical 24-hour services such as fax machines and on-line data processing, computing, transmitting, and receiving equipment.
 - 3. After circuit changes, recheck loads during normal load period. Record all load readings before and after changes and submit test records.

4. Tolerance: Difference exceeding 20 percent between phase loads, within a panelboard, is not acceptable. Rebalance and recheck as necessary to meet this minimum requirement.

END OF SECTION

PART 1 GENERAL

1.1 SUMMARY

- A. This Section includes the following:
 - 1. Receptacles, receptacles with integral GFCI, and associated device plates.
 - 2. Twist-locking receptacles.
 - 3. Snap switches.
- B. Related Sections include the following:
 - 1. Division 01 Section "Construction Waste Management"

1.2 DEFINITIONS

- A. EMI: Electromagnetic interference.
- B. GFCI: Ground-fault circuit interrupter.
- C. Pigtail: Short lead used to connect a device to a branch-circuit conductor.
- D. RFI: Radio-frequency interference.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: List of legends and description of materials and process used for premarking wall plates.
- C. Samples: One for each type of device and wall plate specified, in each color specified.
- D. Field quality-control test reports.
- E. Operation and Maintenance Data: For wiring devices to include in all manufacturers' packing label warnings and instruction manuals that include labeling conditions. Refer to Division 01 Operation and Maintenance Data.

1.4 QUALITY ASSURANCE

- A. Source Limitations: Obtain each type of wiring device and associated wall plate through one source from a single manufacturer. Insofar as they are available, obtain all wiring devices and associated wall plates from a single manufacturer and one source.
- 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 NFPA 70.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers' Names: Subject to compliance with requirements, provide products by one of the following, or an approved equal. (Shortened versions shown in parentheses of the following manufacturers' names are used in other Part 2 articles):
 - 1. Cooper Wiring Devices; a division of Cooper Industries, Inc. (Cooper).
 - 2. Hubbell Incorporated; Wiring Device-Kellems (Hubbell).
 - 3. Leviton Mfg. Company Inc. (Leviton).
 - 4. Pass & Seymour/Legrand; Wiring Devices & Accessories (Pass & Seymour).
 - 5. Or approved equal.

2.2 STRAIGHT BLADE RECEPTACLES

- A. Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 configuration 5-20R, and UL 498. Receptacles shall be heavy duty industrial grade type with one piece brass strap with integral ground.
 - 1. Products: Subject to compliance with requirements, provide one of the following, or an approved equal:
 - a. Cooper; 5361 (single), 5362 (duplex).
 - b. Hubbell; HBL5361 (single), HBL5362 (duplex).
 - c. Leviton; 5361 (single), 5362 (duplex).
 - d. Pass & Seymour; 5361A (single), 5362A (duplex).
 - e. Or approved equal.
- B. Convenience Receptacles, 125 V, 20 A with 12v dc, duplex 2.0A USB type A ports: Comply with NEMA WD 1, NEMA WD 6 configuration 5-20R, and UL 498. Receptacles shall be heavy duty industrial grade type with one piece brass strap with integral ground.
 - 1. Products: Subject to compliance with requirements, provide one of the following, or an approved equal:
 - a. Cooper; TR7756 (duplex).
 - b. Hubbell; USB20A (duplex).
 - c. Leviton; M58AA (duplex).
 - d. Or approved equal.

2.3 GFCI RECEPTACLES

- A. General Description: Straight blade, feed-through type. Comply with NEMA WD 1, NEMA WD 6, UL 498, and UL 943, Class A, and include indicator light that is lighted when device is tripped.
- B. Duplex GFCI Convenience Receptacles, 125 V, 20 A:
 - 1. Products: Subject to compliance with requirements, provide one of the following, or an approved equal:
 - a. Cooper; XGF20.
 - b. Hubbell; GF5362
 - c. Leviton; 7599

- d. Pass & Seymour; 2094.
- e. Or approved equal.
- C. Duplex GFCI Tamper Resistant Convenient Receptacles, 125 V, 20 A:
 - 1. Products: Subject to compliance with requirements, provide one of the following, or an approved equal:
 - a. Cooper; TRSGF20.
 - b. Hubbell; GF5362SG
 - c. Leviton; G5362-TI
 - d. Pass & Seymour; 2097TR.
 - e. Or approved equal.

2.4 SNAP SWITCHES

- A. Comply with NEMA WD1 and UL 20. Switches shall be heavy duty industrial grade with silver cadmium oxide contacts and rated 1 HP at 120v, and 2 HP at 277v.
- B. Switches: 120/277 V, 20 A:
 - 1. Products: Subject to compliance with requirements, provide one of the following, or an approved equal:
 - a. Cooper 2221 (single pole), 2222 (two pole), 2223 (three way), 2224 (four way).
 - b. Hubbell HBL 1221 (single pole), HBL 1222 (two pole), HBL 1223 (three way), HBL 1224 (four way).
 - c. Leviton: 1221-2 (single pole), 1222-2 (two pole), 1223-2 (three way), 1224-2 (four way).
 - d. Pass & Seymour: PS20AC1 (single pole), PS20AC2 (two pole, PS20AC3 (three way), PS20AC4 (four way).
 - e. Or approved equal.

2.5 WALLBOX DIMMERS (LINE VOLTAGE)

- A. Dimmers shall be specifically listed for the load controlled.
- B. Dimmers shall contain and air-gap switch, which shall be accessible without removing the faceplate.
- C. Dimmers shall return lighting to level set prior to interruption of power upon restoration of power.
- D. Dimmers shall be linear slide type. Dimmers shall provide a smooth and continuous square law dimming curve.
- E. Dimmers shall include voltage compensation circuitry that adjusts the firing angle of the dimmer in such a manner as to compensate for variations in the AC line voltage.
- F. Heat fins shall not be visible on the front of the dimmer.
- G. Wallbox dimmers shall be Lutron "Nova" series or approved equal.

2.6 WALL PLATES

- A. Single and combination types to match corresponding wiring devices.
 - 1. Plate-Securing Screws: Metal with head color to match plate finish.
 - 2. Material for Finished Spaces: 0.035-inch-thick, satin-finished stainless steel 302/304.
 - 3. Material for Unfinished Spaces: Galvanized steel.
 - 4. Material for Damp Locations: Cast aluminum with spring-loaded lift cover and listed and labeled for use in "wet locations."
- B. Wet-Location, Weatherproof Cover Plates: NEMA 250, complying with type 3R weatherresistant, thermoplastic with lockable cover, and listed and labeled weather tight while-inuse.
- C. Security Type Cover Plates: 11 ga. steel with countersink captive torx head screws. Plates shall be Kenall Mighty Mac or approved equal.

2.7 FINISHES

- A. Color: Wiring device catalog numbers in Section Text do not designate device color.
 - 1. Wiring Devices Connected to Normal Power System: Gray, unless otherwise indicated or required by NFPA 70 or device listing.

PART 3 EXECUTION

- 3.1 INSTALLATION
 - A. Comply with NECA 1, including the mounting heights listed in that standard, unless otherwise noted.
 - B. Coordination with Other Trades:
 - 1. Take steps to ensure that devices and their boxes are protected. Do not place wall finish materials over device boxes and do not cut holes for boxes with routers that are guided by riding against outside of the boxes.
 - 2. Keep outlet boxes free of plaster, drywall joint compound, mortar, cement, concrete, dust, paint, and other material that may contaminate the raceway system, conductors, and cables.
 - 3. Install device boxes in brick or block walls so that the cover plate does not cross a joint unless the joint is troweled flush with the face of the wall.
 - 4. Install wiring devices after all wall preparation, including painting, is complete.
 - C. Conductors:
 - 1. Do not strip insulation from conductors until just before they are spliced or terminated on devices.
 - 2. Strip insulation evenly around the conductor using tools designed for the purpose. Avoid scoring or nicking of solid wire or cutting strands from stranded wire.
 - 3. The length of free conductors at outlets for devices shall meet provisions of NFPA 70, Article 300, without pigtails.

- D. Device Installation:
 - 1. Replace all devices that have been in temporary use during construction or that show signs that they were installed before building finishing operations were complete.
 - 2. Keep each wiring device in its package or otherwise protected until it is time to connect conductors.
 - 3. Do not remove surface protection, such as plastic film and smudge covers, until the last possible moment.
 - 4. Connect devices to branch circuits using pigtails that are not less than 6 inches in length.
 - 5. When there is a choice, use side wiring with binding-head screw terminals. Wrap solid conductor tightly clockwise, 2/3 to 3/4 of the way around terminal screw.
 - 6. Use a torque screwdriver when a torque is recommended or required by the manufacturer.
 - 7. When conductors larger than No. 12 AWG are installed on 15- or 20-A circuits, splice No. 12 AWG pigtails for device connections.
 - 8. Tighten unused terminal screws on the device.
 - 9. When mounting into metal boxes, remove the fiber or plastic washers used to hold device mounting screws in yokes, allowing metal-to-metal contact.
 - 10. Receptacles located within 6 feet or a water source shall be GFCI type.
 - 11. Receptacles located within detention areas shall be GFCI, Tamper Resistant type.
 - 12. Receptacles located above counters shall include integral duplex USB ports.
- E. Receptacle Orientation:
 - 1. Install ground pin of vertically mounted receptacles up, and on horizontally mounted receptacles to the right.
- F. Device Plates: Do not use oversized or extra-deep plates. Repair wall finishes and remount outlet boxes when standard device plates do not fit flush or do not cover rough wall opening.
 - 1. Provide security type device plates for devices located in detention areas.
- G. Arrangement of Devices: Unless otherwise indicated, mount flush, with long dimension vertical and with grounding terminal of receptacles on top. Group adjacent switches under single, multigang wall plates.

3.2 IDENTIFICATION

- A. Comply with Division 26 Section "Identification for Electrical Systems."
 - 1. Receptacles: Identify panelboard and circuit number from which served. Use hot, stamped or engraved machine printing with black-filled lettering on face of plate, and durable wire markers or tags inside outlet boxes.

3.3 FIELD QUALITY CONTROL

- A. Perform tests and inspections and prepare test reports.
 - 1. Test Instruments: Use instruments that comply with UL 1436.
 - 2. Test Instrument for Convenience Receptacles: Digital wiring analyzer with digital readout or illuminated LED indicators of measurement.

- B. Tests for Convenience Receptacles:
 - 1. Line Voltage: Acceptable range is 105 to 132 V.
 - 2. Percent Voltage Drop under 15-A Load: A value of 6 percent or higher is not acceptable.
 - 3. Ground Impedance: Values of up to 2 ohms are acceptable.
 - 4. GFCI Trip: Test for tripping values specified in UL 1436 and UL 943.
 - 5. Using the test plug, verify that the device and its outlet box are securely mounted.
 - 6. The tests shall be diagnostic, indicating damaged conductors, high resistance at the circuit breaker, poor connections, inadequate fault current path, defective devices, or similar problems. Correct circuit conditions remove malfunctioning units and replace with new ones, and retest as specified above.

END OF SECTION

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Cartridge fuses rated 600-V ac and less for use in control circuits, enclosed switches, enclosed controllers, and motor-control centers.
 - 2. Plug fuses rated 125-V ac and less for use in plug-fuse-type enclosed switches.
 - 3. Plug-fuse adapters for use in Edison-base, plug-fuse sockets.
 - 4. Spare-fuse cabinets.
- B. Related Sections include the following:
 - 1. Division 01 Section "Construction Waste Management".
 - 2. Division 26 Sections:
 - a. "Enclosed Switches and Circuit Breakers".
 - b. "Enclosed Controllers".

1.2 SUBMITTALS

- A. Product Data: For each type of product indicated. Include construction details, material, dimensions, descriptions of individual components, and finishes for spare-fuse cabinets. Include the following for each fuse type indicated:
 - 1. Ambient Temperature Adjustment Information: If ratings of fuses have been adjusted to accommodate ambient temperatures, provide list of fuses with adjusted ratings.
 - a. For each fuse having adjusted ratings, include location of fuse, original fuse rating, local ambient temperature, and adjusted fuse rating.
 - b. Provide manufacturer's technical data on which ambient temperature adjustment calculations are based.
 - 2. Dimensions and manufacturer's technical data on features, performance, electrical characteristics, and ratings.
 - 3. Current-limitation curves for fuses with current-limiting characteristics.
 - 4. Time-current coordination curves (average melt) and current-limitation curves (instantaneous peak let-through current) for each type and rating of fuse.
 - 5. Coordination charts and tables and related data.
 - 6. Fuse sizes for elevator feeders and elevator disconnect switches.
- B. Operation and Maintenance Data: For fuses to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 01 Section "Operation and Maintenance Data", include the following:
 - 1. Ambient temperature adjustment information.
 - 2. Current-limitation curves for fuses with current-limiting characteristics.
 - 3. Time-current coordination curves (average melt) and current-limitation curves (instantaneous peak let-through current) for each type and rating of fuse.
 - 4. Coordination charts and tables and related data.

1.3 QUALITY ASSURANCE

- A. Source Limitations: Obtain fuses, for use within a specific product or circuit, from single source from single manufacturer.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- C. Comply with NEMA FU 1 for cartridge fuses.
- D. Comply with NFPA 70.
- E. Comply with UL 248-11 for plug fuses.

1.4 PROJECT CONDITIONS

A. Where ambient temperature to which fuses are directly exposed is less than 40 deg F or more than 100 deg F, apply manufacturer's ambient temperature adjustment factors to fuse ratings.

1.5 COORDINATION

A. Coordinate fuse ratings with utilization equipment nameplate limitations of maximum fuse size and with system short-circuit current levels.

1.6 EXTRA MATERIALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Fuses: Equal to 10 percent of quantity installed for each size and type, but no fewer than three of each size and type.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Cooper Bussmann, Inc.
 - 2. Edison Fuse, Inc.
 - 3. Mersen.
 - 4. Littelfuse, Inc.
 - 5. Or approved equal.

2.2 CARTRIDGE FUSES

A. Characteristics: NEMA FU 1, nonrenewable cartridge fuses with voltage ratings consistent with circuit voltages. Selections based on characteristics published by Bussman.
- 1. All fuses shall be current limiting with 200,000 amperes interrupting capacity, and shall be certified by Underwriter's Laboratories, to have interrupting capacities adequate and proper for the system in which they are placed.
- 2. Class RK5: Standard dimension; dual-element, time delay type, Bussman FRN-R and FRS-R.
- 3. Small Dimension: Time delay type, Bussman FNQ-R.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Examine fuses before installation. Reject fuses that are moisture damaged or physically damaged.
- B. Examine holders to receive fuses for compliance with installation tolerances and other conditions affecting performance, such as rejection features.
- C. Examine utilization equipment nameplates and installation instructions. Install fuses of sizes and with characteristics appropriate for each piece of equipment.
- D. Evaluate ambient temperatures to determine if fuse rating adjustment factors must be applied to fuse ratings.
- E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 FUSE APPLICATIONS

- A. Cartridge Fuses:
 - 1. UL Class RK-5 fuses shall be installed in all fusible switches not defined above.
 - 2. Small dimension fuses shall be installed as the protective device in all motor control circuits.

3.3 INSTALLATION

- A. Install fuses in fusible devices. Arrange fuses so rating information is readable without removing fuse.
- B. No fuses shall be installed in the equipment until the installation is complete, including thorough cleaning, tightening of all electrical connections and inspection of all ground and grounding conductors. Fuses shall not be shipped installed in equipment and shall not be shipped to job site until equipment and systems are ready to be energized.
- C. A fuse identification label showing the fuse size and type shall be placed inside the door of each fused switch.
- D. Provide fuse reducers where fuse clips are spaced larger than the fuse size required.

3.4 IDENTIFICATION

A. Install labels complying with requirements for identification specified in Division 26 Section "Identification for Electrical Systems" and indicating fuse replacement information on inside door of each fused switch and adjacent to each fuse block, socket, and holder.

END OF SECTION

PART 1 GENERAL

- 1.1 SUMMARY
 - A. Section Includes:
 - 1. Fusible switches.
 - 2. Nonfusible switches.
 - 3. Circuit Breakers
 - 4. Enclosures.
 - B. Related sections include the following:
 - 1. Division 01 Section "Construction Waste Management".
 - 2. Division 26 Sections:
 - a. "Common Work Results for Electrical"
 - b. "Low Voltage Electrical Power Conductors and Cables".
 - c. "Grounding and Bonding for Electrical Systems"
 - d. "Hangers and Supports for Electrical Systems".
 - e. "Identification for Electrical Systems".
 - f. "Enclosed Controllers".

1.2 DEFINITIONS

- A. NC: Normally closed.
- B. NO: Normally open.
- C. SPDT: Single pole, double throw.

1.3 SUBMITTALS

- A. Product Data: For each type of enclosed switch, circuit breaker, accessory, and component indicated. Include dimensioned elevations, sections, weights, and manufacturers' technical data on features, performance, electrical characteristics, ratings, accessories, and finishes.
 - 1. Enclosure types and details for types other than NEMA 250, Type 1.
 - 2. Current and voltage ratings.
 - 3. Short-circuit current ratings (interrupting and withstand, as appropriate).
 - 4. Include evidence of NRTL listing for series rating of installed devices.
 - 5. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices, accessories, and auxiliary components.
 - 6. Include time-current coordination curves (average melt) for each type and rating of overcurrent protective device; include selectable ranges for each type of overcurrent protective device.
- B. Shop Drawings: For enclosed switches and circuit breakers. Include plans, elevations, sections, details, and attachments to other work.
 - 1. Wiring Diagrams: For power, signal, and control wiring.
- C. Qualification Data: For qualified testing agency.

- D. Field quality-control reports.
 - 1. Test procedures used.
 - 2. Test results that comply with requirements.
 - 3. Results of failed tests and corrective action taken to achieve test results that comply with requirements.
- E. Manufacturer's field service report.
- F. Operation and Maintenance Data: For enclosed switches and circuit breakers to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 01 Section "Operation and Maintenance Data," include the following:
 - 1. Manufacturer's written instructions for testing and adjusting enclosed switches and circuit breakers.
 - 2. Time-current coordination curves (average melt) for each type and rating of overcurrent protective device; include selectable ranges for each type of overcurrent protective device.

1.4 QUALITY ASSURANCE

- A. Testing Agency Qualifications: Member company of NETA or an NRTL.
 - 1. Testing Agency's Field Supervisor: Currently certified by NETA to supervise onsite testing.
- B. Source Limitations: Obtain enclosed switches and circuit breakers, overcurrent protective devices, components, and accessories, within same product category, from single source from single manufacturer.
- C. Product Selection for Restricted Space: Drawings indicate maximum dimensions for enclosed switches and circuit breakers, including clearances between enclosures, and adjacent surfaces and other items. Comply with indicated maximum dimensions.
- D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- E. Comply with NFPA 70.

1.5 PROJECT CONDITIONS

- A. Environmental Limitations: Rate equipment for continuous operation under the following conditions unless otherwise indicated:
 - 1. Ambient Temperature: Not less than minus 22 deg F and not exceeding 104 deg F.
 - 2. Altitude: Not exceeding 6600 feet.

1.6 COORDINATION

A. Coordinate layout and installation of switches, and components with equipment served and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

1.7 EXTRA MATERIALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Fuses: Equal to 10 percent of quantity installed for each size and type, but no fewer than three of each size and type.
 - 2. Fuse Pullers: Two for each size and type.

PART 2 PRODUCTS

- 2.1 FUSIBLE SWITCHES
 - A. Available Manufacturers: Subject to compliance with requirements, provide products by one of the following, or an approved equal:
 - 1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
 - 2. General Electric Company; GE Consumer & Industrial Electrical Distribution.
 - 3. Siemens Energy & Automation, Inc.
 - 4. Square D; a brand of Schneider Electric.
 - 5. Or approved equal.
 - B. Type HD, Heavy Duty, Single Throw, 240 and 600-V ac, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, with clips or bolt pads to accommodate specified fuses, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.
 - C. Accessories:
 - 1. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.
 - 2. Neutral Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.
 - 3. Class R Fuse Kit: Provides rejection of other fuse types when Class R fuses are specified.
 - 4. Auxiliary Contact Kit: One NO/NC (Form "C") auxiliary contact(s), arranged to activate before switch blades open.
 - 5. Hookstick Handle: Allows use of a hookstick to operate the handle.
 - 6. Lugs: Compression type, suitable for number, size, and conductor material.
 - 7. Service-Rated Switches: Labeled for use as service equipment.

2.2 NONFUSIBLE SWITCHES

- A. Available Manufacturers: Subject to compliance with requirements, provide products by one of the following, or an approved equal:
 - 1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
 - 2. General Electric Company; GE Consumer & Industrial Electrical Distribution.
 - 3. Siemens Energy & Automation, Inc.
 - 4. Square D; a brand of Schneider Electric.
 - 5. Or approved equal.
- B. Type HD, Heavy Duty, Single Throw, 240 and 600-V ac, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.

C. Accessories:

- 1. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.
- 2. Neutral Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.
- 3. Auxiliary Contact Kit: One NO/NC (Form "C") auxiliary contact(s), arranged to activate before switch blades open.
- 4. Hookstick Handle: Allows use of a hookstick to operate the handle.
- 5. Lugs: Compression type, suitable for number, size, and conductor material.

2.3 CIRCUIT BREAKERS

- A. Available Manufacturers: Subject to compliance with requirements, provide products by one of the following, or an approved equal:
 - 1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
 - 2. General Electric Company; GE Consumer & Industrial Electrical Distribution.
 - 3. Siemens Energy & Automation, Inc.
 - 4. Square D; a brand of Schneider Electric.
 - 5. Or approved equal.
- B. General Requirements: Comply with UL 489, NEMA AB 1, and NEMA AB 3, with interrupting capacity to comply with available fault currents.
- C. Molded-Case Circuit Breaker (MCCB): Comply with UL 489, with interrupting capacity to meet available fault currents.
 - 1. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads, and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.
 - 2. Electronic Trip Circuit Breakers: Microprocessor based trip system with true rms sensing, field-replaceable rating plug or field-replicable electronic trip; and the following field-adjustable settings:
 - a. Instantaneous trip.
 - b. Long- and short-time pickup levels.
 - c. Long- and short-time time adjustments.
 - d. Ground-fault pickup level, time delay, and I²t response, (where indicated on drawings).
 - 3. GFCI Circuit Breakers: Single- and two-pole configurations with Class A ground-fault protection (6-mA trip).
 - 4. Ground-Fault Equipment Protection (GFEP) Circuit Breakers: Class B ground-fault protection (30-mA trip).
 - 5. Molded-Case Circuit-Breaker (MCCB) Features and Accessories:
 - a. Standard frame sizes, trip ratings, and number of poles.
 - b. Lugs: Mechanical style, suitable for number, size, trip ratings, and conductor materials.
 - c. Ground-Fault Protection: Integrally mounted relay and trip unit with adjustable pickup and time-delay settings, push-to-test feature, and ground-fault indicator.
 - d. Shunt Trip: 120-V trip coil energized from separate circuit, set to trip at 55 percent of rated voltage.

- e. Multipole units enclosed in a single housing or factory assembled to operate as a single unit.
- f. Handle Padlocking Device: Fixed attachment, for locking circuit-breaker handle in on or off position.
- g. Handle Clamp: Loose attachment, for holding circuit-breaker handle in on position.

2.4 ENCLOSURES

- A. Enclosed Switches and circuit breakers: NEMA AB 1, NEMA KS 1, NEMA 250, and UL 50, to comply with environmental conditions at installed location.
 - 1. Indoor, Dry and Clean Locations: NEMA 250, Type 1.
 - 2. Outdoor Locations: NEMA 250, Type 3R.
 - 3. Washdown Locations: NEMA 250, Type 4X Stainless Steel.
- 2.5 Protective device selection shall be based on results of the coordination study.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Examine elements and surfaces to receive enclosed switches and circuit breakers for compliance with installation tolerances and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install individual wall-mounted switches and circuit breakers with tops at uniform height unless otherwise indicated.
- B. Switches and Circuit Breakers Installed Between Variable Speed Controllers and Load: Provide auxiliary contacts.
- C. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.
- D. Install fuses in fusible devices and leave in the "off" position after final installation and testing.
- E. Switches shall be properly rated for the voltage of the system to which they are connected and shall have ampacity and horsepower rating corresponding to the load served.
- F. Comply with NECA 1.
- G. Circuit breakers rated below 250 amps shall be thermal magnetic type circuit breakers. Circuit breakers rated above 250 amps shall be electronic trip type. Circuit breakers rated above 1200 amp shall be 100% rated. Circuit breakers rated 1000 amps or more and connected to the 480Y/277 volt system shall have integral ground fault pick-up, time delay, and I2t response.

H. Provide auxiliary contacts for all switches and circuit breakers serving elevator power units.

3.3 IDENTIFICATION

- A. Comply with requirements in Division 26 Section "Identification for Electrical Systems".
 - 1. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs.
 - 2. Label each enclosure with engraved metal or laminated-plastic nameplate.

3.4 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
 - 1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
- B. Acceptance Testing Preparation:
 - 1. Test insulation resistance for each enclosed switch and circuit breaker, component, connecting supply, feeder, and control circuit.
 - 2. Test continuity of each circuit.
- C. Tests and Inspections:
 - 1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
 - 2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
 - 3. Test and adjust controls, remote monitoring, and safeties. Replace damaged and malfunctioning controls and equipment.
- D. Enclosed switches and circuit breakers will be considered defective if they do not pass tests and inspections.

3.5 ADJUSTING

A. Adjust moving parts and operable components to function smoothly and lubricate as recommended by manufacturer.

END OF SECTION

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes the following enclosed controllers rated 600 V and less:
 - 1. Full-voltage manual.
 - 2. Full-voltage magnetic.
- B. Related sections include the following:
 - 1. Division 01 Section "Demonstration and Training".
 - 2. Division 01 Section "Construction Waste Management".
 - 3. Division 26 Sections:
 - a. "Common Work Results for Electrical"
 - b. "Low Voltage Electrical Power Conductors and Cables".
 - c. "Grounding and Bonding for Electrical Systems"
 - d. "Hangers and Supports for Electrical Systems".
 - e. "Identification for Electrical Systems".
 - f. "Fuses".

1.2 DEFINITIONS

- A. CPT: Control power transformer.
- B. MCCB: Molded-case circuit breaker.
- C. MCP: Motor circuit protector.
- D. N.C.: Normally closed.
- E. N.O.: Normally open.
- F. OCPD: Overcurrent protective device.

1.3 PERFORMANCE REQUIREMENTS

- A. Seismic Performance: Enclosed controllers shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
 - 1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event".

1.4 SUBMITTALS

- A. Product Data: For each type of enclosed controller. Include manufacturer's technical data on features, performance, electrical characteristics, ratings, and enclosure types and finishes.
- B. Shop Drawings: For each enclosed controller. Include dimensioned plans, elevations, sections, details, and required clearances and service spaces around controller enclosures.

- 1. Show tabulations of the following:
 - a. Each installed unit's type and details.
 - b. Factory-installed devices.
 - c. Nameplate legends.
 - d. Short-circuit current rating of integrated unit.
 - e. Listed and labeled for integrated short-circuit current (withstand) rating of OCPDs in combination controllers by an NRTL acceptable to authorities having jurisdiction.
 - f. Features, characteristics, ratings, and factory settings of individual OCPDs in combination controllers.
- 2. Wiring Diagrams: For power, signal, and control wiring.
- C. Qualification Data: For qualified testing agency.
- D. Field quality-control reports.
- E. Operation and Maintenance Data: For enclosed controllers to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 01 Section "Operation and Maintenance Data", include the following:
 - 1. Routine maintenance requirements for enclosed controllers and installed components.
 - 2. Manufacturer's written instructions for setting field-adjustable overload relays.
- F. Load-Current and Overload-Relay Heater List: Compile after motors have been installed and arrange to demonstrate that selection of heaters suits actual motor nameplate full-load currents.

1.5 QUALITY ASSURANCE

- A. Testing Agency Qualifications: Member company of NETA or an NRTL.
 - 1. Testing Agency's Field Supervisor: Currently certified by NETA to supervise onsite testing.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- C. Comply with NFPA 70.
- D. IEEE Compliance: Fabricate and test enclosed controllers according to IEEE 344 to withstand seismic forces defined in Division 26 Section "Vibration and Seismic Controls for Electrical Systems".

1.6 DELIVERY, STORAGE AND HANDLING

A. Store enclosed controllers indoors in clean, dry space with uniform temperature to prevent condensation. Protect enclosed controllers from exposure to dirt, fumes, water, corrosive substances, and physical damage.

B. If stored in areas subject to weather, cover enclosed controllers to protect them from weather, dirt, dust, corrosive substances, and physical damage. Remove loose packing and flammable materials from inside controllers.

1.7 PROJECT CONDITIONS

- A. Environmental Limitations: Rate equipment for continuous operation under the following conditions unless otherwise indicated:
 - 1. Ambient Temperature: Not less than minus 22 deg F and not exceeding 104 deg F.
 - 2. Altitude: Not exceeding 6600 feet.

1.8 COORDINATION

- A. Coordinate layout and installation of enclosed controllers with other construction including conduit, piping, equipment, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.
- B. Coordinate installation of roof curbs, equipment supports, and roof penetrations.

1.9 EXTRA MATERIALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Fuses for Fused Switches: Equal to 10 percent of quantity installed for each size and type, but no fewer than three of each size and type.
 - 2. Control Power Fuses: Equal to 10 percent of quantity installed for each size and type, but no fewer than two of each size and type.
 - 3. Indicating Lights: Two of each type and color installed.
 - 4. Auxiliary Contacts: Furnish one spare(s) for each size and type of magnetic controller installed.
 - 5. Power Contacts: Furnish three spares for each size and type of magnetic contactor installed.

PART 2 PRODUCTS

2.1 FULL-VOLTAGE CONTROLLERS

- A. General Requirements for Full-Voltage Controllers: Comply with NEMA ICS 2, general purpose, Class A.
- B. Motor-Starting Switches: "Quick-make, quick-break" toggle or push-button action; marked to show whether unit is off or on.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following, or an approved equal:
 - a. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
 - b. General Electric Company; GE Consumer & Industrial Electrical Distribution.
 - c. Siemens Energy & Automation, Inc.
 - d. Square D; a brand of Schneider Electric.
 - e. Or approved equal.

- 2. Configuration: Nonreversing.
- 3. Flush or surface mounting as indicated.
- 4. Green pilot light.
- C. Fractional Horsepower Manual Controllers: "Quick-make, quick-break" toggle or pushbutton action; marked to show whether unit is off, on, or tripped.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following, or an approved equal:
 - a. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
 - b. General Electric Company; GE Consumer & Industrial Electrical Distribution.
 - c. Siemens Energy & Automation, Inc.
 - d. Square D; a brand of Schneider Electric.
 - e. Or approved equal.
 - 2. Configuration: Nonreversing.
 - 3. Overload Relays: Inverse-time-current characteristics; NEMA ICS 2, Class 20 tripping characteristics; heaters matched to nameplate full-load current of actual protected motor; external reset push button; bimetallic type.
 - 4. Flush or surface mounting as indicated.
 - 5. Green run pilot light.
 - 6. Controller shall be inoperative if overload element is removed.
- D. Magnetic Controllers: Full voltage, across the line, electrically held.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following, or an approved equal:
 - a. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
 - b. General Electric Company; GE Consumer & Industrial Electrical Distribution.
 - c. Siemens Energy & Automation, Inc.
 - d. Square D; a brand of Schneider Electric.
 - e. Or approved equal.
 - 2. Configuration: Nonreversing.
 - 3. Contactor Coils: Pressure-encapsulated type. Coils shall be replaceable from the front without removing starter from the panel.
 - a. Operating Voltage: Depending on contactor NEMA size and line-voltage rating, manufacturer's standard matching control power or line voltage.
 - 4. Power Contacts: Totally enclosed, double-break, silver-cadmium oxide; assembled to allow inspection and replacement without disturbing line or load wiring.
 - 5. Control Circuits: 120-V ac; obtained from integral CPT, with primary and secondary fuses of sufficient capacity to operate integral devices and remotely located pilot, indicating, and control devices.
 - a. CPT Spare Capacity: 50 VA.
 - 6. Bimetallic Overload Relays:

- a. Inverse-time-current characteristic.
- b. Class 20 tripping characteristic.
- c. Heaters in each phase matched to nameplate full-load current of actual protected motor and with appropriate adjustment for duty cycle.
- d. Ambient compensated.
- e. Automatic resetting.
- 7. NC/NO, isolated overload alarm contact.
- 8. External overload reset push button.
- 9. Flush or surface mounted as indicated.
- 10. Red or green pilot light as indicated.
- E. Combination Magnetic Controller: Factory-assembled combination of magnetic controller, OCPD, and disconnecting means.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following, or an approved equal:
 - a. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
 - b. General Electric Company; GE Consumer & Industrial Electrical Distribution.
 - c. Siemens Energy & Automation, Inc.
 - d. Square D; a brand of Schneider Electric.
 - e. Or approved equal.
 - 2. Fusible Disconnecting Means:
 - a. NEMA KS 1, heavy-duty, horsepower-rated, fusible switch with clips or bolt pads to accommodate Class R fuses.
 - b. Lockable Handle: Accepts three padlocks and interlocks with cover in closed position.
 - c. Auxiliary Contacts: N.O./N.C., arranged to activate before switch blades open.
 - 3. Nonfusible Disconnecting Means:
 - a. NEMA KS 1, heavy-duty, horsepower-rated, nonfusible switch.
 - b. Lockable Handle: Accepts three padlocks and interlocks with cover in closed position.
 - c. Auxiliary Contacts: N.O./N.C., arranged to activate before switch blades open.

2.2 ENCLOSURES

- A. Enclosed Controllers: NEMA ICS 6, to comply with environmental conditions at installed location.
 - 1. Dry and Clean Indoor Locations: Type 1.
 - 2. Outdoor Locations: Type 3R.
 - 3. Wash-Down Areas: Type 4X Stainless Steel.
 - 4. Food Production and Packaging Locations: NEMA 4X Stainless Steel.

2.3 ACCESSORIES

- A. General Requirements for Control Circuit and Pilot Devices: NEMA ICS 5; factory installed in controller enclosure cover unless otherwise indicated.
 - 1. Push Buttons, Pilot Lights, and Selector Switches: Heavy-duty, oiltight type.
 - a. Push Buttons: Recessed, Shrouded types; momentary as indicated.
 - b. Pilot Lights: LED types; colors as indicated; push to test.
 - c. Selector Switches: Rotary type.
- B. Reversible N.C./N.O. auxiliary contact(s).
- C. Control Relays: Auxiliary and adjustable solid-state time-delay relays.
- D. Phase-Failure, Phase-Reversal, and Undervoltage and Overvoltage Relays: Solid-state sensing circuit with isolated output contacts for hard-wired connections. Provide adjustable undervoltage, overvoltage, and time-delay settings.
- E. Sun shields installed on fronts, sides, and tops of enclosures installed outdoors and subject to direct and extended sun exposure.
- F. Cover gaskets for Type 1 enclosures.
- G. Terminals for connecting power factor correction capacitors to the load side of overload relays.
- H. Spare control wiring terminal blocks, quantity as indicated; wired.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Examine areas and surfaces to receive enclosed controllers, with Installer present, for compliance with requirements and other conditions affecting performance of the Work.
- B. Examine enclosed controllers before installation. Reject enclosed controllers that are wet, moisture damaged, or mold damaged.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Wall-Mounted Controllers: Install enclosed controllers on walls with tops at uniform height unless otherwise indicated, and by bolting units to wall or mounting on lightweight structural-steel channels bolted to wall. For controllers not at walls, provide freestanding racks complying with Division 26 Section "Hangers and Supports for Electrical Systems".
- B. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.
- C. Install fuses in each fusible-switch enclosed controller.
- D. Install fuses in control circuits if not factory installed. Comply with requirements in Division 26 Section "Fuses".

- E. Install heaters in thermal overload relays. Select heaters based on actual nameplate fullload amperes after motors have been installed.
- F. Install, connect, and fuse thermal-protector monitoring relays furnished with motor-driven equipment.
- G. Comply with NECA 1.

3.3 IDENTIFICATION

- A. Identify enclosed controllers, components, and control wiring. Comply with requirements for identification specified in Division 26 Section "Identification for Electrical Systems".
 - 1. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs.
 - 2. Label each enclosure with engraved nameplate.
 - 3. Label each enclosure-mounted control and pilot device.

3.4 CONTROL WIRING INSTALLATION

- A. Install wiring between enclosed controllers and remote devices and facility's central control system.
- B. Bundle, train, and support wiring in enclosures.
- C. Connect selector switches and other automatic-control selection devices where applicable.
 - 1. Connect selector switches to bypass only those manual- and automatic-control devices that have no safety functions when switch is in manual-control position.
 - 2. Connect selector switches with enclosed-controller circuit in both manual and automatic positions for safety-type control devices such as low- and high-pressure cutouts, high-temperature cutouts, and motor overload protectors.

3.5 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- B. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.
- C. Acceptance Testing Preparation:
 - 1. Test insulation resistance for each enclosed controller, component, connecting supply, feeder, and control circuit.
 - 2. Test continuity of each circuit.
- D. Tests and Inspections:
 - 1. Inspect controllers, wiring, components, connections, and equipment installation. Test and adjust controllers, components, and equipment.
 - 2. Test insulation resistance for each enclosed-controller element, component, connecting motor supply, feeder, and control circuits.
 - 3. Test continuity of each circuit.

- 4. Verify that voltages at controller locations are within plus or minus 10 percent of motor nameplate rated voltages. If outside this range for any motor, notify Architect before starting the motor(s).
- 5. Test each motor for proper phase rotation.
- 6. Perform each electrical test and visual and mechanical inspection stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
- 7. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
- 8. Test and adjust controls, remote monitoring, and safeties. Replace damaged and malfunctioning controls and equipment.
- E. Enclosed controllers will be considered defective if they do not pass tests and inspections.
- F. Prepare test and inspection reports including a certified report that identifies enclosed controllers and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

3.6 ADJUSTING

A. Set field-adjustable switches, auxiliary relays, time-delay relays, timers, and overloadrelay pickup and trip ranges.

3.7 PROTECTION

- A. Temporary Heating: Apply temporary heat to maintain temperature according to manufacturer's written instructions until enclosed controllers are ready to be energized and placed into service.
- B. Replace controllers whose interiors have been exposed to water or other liquids prior to Substantial Completion.

END OF SECTION

PART 1 GENERAL

1.1 SUMMARY

- A. This Section includes packaged engine-generator sets for emergency power supply with the following features:
 - 1. Natural gas engine.
 - 2. Unit-mounted cooling system.
 - 3. Unit-mounted control and monitoring.
 - 4. Performance requirements for sensitive loads.
 - 5. Outdoor enclosure.
 - 6. Temporary load bank and generator docking station.
- B. Related Sections include the following:
 - 1. Division 26 Section "Transfer Switches" for transfer switches including sensors and relays to initiate automatic-starting and -stopping signals for engine-generator sets.

1.2 DEFINITIONS

A. Operational Bandwidth: The total variation from the lowest to highest value of a parameter over the range of conditions indicated, expressed as a percentage of the nominal value of the parameter.

1.3 SUBMITTALS

- A. Product Data: For each type of packaged engine generator indicated. Include rated capacities, operating characteristics, and furnished specialties and accessories. In addition, include the following:
 - 1. Thermal damage curve for generator.
 - 2. Time-current characteristic curves for generator protective device.
- B. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
 - 1. Dimensioned outline plan and elevation drawings of engine-generator set, and other components specified.
 - 2. Design Calculations: Signed and sealed by a qualified professional engineer. Calculate requirements for selecting vibration isolators and seismic restraints and for designing vibration isolation bases.
 - 3. Vibration Isolation Base Details: Signed and sealed by a qualified professional engineer. Detail fabrication, including anchorages and attachments to structure and to supported equipment. Include base weights.
 - 4. Wiring Diagrams: Power, signal, and control wiring.
- C. Qualification Data: For installer, manufacturer, and testing agency.
- D. Source quality-control test reports.
 - 1. Certified summary of prototype-unit test report.

- 2. Certified Test Reports: For components and accessories that are equivalent, but not identical, to those tested on prototype unit.
- 3. Certified Summary of Performance Tests: Certify compliance with specified requirement to meet performance criteria for sensitive loads.
- 4. Report of factory test on units to be shipped for this Project, showing evidence of compliance with specified requirements.
- 5. Report of sound generation.
- 6. Report of exhaust emissions showing compliance with applicable regulations.
- 7. Certified Torsional Vibration Compatibility: Comply with NFPA 110.
- E. Field quality-control test reports.
- F. Operation and Maintenance Data: For packaged engine generators to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 01 Section "Operation and Maintenance Data," include the following:
 - 1. List of tools and replacement items recommended to be stored at Project for ready access. Include part and drawing numbers, current unit prices, and source of supply.
- G. Warranty: Special warranty specified in this Section.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of units required for this Project.
 - 1. Maintenance Proximity: Not more than four hours' normal travel time from Installer's place of business to Project site.
 - 2. Engineering Responsibility: Preparation of data for vibration isolators and seismic restraints of engine skid mounts, including Shop Drawings, based on testing and engineering analysis of manufacturer's standard units in assemblies similar to those indicated for this Project.
- B. Manufacturer Qualifications: A qualified manufacturer. Maintain, within 200 miles of Project site, a service center capable of providing training, parts, and emergency maintenance repairs.
- C. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is a member company of the InterNational Electrical Testing Association or is a nationally recognized testing laboratory (NRTL), and that is acceptable to authorities having jurisdiction.
 - 1. Testing Agency's Field Supervisor: Person currently certified by the InterNational Electrical Testing Association or the National Institute for Certification in Engineering Technologies to supervise on-site testing specified in Part 3.
- D. Source Limitations: Obtain packaged generator sets and auxiliary components through one source from a single manufacturer.
- E. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

- F. Comply with ASME B15.1.
- G. Comply with NFPA 37.
- H. Comply with NFPA 70.
- I. Comply with NFPA 99.
- J. Comply with NFPA 110 requirements for Level 1 emergency power supply system.
- K. Comply with UL 2200.
- L. Engine Exhaust Emissions: Comply with applicable state and local government requirements.
- M. Noise Emission: Comply with applicable state and local government requirements for maximum noise level at adjacent property boundaries due to sound emitted by generator set including engine, engine exhaust, engine cooling-air intake and discharge, and other components of installation.

1.5 PROJECT CONDITIONS

- A. Interruption of Existing Electrical Service: Do not interrupt electrical service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electrical service according to requirements indicated:
 - 1. Notify Architect no fewer than seven days in advance of proposed interruption of electrical service.
 - 2. Do not proceed with interruption of electrical service without Architect's written permission.
- B. Environmental Conditions: Engine-generator system shall withstand the following environmental conditions without mechanical or electrical damage or degradation of performance capability:
 - 1. Ambient Temperature: Minus 15 to plus 40 deg C.
 - 2. Relative Humidity: 0 to 95 percent.
 - 3. Altitude: Sea level to 1000 feet (300 m).

1.6 COORDINATION

- A. Coordinate size and location of concrete bases for package engine generators. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 03.
- B. Coordinate size and location of roof curbs, equipment supports, and roof penetrations for remote radiators. These items are specified in Division 07 Section "Roof Accessories."

1.7 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of packaged engine generators and associated auxiliary components that fail in materials or workmanship within specified warranty period.

1. Warranty Period: 5 years from date of Substantial Completion.

1.8 MAINTENANCE SERVICE

A. Initial Maintenance Service: Beginning at Substantial Completion, provide 12 months' full maintenance by skilled employees of manufacturer's designated service organization. Include quarterly exercising to check for proper starting, load transfer, and running under load. Include routine preventive maintenance as recommended by manufacturer and adjusting as required for proper operation. Provide parts and supplies same as those used in the manufacture and installation of original equipment.

1.9 EXTRA MATERIALS

- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Fuses: One for every 10 of each type and rating, but no fewer than one of each.
 - 2. Indicator Lamps: Two for every six of each type used, but no fewer than two of each.
 - 3. Filters: One set each of lubricating oil, fuel, and combustion-air filters.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Basis of Design Product: Subject to the compliance with requirements, provide product by one of the following:
 - 1. Onan/Cummins Power Generation; Industrial Business Group.
 - 2. Caterpillar; Engine Division.
 - 3. Generac Power Systems.
 - 4. Or Approved Equal.

2.2 ENGINE-GENERATOR SET

- A. Factory-assembled and -tested, engine-generator set.
- B. Mounting Frame: Maintain alignment of mounted components without depending on concrete foundation; and have lifting attachments.
 - 1. Rigging Diagram: Inscribed on metal plate permanently attached to mounting frame to indicate location and lifting capacity of each lifting attachment and generator-set center of gravity.
- C. Capacities and Characteristics:
 - 1. Power Output Ratings: Nominal ratings as indicated.
 - 2. Output Connections: Three-phase, four wire.
 - 3. Nameplates: For each major system component to identify manufacturer's name and address, and model and serial number of component.
- D. Generator-Set Performance:

- 1. Steady-State Voltage Operational Bandwidth: 3 percent of rated output voltage from no load to full load.
- 2. Transient Voltage Performance: Not more than 20 percent variation for 50 percent step-load increase or decrease. Voltage shall recover and remain within the steady-state operating band within three seconds.
- 3. Steady-State Frequency Operational Bandwidth: 0.5 percent of rated frequency from no load to full load.
- 4. Steady-State Frequency Stability: When system is operating at any constant load within the rated load, there shall be no random speed variations outside the steady-state operational band and no hunting or surging of speed.
- 5. Transient Frequency Performance: Less than 5 percent variation for 50 percent step-load increase or decrease. Frequency shall recover and remain within the steady-state operating band within five seconds.
- Output Waveform: At no load, harmonic content measured line to line or line to neutral shall not exceed 5 percent total and 3 percent for single harmonics. Telephone influence factor, determined according to NEMA MG 1, shall not exceed 50 percent.
- 7. Sustained Short-Circuit Current: For a 3-phase, bolted short circuit at system output terminals, system shall supply a minimum of 250 percent of rated full-load current for not less than 10 seconds and then clear the fault automatically, without damage to generator system components.
- 8. Start Time: Comply with NFPA 110, Type 10, system requirements.

2.3 ENGINE

- A. Fuel: Natural gas.
- B. Rated Engine Speed: 1800 rpm.
- C. Maximum Piston Speed for Four-Cycle Engines: 2250 fpm (11.4 m/s).
- D. Lubrication System: The following items are mounted on engine or skid:
 - 1. Filter and Strainer: Rated to remove 90 percent of particles 5 micrometers and smaller while passing full flow.
 - 2. Thermostatic Control Valve: Control flow in system to maintain optimum oil temperature. Unit shall be capable of full flow and is designed to be fail-safe.
 - 3. Crankcase Drain: Arranged for complete gravity drainage to an easily removable container with no disassembly and without use of pumps, siphons, special tools, or appliances.
- E. Engine Fuel System:
 - 1. Dual Natural Gas with LP-Gas Backup (Vapor-Withdrawal) System:
 - a. Carburetor.
 - b. Secondary Gas Regulators: One for each fuel type.
 - c. Fuel-Shutoff Solenoid Valves: One for each fuel source.
 - d. Flexible Fuel Connectors: One for each fuel source.
- F. Coolant Jacket Heater: Electric-immersion type, factory installed in coolant jacket system with circulating pump. Comply with NFPA 110 requirements for Level 1 equipment for heater capacity.

- G. Governor: Adjustable isochronous, with speed sensing.
- H. Cooling System: Closed loop, liquid cooled, with radiator factory mounted on enginegenerator-set mounting frame and integral engine-driven coolant pump.
 - 1. Coolant: Solution of 50 percent ethylene-glycol-based antifreeze and 50 percent water, with anticorrosion additives as recommended by engine manufacturer.
 - 2. Size of Radiator: Adequate to contain expansion of total system coolant from cold start to 110 percent load condition.
 - 3. Expansion Tank: Constructed of welded steel plate and rated to withstand maximum closed-loop coolant system pressure for engine used. Equip with gage glass and petcock.
 - 4. Temperature Control: Self-contained, thermostatic-control valve modulates coolant flow automatically to maintain optimum constant coolant temperature as recommended by engine manufacturer.
 - 5. Coolant Hose: Flexible assembly with inside surface of nonporous rubber and outer covering of aging-, ultraviolet-, and abrasion-resistant fabric.
 - a. Rating: 50-psig (345-kPa) maximum working pressure with coolant at 180 deg F (82 deg C), and noncollapsible under vacuum.
 - b. End Fittings: Flanges or steel pipe nipples with clamps to suit piping and equipment connections.
- I. Muffler/Silencer: Critical type, sized as recommended by engine manufacturer and selected with exhaust piping system to not exceed engine manufacturer's engine backpressure requirements.
 - 1. Minimum sound attenuation of 25 dB at 500 Hz.
 - 2. Sound level measured at a distance of 10 feet (3 m) from exhaust discharge after installation is complete shall be 85 dBA or less.
- J. Air-Intake Filter: Heavy-duty, engine-mounted air cleaner with replaceable dry-filter element and "blocked filter" indicator.
- K. Starting System: 24-V electric, with negative ground.
 - 1. Components: Sized so they will not be damaged during a full engine-cranking cycle with ambient temperature at maximum specified in Part 1 "Project Conditions" Article.
 - 2. Cranking Motor: Heavy-duty unit that automatically engages and releases from engine flywheel without binding.
 - 3. Cranking Cycle: As required by NFPA 110 for system level specified.
 - 4. Battery: Adequate capacity within ambient temperature range specified in Part 1 "Project Conditions" Article to provide specified cranking cycle at least three times without recharging.
 - 5. Battery Cable: Size as recommended by engine manufacturer for cable length indicated. Include required interconnecting conductors and connection accessories.
 - 6. Battery Compartment: Factory fabricated of metal with acid-resistant finish and thermal insulation. Thermostatically controlled heater shall be arranged to maintain battery above 10 deg C regardless of external ambient temperature within range specified in Part 1 "Project Conditions" Article. Include accessories required to support and fasten batteries in place.

- 7. Battery-Charging Alternator: Factory mounted on engine with solid-state voltage regulation and 35-A minimum continuous rating.
- 8. Battery Charger: Current-limiting, automatic-equalizing and float-charging type. Unit shall comply with UL 1236 and include the following features:
 - a. Operation: Equalizing-charging rate of 10 A shall be initiated automatically after battery has lost charge until an adjustable equalizing voltage is achieved at battery terminals. Unit shall then be automatically switched to a lower float-charging mode and shall continue to operate in that mode until battery is discharged again.
 - b. Automatic Temperature Compensation: Adjust float and equalize voltages for variations in ambient temperature from minus 40 deg C to plus 60 deg C to prevent overcharging at high temperatures and undercharging at low temperatures.
 - c. Automatic Voltage Regulation: Maintain constant output voltage regardless of input voltage variations up to plus or minus 10 percent.
 - d. Ammeter and Voltmeter: Flush mounted in door. Meters shall indicate charging rates.
 - e. Safety Functions: Sense abnormally low battery voltage and close contacts providing low battery voltage indication on control and monitoring panel. Sense high battery voltage and loss of ac input or dc output of battery charger. Either condition shall close contacts that provide a battery-charger malfunction indication at system control and monitoring panel.
 - f. Enclosure and Mounting: NEMA 250, Type 1, wall-mounted cabinet installed within generator enclosure.

2.4 CONTROL AND MONITORING

- A. Automatic Starting System Sequence of Operation: When mode-selector switch on the control and monitoring panel is in the automatic position, remote-control contacts in one or more separate automatic transfer switches initiate starting and stopping of generator set. When mode-selector switch is switched to the on position, generator set starts. The off position of same switch initiates generator-set shutdown. When generator set is running, specified system or equipment failures or derangements automatically shut down generator set and initiate alarms. Operation of a remote emergency-stop switch also shuts down generator set.
- B. Manual Starting System Sequence of Operation: Switching on-off switch on the generator control panel to the on position starts generator set. The off position of same switch initiates generator-set shutdown. When generator set is running, specified system or equipment failures or derangements automatically shut down generator set and initiate alarms. Operation of a remote emergency-stop switch also shuts down generator set.
- C. Configuration: Operating and safety indications, protective devices, basic system controls, and engine gages shall be grouped in a common control and monitoring panel mounted on the generator set. Mounting method shall isolate the control panel from generator-set vibration.
- D. Indicating and Protective Devices and Controls: As required by NFPA 110 for Level 1 system, and the following:
 - 1. AC voltmeter.
 - 2. AC ammeter.
 - 3. AC frequency meter.

- 4. DC voltmeter (alternator battery charging).
- 5. Engine-coolant temperature gage.
- 6. Engine lubricating-oil pressure gage.
- 7. Running-time meter.
- 8. Ammeter-voltmeter, phase-selector switch(es).
- 9. Generator-voltage adjusting rheostat.
- 10. Fuel tank derangement alarm.
- 11. Fuel tank high-level shutdown of fuel supply alarm.
- 12. Generator overload.
- E. Indicating and Protective Devices and Controls:
 - 1. AC voltmeter.
 - 2. AC ammeter.
 - 3. AC frequency meter.
 - 4. DC voltmeter (alternator battery charging).
 - 5. Engine-coolant temperature gage.
 - 6. Engine lubricating-oil pressure gage.
 - 7. Running-time meter.
 - 8. Ammeter-voltmeter, phase-selector switch(es).
 - 9. Generator-voltage adjusting rheostat.
 - 10. Start-stop switch.
 - 11. Overspeed shutdown device.
 - 12. Coolant high-temperature shutdown device.
 - 13. Coolant low-level shutdown device.
 - 14. Oil low-pressure shutdown device.
 - 15. Fuel tank derangement alarm.
 - 16. Fuel tank high-level shutdown of fuel supply alarm.
 - 17. Generator overload.
- F. Supporting Items: Include sensors, transducers, terminals, relays, and other devices and include wiring required to support specified items. Locate sensors and other supporting items on engine or generator, unless otherwise indicated.
- G. Connection to Data Link: A separate terminal block, factory wired to Form C dry contacts, for each alarm and status indication is reserved for connections for data-link transmission of indications to remote data terminals.
- H. Common Remote Audible Alarm: Comply with NFPA 110 requirements for Level 1 systems. Include necessary contacts and terminals in control and monitoring panel.
 - 1. Overcrank shutdown.
 - 2. Coolant low-temperature alarm.
 - 3. Control switch not in auto position.
 - 4. Battery-charger malfunction alarm.
 - 5. Battery low-voltage alarm.
- I. Remote Alarm Annunciator: Comply with NFPA 99. An LED labeled with proper alarm conditions shall identify each alarm event and a common audible signal shall sound for each alarm condition. Silencing switch in face of panel shall silence signal without altering visual indication. Connect so that after an alarm is silenced, clearing of initiating condition will reactivate alarm until silencing switch is reset. Cabinet and faceplate are surface- or flush-mounting type to suit mounting conditions indicated.

- J. Remote Emergency-Stop Switch: Surface mounted on exterior of generator enclosure, unless otherwise indicated; and labeled. Push button shall be protected from accidental operation. Provide weatherproof cover.
- K. Provide pyrometer to allow monitoring of exhaust gas temperature.

2.5 GENERATOR OVERCURRENT AND FAULT PROTECTION

- A. Generator Circuit Breaker: Molded-case, 5-funtion electronic-trip type; 100 percent rated; complying with UL 489.
 - 1. Tripping Characteristics: Adjustable long-time and short-time delay and instantaneous.
 - 2. Trip Settings: Selected to coordinate with generator thermal damage curve.
 - 3. Shunt Trip: Connected to trip breaker when generator set is shut down by other protective devices.
 - 4. Mounting: Adjacent to or integrated with control and monitoring panel.
- B. Generator Protector: Microprocessor-based unit shall continuously monitor current level in each phase of generator output, integrate generator heating effect over time, and predict when thermal damage of alternator will occur. When signaled by generator protector or other generator-set protective devices, a shunt-trip device in the generator disconnect switch shall open the switch to disconnect the generator from load circuits. Protector shall perform the following functions:
 - 1. Initiates a generator overload alarm when generator has operated at an overload equivalent to 110 percent of full-rated load for 60 seconds. Indication for this alarm is integrated with other generator-set malfunction alarms.
 - 2. Under single or three-phase fault conditions, regulates generator to 300 percent of rated full-load current for up to 10 seconds.
 - 3. As overcurrent heating effect on the generator approaches the thermal damage point of the unit, protector switches the excitation system off, opens the generator disconnect device, and shuts down the generator set.
 - 4. Senses clearing of a fault by other overcurrent devices and controls recovery of rated voltage to avoid overshoot.
- C. Ground-Fault Indication: Comply with NFPA 70, "Emergency System" signals for ground-fault. Integrate ground-fault alarm indication with other generator-set alarm indications.

2.6 GENERATOR, EXCITER, AND VOLTAGE REGULATOR

- A. Comply with NEMA MG 1.
- B. Drive: Generator shaft shall be directly connected to engine shaft. Exciter shall be rotated integrally with generator rotor.
- C. Electrical Insulation: Class H or Class F.
- D. Stator-Winding Leads: Brought out to terminal box to permit future reconnection for other voltages if required.
- E. Construction shall prevent mechanical, electrical, and thermal damage due to vibration, overspeed up to 125 percent of rating, and heat during operation at 110 percent of rated capacity.

- F. Enclosure: Dripproof.
- G. Instrument Transformers: Mounted within generator enclosure.
- H. Voltage Regulator: Solid-state type, separate from exciter, providing performance as specified.
 - 1. Adjusting rheostat on control and monitoring panel shall provide plus or minus 5 percent adjustment of output-voltage operating band.
- I. Strip Heater: Thermostatically controlled unit arranged to maintain stator windings above dew point.
- J. Windings: Two-thirds pitch stator winding and fully linked amortisseur winding.
- K. Subtransient Reactance: 12 percent, maximum.

2.7 OUTDOOR GENERATOR-SET ENCLOSURE

- A. Description: Vandal-resistant, level 2 sound attenuated weatherproof steel housing, wind resistant up to 100 mph (160 km/h). Multiple panels shall be lockable and provide adequate access to components requiring maintenance. Panels shall be removable by one person without tools. Instruments and control shall be mounted within enclosure.
- B. Engine Cooling Airflow through Enclosure: Maintain temperature rise of system components within required limits when unit operates at 110 percent of rated load for 2 hours with ambient temperature at top of range specified in system service conditions.
 - 1. Louvers: Fixed-engine, cooling-air inlet, and discharge. Storm-proof and drainable louvers prevent entry of rain and snow.
 - 2. Automatic Dampers: At engine cooling-air inlet and discharge. Dampers shall be closed to reduce enclosure heat loss in cold weather when unit is not operating.
- C. Interior Lights with Switch: Factory-wired, vapor-proof-type fixtures within housing; arranged to illuminate controls and accessible interior. Arrange for external electrical connection.
 - 1. AC lighting system and connection point for operation when remote source is available.
 - 2. DC lighting system for operation when remote source and generator are both unavailable.
- D. Convenience Outlets: Factory wired, GFCI. Mount within the generator enclosure where accessible from opened enclosure door.
- E. Muffler/Silencer shall be concealed within the generator enclosure.

2.8 MOTORS

- A. General requirements for motors are specified in Division 23 Section "Common Motor Requirements for HVAC Equipment."
 - 1. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.

2. Controllers, Electrical Devices, and Wiring: Electrical devices and connections are specified in Division 26 Sections.

2.9 GENERATOR DOCKING STATION

- A. Basis of Design Product: Subject to compliance with requirements provide Trystar DBSD-6 dual purpose docking station or comparable product by one of the following:
 - 1. Square D.
 - 2. Eaton.
 - 3. APT Power.
 - 4. Or approved equal.
- B. Docking station shall include 16 Series Camlok Panel Mounts for use as connection to Portable Generator and Temporary Load Bank.
- C. Entire package must be listed to ETL or UL 1008 Standards. UL listing of individual components is not acceptable.
- D. Enclosures:
 - 1. NEMA 3R rain-tight, 304 GA aluminum enclosure.
 - a. Pad-lockable front door shall include a hinged access plate at the bottom for entry of cables from portable generator or portable load bank. NEMA 3R integrity shall be maintained with access plate open for cable entry.
 - b. Front and side through a front access panel shall be accessible for maintenance.
 - c. Top, side, and bottom through a front access panel shall be accessible for permanent cabling.
 - 2. Finishes:
 - a. Paint after fabrication. Powder coated Hammertone Gray.
- E. Phase, Neutral, and Ground Buses:
 - 1. Material: Silver-plated Copper.
 - 2. Equipment Ground Bus: bonded to box.
 - 3. Isolated Ground Bus: insulated from box.
 - 4. Ground Bus: 50% of phase size.
 - 5. Neutral Bus: Neutral bus rated 100 percent of phase bus.
 - 6. Round edges on bus.
- F. Temporary generator connectors shall be Camlok style mounted on gland plate.
 - 1. Camlok shall be color coded according to system voltage.
 - a. A phase Black or Brown
 - b. B phase Red or Orange
 - c. C phase Blue or Yellow
 - d. N Neutral White

- e. G Ground Green
- G. Temporary load bank connectors shall be Camlok style mounted on gland plate.
 - 1. Camlok shall be color coded according to system voltage.
 - a. A phase Black or Brown
 - b. B phase Red or Orange
 - c. C phase Blue or Yellow
 - d. G Ground Green
- H. Temporary connectors shall include protective flip lids to prevent accidental contact.
- I. Permanent connectors shall be broad range set-screw type, located behind an aluminum barrier.
- J. Short Circuit & Withstand Rating.
 - 1. Shall be minimum 65KAIC unless otherwise indicated on drawing.
- K. Phase Rotation Monitor Device:
 - 1. Phase monitoring relay to be Siemens 3U4512-1AR20 or equal.
- L. Circuit Breakers.
 - 1. Must be UL 489 Listed Breaker.
 - 2. Breakers shall be removable for service and maintenance.
- M. Provide connection points from transfer switches for start/stop wiring for temporary generator.
- N. Provide connection points from transfer switches for load shed wiring to load bank.

2.11 VIBRATION ISOLATION DEVICES

- A. Restrained Spring Isolators: Freestanding, steel, open-spring isolators with seismic restraint.
 - 1. Housing: Steel with resilient vertical-limit stops to prevent spring extension due to wind loads or if weight is removed; factory-drilled baseplate bonded to 1/4-inch- (6-mm-) thick, elastomeric isolator pad attached to baseplate underside; and adjustable equipment mounting and leveling bolt that acts as blocking during installation.
 - 2. Outside Spring Diameter: Not less than 80 percent of compressed height of the spring at rated load.
 - 3. Minimum Additional Travel: 50 percent of required deflection at rated load.
 - 4. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
 - 5. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.

2.12 FINISHES

A. Indoor and Outdoor Enclosures and Components: Manufacturer's standard tan or gray finish over corrosion-resistant pretreatment and compatible primer. Finish color shall be selected at the time of shop drawing review.

2.13 SOURCE QUALITY CONTROL

- A. Prototype Testing: Factory test engine-generator set using same engine model, constructed of identical or equivalent components and equipped with identical or equivalent accessories.
 - 1. Tests: Comply with NFPA 110, Level 1 Energy Converters and with IEEE 115.
- B. Project-Specific Equipment Tests: Before shipment, factory test engine-generator set and other system components and accessories manufactured specifically for this Project. Perform tests at rated load and power factor. Include the following tests:
 - 1. Test components and accessories furnished with installed unit that are not identical to those on tested prototype to demonstrate compatibility and reliability.
 - 2. Full load run.
 - 3. Maximum power.
 - 4. Voltage regulation.
 - 5. Transient and steady-state governing.
 - 6. Single-step load pickup.
 - 7. Safety shutdown.
 - 8. Provide 14 days' advance notice of tests and opportunity for observation of tests by Owner's representative.
 - 9. Report factory test results within 10 days of completion of test.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Examine areas, equipment bases, and conditions, with Installer present, for compliance with requirements for installation and other conditions affecting packaged engine-generator performance.
- B. Examine roughing-in of piping systems and electrical connections. Verify actual locations of connections before packaged engine-generator installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Comply with packaged engine-generator manufacturers' written installation and alignment instructions and with NFPA 110.
- B. Install packaged engine generator to provide access, without removing connections or accessories, for periodic maintenance.
- C. Install packaged engine generator with restrained spring isolators having a minimum deflection of 1 inch (25 mm) on 4-inch- (100-mm-) high concrete base. Secure sets to

anchor bolts installed in concrete bases. Concrete base construction is specified in Division 26 Section "Vibration and Seismic Controls for Electrical Systems."

- D. Electrical Wiring: Install electrical devices furnished by equipment manufacturers but not specified to be factory mounted.
- E. Provide all fuel required for testing.
- F. Provide all fuel required to fill generator base tank completely at the completion of construction.
- G. Install emergency power off push button with weatherproof protective cover.
- H. Install temporary load bank and generator docking station.

3.3 CONNECTIONS

- A. Piping installation requirements are specified in Division 23 Sections. Drawings indicate general arrangement of piping and specialties.
- B. Connect fuel, cooling-system, and exhaust-system piping adjacent to packaged engine generator to allow service and maintenance.
- C. Connect engine exhaust pipe to engine with flexible connector.
- D. Connect fuel piping to engines with a gate valve and union and flexible connector.
 - 1. Natural gas piping, valves, and specialties for gas distribution are specified in Division 23 Section "Facility Natural Gas Piping."
- E. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."
- F. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

3.4 IDENTIFICATION

A. Identify system components according to Division 26 Section "Identification for Electrical Systems."

3.5 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections. Report results in writing.
- B. Tests and Inspections:
 - 1. Perform tests recommended by manufacturer and each electrical test and visual and mechanical inspection for "AC Generators and for Emergency Systems" specified in NETA Acceptance Testing Specification. Certify compliance with test parameters.

- 2. NFPA 110 Acceptance Tests: Perform tests required by NFPA 110 that are additional to those specified here including, but not limited to, single-step full-load pickup test.
- 3. Battery Tests: Equalize charging of battery cells according to manufacturer's written instructions. Record individual cell voltages.
 - a. Measure charging voltage and voltages between available battery terminals for full-charging and float-charging conditions. Check electrolyte level and specific gravity under both conditions.
 - b. Test for contact integrity of all connectors. Perform an integrity load test and a capacity load test for the battery.
 - c. Verify acceptance of charge for each element of the battery after discharge.
 - d. Verify that measurements are within manufacturer's specifications.
- 4. Battery-Charger Tests: Verify specified rates of charge for both equalizing and float-charging conditions.
- 5. System Integrity Tests: Methodically verify proper installation, connection, and integrity of each element of engine-generator system before and during system operation. Check for air, exhaust, and fluid leaks.
- Exhaust-System Back-Pressure Test: Use a manometer with a scale exceeding 40-inch wg (120 kPa). Connect to exhaust line close to engine exhaust manifold. Verify that back pressure at full-rated load is within manufacturer's written allowable limits for the engine.
- 7. Exhaust Emissions Test: Comply with applicable government test criteria.
- 8. Voltage and Frequency Transient Stability Tests: Use recording oscilloscope to measure voltage and frequency transients for 50 and 100 percent step-load increases and decreases and verify that performance is as specified.
- 9. Harmonic-Content Tests: Measure harmonic content of output voltage under 25 percent and at 100 percent of rated linear load. Verify that harmonic content is within specified limits.
- 10. Noise Level Tests: Measure A-weighted level of noise emanating from generatorset installation, including engine exhaust and cooling-air intake and discharge, at four locations on the property line, and compare measured levels with required values.
- C. Coordinate tests with tests for transfer switches and run them concurrently.
- D. Test instruments shall have been calibrated within the last 12 months, traceable to standards of NIST, and adequate for making positive observation of test results. Make calibration records available for examination on request.
- E. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
- F. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
- G. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- H. Remove and replace malfunctioning units and retest as specified above.
- I. Retest: Correct deficiencies identified by tests and observations and retest until specified requirements are met.

- J. Report results of tests and inspections in writing. Record adjustable relay settings and measured insulation resistances, time delays, and other values and observations. Attach a label or tag to each tested component indicating satisfactory completion of tests.
- K. Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each power wiring termination and each bus connection. Remove all access panels so terminations and connections are accessible to portable scanner.
 - 1. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan 11 months after date of Substantial Completion.
 - 2. Instrument: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.
 - 3. Record of Infrared Scanning: Prepare a certified report that identifies terminations and connections checked and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

3.6 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain packaged engine generators. Refer to Division 01 Section "Demonstration and Training."

END OF SECTION

PART 1 GENERAL

1.1 SUMMARY

A. Section includes automatic transfer switches rated 600 V and less, including the following:

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for transfer switches.
 - 2. Include rated capacities, operating characteristics, electrical characteristics, and accessories.
- B. Shop Drawings:
 - 1. Include plans, elevations, sections, details showing minimum clearances, conductor entry provisions, gutter space, and installed features and devices.
 - 2. Include material lists for each switch specified.
 - 3. Single-Line Diagram: Show connections between transfer switch, power sources, and load; and show interlocking provisions for each combined transfer switch and bypass/isolation switch.
 - 4. Riser Diagram: Show interconnection wiring between transfer switches, bypass/isolation switches, annunciators, and control panels.

1.3 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For manufacturer-authorized service representative.
- B. Seismic Qualification Certificates: For transfer switches, accessories, and components, from manufacturer.
 - 1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
 - 2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
 - 3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
- C. Field quality-control reports.

1.4 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For each type of product to include in emergency, operation, and maintenance manuals.
 - 1. In addition to items specified in Section 0178800 "Operation and Maintenance Data," include the following:
 - a. Features and operating sequences, both automatic and manual.
 - b. List of all factory settings of relays; provide relay-setting and calibration instructions, including software, where applicable.

1.5 QUALITY ASSURANCE

- A. Testing Agency Qualifications:
 - 1. Member company of NETA.
 - a. Testing Agency's Field Supervisor: Certified by NETA to supervise on-site testing.

1.6 FIELD CONDITIONS

- A. Interruption of Existing Electrical Service: Do not interrupt electrical service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electrical service:
 - 1. Notify Architect no fewer than Seven days in advance of proposed interruption of electrical service.
 - 2. Do not proceed with interruption of electrical service without Architect's written permission.

1.7 WARRANTY

- A. Manufacturer's Warranty: Manufacturer agrees to repair or replace components of transfer switch or transfer switch components that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Period: 12 months from date of Substantial Completion.

PART 2 PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Comply with NEMA ICS 1.
- C. Comply with NFPA 99.
- D. Comply with NFPA 110.
- E. Comply with UL 1008 unless requirements of these Specifications are stricter.
- F. Indicated Current Ratings: Apply as defined in UL 1008 for continuous loading and total system transfer, including tungsten filament lamp loads not exceeding 30 percent of switch ampere rating, unless otherwise indicated.
- G. Tested Fault-Current Closing and Short-Circuit Ratings: Adequate for duty imposed by protective devices at installation locations in Project under the fault conditions indicated, based on testing according to UL 1008.

- 1. Where transfer switch includes internal fault-current protection, rating of switch and trip unit combination shall exceed indicated fault-current value at installation location.
- 2. Short-time withstand capability for three cycles.
- H. Repetitive Accuracy of Solid-State Controls: All settings shall be plus or minus 2 percent or better over an operating temperature range of minus 20 to plus 70 deg C.
- I. Resistance to Damage by Voltage Transients: Components shall meet or exceed voltage-surge withstand capability requirements when tested according to IEEE C62.62. Components shall meet or exceed voltage-impulse withstand test of NEMA ICS 1.
- J. Electrical Operation: Accomplish by a nonfused, momentarily energized solenoid or electric-motor-operated mechanism. Switches for emergency or standby purposes shall be mechanically and electrically interlocked in both directions to prevent simultaneous connection to both power sources unless closed transition.
- K. Neutral Switching: Where four-pole switches are indicated, provide neutral pole switched simultaneously with phase poles.
- L. Annunciation, Control, and Programming Interface Components: Devices at transfer switches for communicating with remote programming devices, annunciators, or annunciator and control panels shall have communication capability matched with remote device.
- M. Factory Wiring: Train and bundle factory wiring and label, consistent with Shop Drawings, by color-code or by numbered or lettered wire and cable with printed tape or shrinkable sleeve markers at terminations. Color-coding and wire and cable markers are specified in Division 26 Section "Identification for Electrical Systems."
 - 1. Designated Terminals: Pressure type, suitable for types and sizes of field wiring indicated.
 - 2. Power-Terminal Arrangement and Field-Wiring Space: Suitable for top, side, or bottom entrance of feeder conductors as indicated.
 - 3. Control Wiring: Equipped with lugs suitable for connection to terminal strips.
 - 4. Accessible via front access.
- N. Enclosures: General-purpose NEMA 250, Type 1, complying with NEMA ICS 6 and UL 508, unless otherwise indicated.

2.2 CONTACTOR-TYPE AUTOMATIC TRANSFER SWITCHES

- A. Basis of Design: Subject to compliance with specifications, provide ASCO, division of Schneider Electric Series 7000 transfer switch with group 5 controller or comparable product by one of the following:
 - 1. Russelectric, Inc.
 - 2. Or Approved Equal.
- B. Comply with Level 1 equipment according to NFPA 110.
- C. Switch Characteristics: Designed for continuous-duty repetitive transfer of full-rated current between active power sources.

- 1. Limitation: Switches using molded-case switches or circuit breakers or insulatedcase circuit-breaker components are unacceptable.
- 2. Switch Action: Double throw; mechanically held in both directions.
- 3. Contacts: Silver composition or silver alloy for load-current switching. Contactorstyle automatic transfer-switch units, rated 600 A and higher, shall have separate arcing contacts.
- 4. Conductor Connectors: Suitable for use with conductor material and sizes.
- 5. Material: Hard-drawn copper, 98 percent conductivity.
- 6. Main and Neutral Lugs: Mechanical type.
- 7. Ground Lugs and Bus-Configured Terminators: Mechanical type.
- 8. Ground bar.
- 9. Connectors shall be marked for conductor size and type according to UL 1008.
- D. Automatic Open-Transition Transfer Switches: Interlocked to prevent the load from being closed on both sources at the same time.
 - 1. Sources shall be mechanically and electrically interlocked to prevent closing both sources on the load at the same time.
- E. Automatic Delayed-Transition Transfer Switches: Pauses or stops in intermediate position to momentarily disconnect both sources, with transition controlled by programming in the automatic transfer-switch controller. Interlocked to prevent the load from being closed on both sources at the same time.
 - 1. Adjustable Time Delay: For override of normal-source voltage sensing to delay transfer and engine start signals for alternative source. Adjustable from zero to six seconds, and factory set for one second.
 - 2. Sources shall be mechanically and electrically interlocked to prevent closing both sources on the load at the same time.
 - 3. Fully automatic break-before-make operation with center off position.
 - 4. Fully automatic break-before-make operation with transfer when two sources have near zero phase difference.
- F. Automatic Closed-Transition Transfer Switches: Connect both sources to load momentarily. Transition is controlled by programming in the automatic transfer-switch controller.
 - 1. Fully automatic make-before-break operation when transferring between two available power sources.
 - 2. Load transfer without interruption, through momentary interconnection of both power sources not exceeding 100 ms.
 - 3. Initiation of No-Interruption Transfer: Controlled by in-phase monitor and sensors confirming both sources are present and acceptable.
 - a. Initiation occurs without active control of generator.
 - b. Controls ensure that closed-transition load transfer closure occurs only when the two sources are within plus or minus 5 electrical degrees maximum, and plus or minus 5 percent maximum voltage difference.
 - 4. Failure of power source serving load initiates automatic break-before-make transfer.

- G. Electric Switch Operation: Electrically actuated by push buttons designated "Normal Source" and "Alternative Source." Switch shall be capable of transferring load in either direction with either or both sources energized.
- H. Signal-Before-Transfer Contacts: A set of normally open/normally closed dry contacts operates in advance of retransfer to normal source. Interval shall be adjustable from 1 to 30 seconds.
- I. Automatic Transfer-Switch Controller Features:
 - 1. Controller operates through a period of loss of control power.
 - 2. Undervoltage Sensing for Each Phase of Normal and Alternate Source: Sense low phase-to-ground voltage on each phase. Pickup voltage shall be adjustable from 85 to 100 percent of nominal, and dropout voltage shall be adjustable from 75 to 98 percent of pickup value. Factory set for pickup at 90 percent and dropout at 85 percent.
 - 3. Voltage/Frequency Lockout Relay: Prevent premature transfer to generator. Pickup voltage shall be adjustable from 85 to 100 percent of nominal. Factory set for pickup at 90 percent. Pickup frequency shall be adjustable from 90 to 100 percent of nominal. Factory set for pickup at 95 percent.
 - 4. Time Delay for Retransfer to Normal Source: Adjustable from zero to 30 minutes, and factory set for 10 minutes. Override shall automatically defeat delay on loss of voltage or sustained undervoltage of emergency source, provided normal supply has been restored.
 - 5. Test Switch: Simulate normal-source failure.
 - 6. Switch-Position Pilot Lights: Indicate source to which load is connected.
 - 7. Source-Available Indicating Lights: Supervise sources via transfer-switch normaland emergency-source sensing circuits.
 - a. Normal Power Supervision: Green light with nameplate engraved "Normal Source Available."
 - b. Emergency Power Supervision: Red light with nameplate engraved "Emergency Source Available."
 - 8. Unassigned Auxiliary Contacts: Two normally open, single-pole, double-throw contacts for each switch position, rated 10 A at 240-V ac.
 - 9. Transfer Override Switch: Overrides automatic retransfer control so transfer switch will remain connected to emergency power source regardless of condition of normal source. Pilot light indicates override status.
 - 10. Engine Starting Contacts: One isolated and normally closed, and one isolated and normally open; rated 10 A at 32-V dc minimum.
 - 11. Engine Shutdown Contacts: Time delay adjustable from zero to five minutes, and factory set for five minutes. Contacts shall initiate shutdown at remote engine-generator controls after retransfer of load to normal source.
 - 12. Engine-Generator Exerciser: Solid-state, programmable-time switch starts engine generator and transfers load to it from normal source for a preset time, then retransfers and shuts down engine after a preset cool-down period. Initiates exercise cycle at preset intervals adjustable from 7 to 30 days. Running periods shall be adjustable from 10 to 30 minutes. Factory settings shall be for 7-day exercise cycle, 20-minute running period, and 5-minute cool-down period. Exerciser features include the following:
 - a. Exerciser Transfer Selector Switch: Permits selection of exercise with and without load transfer.
 - b. Push-button programming control with digital display of settings.
- c. Integral battery operation of time switch when normal control power is unavailable.
- J. Large-Motor-Load Power Transfer:
 - In-Phase Monitor: Factory-wired, internal relay controls transfer so contacts close only when the two sources are synchronized in phase and frequency. Relay shall compare phase relationship and frequency difference between normal and emergency sources and initiate transfer when both sources are within 15 electrical degrees, and only if transfer can be completed within 60 electrical degrees. Transfer shall be initiated only if both sources are within 2 Hz of nominal frequency and 70 percent or more of nominal voltage.

2.3 SOURCE QUALITY CONTROL

- A. Factory Tests: Test and inspect components, assembled switches, and associated equipment according to UL 1008. Ensure proper operation. Check transfer time and voltage, frequency, and time-delay settings for compliance with specified requirements. Perform dielectric strength test complying with NEMA ICS 1.
- B. Prepare test and inspection reports.
 - 1. For each of the tests required by UL 1008, performed on representative devices, for emergency systems. Include results of test for the following conditions:
 - a. Overvoltage.
 - b. Undervoltage.
 - c. Loss of supply voltage.
 - d. Reduction of supply voltage.
 - e. Alternative supply voltage or frequency is at minimum acceptable values.
 - f. Temperature rise.
 - g. Dielectric voltage-withstand; before and after short-circuit test.
 - h. Overload.
 - i. Contact opening.
 - j. Endurance.
 - k. Short circuit.
 - I. Short-time current capability.
 - m. Receptacle withstand capability.
 - n. Insulating base and supports damage.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Floor-Mounting Switch: Anchor to floor by bolting.
 - 1. Install transfer switches on cast-in-place concrete equipment base(s). Comply with requirements for equipment bases and foundations as specified.
 - 2. Comply with requirements for seismic control devices as specified.
 - 3. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases.
 - 4. Provide workspace and clearances required by NFPA 70.

- B. Identify components according to Division 26 Section "Identification for Electrical Systems."
- C. Set field-adjustable intervals and delays, relays, and engine exerciser clock.
- D. Comply with NECA 1.

3.2 CONNECTIONS

- A. Wiring to Remote Components: Match type and number of cables and conductors to generator sets, control, and communication requirements of transfer switches as recommended by manufacturer. Increase raceway sizes at no additional cost to Owner if necessary to accommodate required wiring.
- B. Wiring Method: Install cables in raceways and cable trays except within electrical enclosures. Conceal raceway and cables except in unfinished spaces.
 - 1. Comply with requirements for raceways and boxes specified in Section 260533 "Raceways and Boxes for Electrical Systems."
- C. Wiring within Enclosures: Bundle, lace, and train conductors to terminal points with no excess and without exceeding manufacturer's limitations on bending radii.
- D. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."
- E. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."
- F. Route and brace conductors according to manufacturer's written instructions, and Division 26 Section "Hangers and Supports for Electrical Systems." Do not obscure manufacturer's markings and labels.
- G. Final connections to equipment shall be made with liquidtight, flexible metallic conduit no more than 18 inches (457 mm) in length.

3.3 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- B. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.
- C. Perform the following tests and inspections with the assistance of a factory-authorized service representative:
 - 1. After installing equipment, test for compliance with requirements according to NETA ATS.
 - 2. Visual and Mechanical Inspection:
 - a. Compare equipment nameplate data with Drawings and Specifications.
 - b. Inspect physical and mechanical condition.
 - c. Inspect anchorage, alignment, grounding, and required clearances.
 - d. Verify that the unit is clean.

- e. Verify appropriate lubrication on moving current-carrying parts and on moving and sliding surfaces.
- f. Verify that manual transfer warnings are attached and visible.
- g. Verify tightness of all control connections.
- h. Inspect bolted electrical connections for high resistance using one of the following methods, or both:
 - 1) Use of low-resistance ohmmeter.
 - Verify tightness of accessible bolted electrical connections by calibrated torque-wrench method according to manufacturer's published data.
- i. Perform manual transfer operation.
- j. Verify positive mechanical interlocking between normal and alternate sources.
- k. Perform visual and mechanical inspection of surge arresters.
- I. Inspect control power transformers.
 - 1) Inspect for physical damage, cracked insulation, broken leads, tightness of connections, defective wiring, and overall general condition.
 - 2) Verify that primary and secondary fuse or circuit-breaker ratings match Drawings.
 - 3) Verify correct functioning of drawout disconnecting contacts, grounding contacts, and interlocks.
- 3. Electrical Tests:
 - a. Perform insulation-resistance tests on all control wiring with respect to ground.
 - b. Perform a contact/pole-resistance test. Compare measured values with manufacturer's acceptable values.
 - c. Verify settings and operation of control devices.
 - d. Calibrate and set all relays and timers.
 - e. Verify phase rotation, phasing, and synchronized operation.
 - f. Perform automatic transfer tests.
 - g. Verify correct operation and timing of the following functions:
 - 1) Normal source voltage-sensing and frequency-sensing relays.
 - 2) Engine start sequence.
 - 3) Time delay on transfer.
 - 4) Alternative source voltage-sensing and frequency-sensing relays.
 - 5) Automatic transfer operation.
 - 6) Interlocks and limit switch function.
 - 7) Time delay and retransfer on normal power restoration.
 - 8) Engine cool-down and shutdown feature.
- 4. Measure insulation resistance phase-to-phase and phase-to-ground with insulation-resistance tester. Include external annunciation and control circuits. Use test voltages and procedure recommended by manufacturer. Comply with manufacturer's specified minimum resistance.
 - a. Check for electrical continuity of circuits and for short circuits.

- b. Inspect for physical damage, proper installation and connection, and integrity of barriers, covers, and safety features.
- c. Verify that manual transfer warnings are properly placed.
- d. Perform manual transfer operation.
- 5. After energizing circuits, perform each electrical test for transfer switches stated in NETA ATS and demonstrate interlocking sequence and operational function for each switch at least three times.
 - a. Simulate power failures of normal source to automatic transfer switches and retransfer from emergency source with normal source available.
 - b. Simulate loss of phase-to-ground voltage for each phase of normal source.
 - c. Verify time-delay settings.
 - d. Verify pickup and dropout voltages by data readout or inspection of control settings.
 - e. Test bypass/isolation unit functional modes and related automatic transferswitch operations.
 - f. Perform contact-resistance test across main contacts and correct values exceeding 500 microhms and values for one pole deviating by more than 50 percent from other poles.
 - g. Verify proper sequence and correct timing of automatic engine starting, transfer time delay, retransfer time delay on restoration of normal power, and engine cool-down and shutdown.
- 6. Ground-Fault Tests: Coordinate with testing of ground-fault protective devices for power delivery from both sources.
 - a. Verify grounding connections and locations and ratings of sensors.
- D. Coordinate tests with tests of generator and run them concurrently.
- E. Report results of tests and inspections in writing. Record adjustable relay settings and measured insulation and contact resistances and time delays. Attach a label or tag to each tested component indicating satisfactory completion of tests.
- F. Transfer switches will be considered defective if they do not pass tests and inspections.
- G. Remove and replace malfunctioning units and retest as specified above.
- H. Prepare test and inspection reports.
- I. Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each switch. Remove all access panels so joints and connections are accessible to portable scanner.
 - 1. Instrument: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.
 - 2. Record of Infrared Scanning: Prepare a certified report that identifies switches checked and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.
 - 3. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each switch 11 months after date of Substantial Completion.

3.4 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain transfer switches and related equipment.
- B. Training shall include testing ground-fault protective devices and instructions to determine when the ground-fault system shall be retested. Include instructions on where ground-fault sensors are located and how to avoid negating the ground-fault protection scheme during testing and circuit modifications.
- C. Coordinate this training with that for generator equipment.

END OF SECTION

PART 1 GENERAL

1.1 SUMMARY

A. Section includes field-mounted SPD for low-voltage (120 to 600 V) power distribution and control equipment.

1.2 DEFINITIONS

- A. ATS: Acceptance Testing Specifications.
- B. SVR: Suppressed voltage rating.
- C. SPD: Surge Protective Device.
- D. SCCR: Short Circuit Current Rating.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated. Include rated capacities, operating weights, electrical characteristics, furnished specialties, and accessories.
- B. Qualification Data: For qualified testing agency.
- C. Product Certificates: For SPD's, from manufacturer certifying compliance with UL1283 and UL1449.
- D. Field quality-control reports.
- E. Operation and Maintenance Data: For SPD's to include in emergency, operation, and maintenance manuals. Refer to Division 01 Operation and Maintenance Data.
- F. Warranties: Sample of special warranties.

1.4 QUALITY ASSURANCE

- A. Testing Agency Qualifications: Member Company of NETA or an NRTL.
 - 1. Testing Agency's Field Supervisor: Currently certified by NETA to supervise onsite testing.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a testing agency, and marked for intended location and application.
- C. Comply with IEEE C62.41.2 and test devices according to IEEE C62.45.
- D. Comply with NEMA LS 1.
- E. Comply with UL 1283 and UL 1449.
- F. Comply with NFPA 70.
- G. Source Limitations: Obtain suppression devices and accessories through one source from a single manufacturer.

1.5 PROJECT CONDITIONS

- A. Service Conditions: Rate TVSS devices for continuous operation under the following conditions unless otherwise indicated:
 - 1. Maximum Continuous Operating Voltage: Not less than 115 percent of nominal system operating voltage.
 - 2. Operating Temperature: 30 to 120 deg F.
 - 3. Humidity: 0 to 85 percent, noncondensing.
 - 4. Altitude: Less than 20,000 feet above sea level.

1.6 COORDINATION

A. Coordinate location of field-mounted SPD's to allow adequate clearances for maintenance.

1.7 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of surge suppressors that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Period: Five years from date of Substantial Completion.

1.8 EXTRA MATERIALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Replaceable Protection Modules: One of each size and type installed.

PART 2 PRODUCTS

2.1 SERVICE ENTRANCE SUPPRESSORS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Advanced Protection Technologies Inc. (APT).
 - 2. Current Technology Inc.; Danaher Power Solutions.
 - 3. Eaton Corporation.
 - 4. General Electric Company; GE Consumer & Industrial Electrical Distribution.
 - 5. Emerson Electric Co.
 - 6. Siemens Energy & Automation, Inc.
 - 7. Schneider Electric Industries.
 - 8. Or Approved Equal.
- B. Surge Protection Devices:
 - 1. Comply with UL 1449.
 - 2. Modular design (with field-replaceable modules).
 - 3. Fuses rated at 200-kA interrupting capacity.
 - 4. Fabrication using bolted compression lugs for internal wiring.
 - 5. Integral disconnect switch.
 - 6. Redundant suppression circuits.

- 7. Redundant replaceable modules.
- 8. Arrangement with copper bus bars and for bolted connections to phase buses, neutral bus, and ground bus.
- 9. Arrangement with wire connections to phase buses, neutral bus, and ground bus.
- 10. LED indicator lights for power and protection status.
- 11. Audible alarm, with silencing switch, to indicate when protection has failed.
- 12. Form-C contacts rated at 5 Å and 250-V ac, one normally open and one normally closed, for remote monitoring of protection status. Contacts shall reverse on failure of any surge diversion module or on opening of any current-limiting device. Coordinate with building power monitoring and control system.
- 13. Transient-event counter set to totalize transient surges.
- 14. Sine wave tracking.
- C. Peak Single-Impulse Surge Current Rating: 240 kA per mode/480 kA per phase.
- D. SCCR: 200 kA
- E. Protection modes and UL 1449 VPR for grounded wye circuits with 480Y/277 V and 208Y/120 V, 3-phase, 4-wire circuits shall be as follows:
 - 1. Line to Neutral: 1200 V for 480Y/277 V; 700 V for 208Y/120 V.
 - 2. Line to Ground: 1200 V for 480Y/277 V; 700 V for 208Y/120 V.
 - 3. Neutral to Ground: 2000 V for 480Y/277 V; 1000 V for 208Y/120 V.

2.2 ENCLOSURES

A. Indoor Enclosures: NEMA 250 Type 1. Separate from switchboard.

PART 3 EXECUTION

- 3.1 INSTALLATION
 - A. Install SPD devices at service entrance on load side, with ground lead bonded to service entrance ground.
- 3.2 FIELD QUALITY CONTROL
 - A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
 - B. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.
 - 1. Verify that electrical wiring installation complies with manufacturer's written installation requirements.
 - C. Tests and Inspections:
 - 1. Perform each visual and mechanical inspection and electrical test stated in NETA ATS, "Surge Arresters, Low-Voltage Surge Protection Devices" Section. Certify compliance with test parameters.
 - 2. After installing SPD's but before electrical circuitry has been energized, test for compliance with requirements.
 - 3. Complete startup checks according to manufacturer's written instructions.

- D. SPD will be considered defective if it does not pass tests and inspections.
- E. Prepare test and inspection reports.

3.3 STARTUP SERVICE

- A. Do not energize or connect service entrance equipment, panelboards, control terminals or data terminals to their sources until SPD's are installed and connected.
- B. Do not perform insulation resistance tests of the distribution wiring equipment with the SPD installed. Disconnect before conducting insulation resistance tests and reconnect immediately after the testing is over.

END OF SECTION

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes the following types of LED luminaires:
 - 1. LED Luminaires.
 - 2. Materials.
 - 3. Finishes.
 - 4. Luminaire support.

1.2 DEFINITIONS

- A. CCT: Correlated color temperature.
- B. CRI: Color Rendering Index.
- C. Fixture: See "Luminaire."
- D. LED: Light-emitting diode.
- E. Lumen: Measured output of lamp and luminaire, or both.
- F. Luminaire: Complete lighting unit, including lamp, reflector, and housing.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Arrange in order of luminaire designation.
 - 2. Include data on features, accessories, and finishes.
 - 3. Include physical description and dimensions of luminaires.
 - 4. Include life, output (lumens, CCT, and CRI), and energy efficiency data.
 - 5. Photometric data and adjustment factors based on laboratory tests. Manufacturers' Certified Data: Photometric data certified by manufacturer's

1.4 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For luminaires and lighting systems to include in operation and maintenance manuals.
 - 1. Provide a list of all lamp types used on Project; use ANSI and manufacturers' codes.

1.5 QUALITY ASSURANCE

- A. Luminaire Photometric Data Testing Laboratory Qualifications: Luminaire manufacturer's laboratory that is accredited under the NVLAP for Energy Efficient Lighting Products.
- B. Provide luminaires from a single manufacturer for each luminaire type.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Protect finishes of exposed surfaces by applying a strippable, temporary protective covering before shipping.

1.7 WARRANTY

- A. Warranty: Manufacturer and Installer agree to repair or replace components of luminaires that fail in materials or workmanship within specified warranty period.
- B. Warranty Period: Five year(s) from date of Substantial Completion.

PART 2 PRODUCTS

- 2.1 LUMINAIRE REQUIREMENTS
 - A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
 - B. Standards:
 - 1. ENERGY STAR certified.
 - 2. Recessed luminaires shall comply with NEMA LE 4.
 - C. Lamps dimmable from 100 percent to 0 percent of maximum light output.
 - D. Internal driver.
 - E. Nominal Operating Voltage: As indicated.
 - 1. Lens Thickness: At least 0.125 inch minimum unless otherwise indicated.

2.2 MANUFACTURERS

- A. In Lighting Fixture Schedule where titles below are column or row headings that introduce lists, the following requirements apply to product selections:
 - 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, or approved equal.

2.3 MATERIALS

- A. Metal Parts:
 - 1. Free of burrs and sharp corners and edges.
 - 2. Sheet metal components shall be steel unless otherwise indicated.
 - 3. Form and support to prevent warping and sagging.
- B. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position.

C. Factory-Applied Labels: Comply with UL 1598. Include recommended lamps. Locate labels where they will be readily visible to service personnel, but not seen from normal viewing angles when lamps are in place.

2.4 METAL FINISHES

- A. Variations in finishes are unacceptable in the same piece.
- 2.5 LUMINAIRE SUPPORT
 - A. Comply with requirements in Section 260529 "Hangers and Supports for Electrical Systems".
 - B. Wires: ASTM A 641/A 641 M, Class 3, soft temper, zinc-coated steel, 12 gage.

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 luminaire to verify actual locations of luminaire and electrical connections before luminaire installation. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Comply with NECA 1.
- B. Install luminaires level, plumb, and square with ceilings and walls unless otherwise indicated.
- C. Install lamps in each luminaire.
- D. Supports:
 - 1. Sized and rated for luminaire weight.
 - 2. Able to maintain luminaire position after cleaning and relamping.
 - 3. Provide support for luminaire without causing deflection of ceiling.
 - 4. Luminaire mounting devices shall be capable of supporting a horizontal force of 100 percent of luminaire weight and vertical force of 400 percent of luminaire weight.
- E. Ceiling-Grid-Mounted Luminaires:
 - 1. Secure to any required outlet box.
 - 2. Luminaire installed in or on lay-in ceiling system shall be supported independently of the ceiling system grid with No. 14 galvanized support wires at two opposite corners of the fixture from the building structural system.
 - 3. Use approved devices and support components to connect luminaire to ceiling grid and building structure in a minimum of four locations, spaced near corners of luminaire.

F. Comply with requirements in Section 260519 "Low-Voltage Electrical Power Conductors and Cables" for wiring connections.

3.3 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections:
 - 1. Operational Test: After installing luminaires, switches, and accessories, and after electrical circuitry has been energized, test units to confirm proper operation.
- B. Luminaire will be considered defective if it does not pass operation tests and inspections.
- C. Prepare test and inspection reports.

END OF SECTION

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Exit signs.
 - 2. Luminaire supports.

1.2 DEFINITIONS

- A. CCT: Correlated color temperature.
- B. CRI: Color Rendering Index.
- C. Lumen: Measured output of lamp and luminaire, or both.
- D. Luminaire: Complete lighting unit, including lamp, reflector, and housing.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of emergency lighting unit and exit sign.
 - 1. Include data on features, accessories, and finishes.
 - 2. Include physical description of the unit and dimensions.
 - 3. Include life, output of luminaire (lumens, CCT, and CRI), and energy-efficiency data.
 - 4. Include photometric data and adjustment factors based on laboratory tests for each luminaire type.
 - a. Manufacturers' Certified Data: Photometric data certified by manufacturer's laboratory with a current accreditation under the National Voluntary Laboratory Accreditation Program for Energy Efficient Lighting Products.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For luminaires and lighting systems to include in emergency, operation, and maintenance manuals.

1.5 QUALITY ASSURANCE

- A. Luminaire Photometric Data Testing Laboratory Qualifications: Luminaire manufacturer's laboratory that is accredited under the National Volunteer Laboratory Accreditation Program for Energy Efficient Lighting Products.
- B. Comply with NFPA 70.
- 1.6 DELIVERY, STORAGE, AND HANDLING
 - A. Protect finishes of exposed surfaces by applying a strippable, temporary protective covering before shipping.

1.7 WARRANTY

- A. Warranty: Manufacturer and Installer agree to repair or replace components of luminaires that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Period: Five year(s) from date of Substantial Completion.

PART 2 PRODUCTS

- 2.1 GENERAL REQUIREMENTS FOR EMERGENCY LIGHTING
 - A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
 - B. NRTL Compliance: Fabricate and label exit signs to comply with UL 924.
 - C. Comply with NFPA 70 and NFPA 101.

2.2 MANUFACTURERS

- A. In Lighting Fixture Schedule where titles below are column or row headings that introduce lists, the following requirements apply to product selections:
- 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, or approved equal.

2.3 EXIT SIGNS

- A. General Requirements for Exit Signs: Comply with UL 924; for sign colors, visibility, luminance, and lettering size, comply with authorities having jurisdiction.
 - 1. Operating at nominal voltage of 120 V or 277 V ac as indicated.
 - 2. Lamps for AC Operation: LEDs; 50,000 hours minimum rated lamp life.

2.4 MATERIALS

- A. Metal Parts:
 - 1. Free of burrs and sharp corners and edges.
 - 2. Sheet metal components shall be steel unless otherwise indicated.
 - 3. Form and support to prevent warping and sagging.
- B. Doors, Frames, and Other Internal Access:
 - 1. Smooth operating, free of light leakage under operating conditions.
 - 2. Designed to permit relamping without use of tools.
 - 3. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position.

2.5 METAL FINISHES

A. Appearance of Finished Work: Noticeable variations in same piece are not acceptable.

2.6 LUMINAIRE SUPPORT COMPONENTS

A. Comply with requirements in Section 260529 "Hangers and Supports for Electrical Systems".

PART 3 EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for conditions affecting performance of luminaires.
- B. Examine roughing-in for luminaire to verify actual locations of luminaire and electrical connections before luminaire installation.
- C. Examine walls and ceilings for suitable conditions where exit signs units will be installed.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Comply with NECA 1.
- B. Install luminaires level, plumb, and square with ceilings and walls unless otherwise indicated.
- C. Install lamps in each luminaire.
- D. Supports:
 - 1. Sized and rated for luminaire weight.
 - 2. Provide support for luminaire without causing deflection of ceiling.
 - 3. Luminaire-mounting devices shall be capable of supporting a horizontal force of 100 percent of luminaire weight and vertical force of 400 percent of luminaire weight.
- E. Ceiling Grid Mounted Luminaires:
 - 1. Secure to any required outlet box.
 - 2. Use approved devices and support components to connect luminaire to ceiling grid and building structure in a minimum of four locations, spaced near corners of luminaire.
- F. Wall-Mounted Luminaire Support:
 - 1. Attached to structural members in walls.
 - 2. Do not attach luminaries directly to gypsum board.

END OF SECTION

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. Telecommunications mounting elements.
 - 2. Backboards.
 - 3. Telecommunications equipment racks and cabinets.
 - 4. Grounding.
- B. Related sections include the following:
 - 1. Division 26 Sections:
 - a. "Common Work Results for Electrical"
 - b. "Grounding and Bonding for Electrical Systems"
 - c. "Identification for Electrical Systems".
 - d. "Cable Trays for Electrical Systems".
 - 2. Division 27 Sections:
 - a. "Communications Horizontal Cabling" for voice and data cabling associated with system panels and devices.

1.3 DEFINITIONS

- A. Basket Cable Tray: A fabricated structure consisting of wire mesh bottom and side rails.
- B. BICSI: Building Industry Consulting Service International.
- C. Ladder Cable Tray: A fabricated structure consisting of two longitudinal side rails connected by individual transverse members (rungs).
- D. LAN: Local area network.
- E. RCDD: Registered Communications Distribution Designer.

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for equipment racks and cabinets. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.
- B. Qualification Data: For Installer, qualified layout technician, installation supervisor, and field inspector.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Cabling Installer must have personnel certified by BICSI on staff.
 - 1. Layout Responsibility: Preparation of Shop Drawings shall be under the direct supervision of RCDD.
 - 2. Installation Supervision: Installation shall be under the direct supervision of Registered Technician, who shall be present at all times when Work of this Section is performed at Project site.
 - 3. Field Inspector: Currently registered by BICSI as RCDD to perform the on-site inspection.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- C. Telecommunications Pathways and Spaces: Comply with TIA/EIA-569-A.
- D. Grounding: Comply with ANSI-J-STD-607-A.

1.6 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install equipment frames and cable trays until spaces are enclosed and weathertight, wet work in spaces is complete and dry, and work above ceilings is complete.

1.7 COORDINATION

- A. Coordinate layout and installation of communications equipment with Owner's telecommunications and LAN equipment and service suppliers. Coordinate service entrance arrangement with local exchange carrier.
 - 1. Meet jointly with telecommunications and LAN equipment suppliers, local exchange carrier representatives, and Owner to exchange information and agree on details of equipment arrangements and installation interfaces.
 - 2. Record agreements reached in meetings and distribute them to other participants.
 - 3. Adjust arrangements and locations of distribution frames, cross-connects, and patch panels in equipment rooms to accommodate and optimize arrangement and space requirements of telephone switch and LAN equipment.
 - 4. Adjust arrangements and locations of equipment with distribution frames, crossconnects, and patch panels of cabling systems of other communications, electronic safety and security, and related systems that share space in the equipment room.
- B. Coordinate location of power raceways and receptacles with locations of communications equipment requiring electrical power to operate.

PART 2 - PRODUCTS

- 2.1 PATHWAYS
 - A. General Requirements: Comply with TIA/EIA-569-A.
 - B. Cable Support: NRTL labeled. Cable support brackets shall be designed to prevent degradation of cable performance and pinch points that could damage cable. Cable tie slots fasten cable ties to brackets.

- 1. Comply with NFPA 70 and UL 2043 for fire-resistant and low-smoke-producing characteristics.
- 2. Support brackets with cable tie slots for fastening cable ties to brackets.
- 3. Lacing bars, spools, J-hooks, and D-rings.
- 4. Straps and other devices.
- C. Cable Trays: Refer to section "Cable Trays for Electrical Systems" for cable trays.
- D. Conduit and Boxes: Comply with requirements in Division 26 Section "Raceway and Boxes for Electrical Systems". Flexible metal conduit shall not be used.
 - 1. Outlet boxes shall be no smaller than 4 inch square, and 2-1/8 inches deep. Provide all trim rings required to install in wall.

2.2 BACKBOARDS

A. Backboards: Plywood, fire-retardant treated, 3/4 by 48 by 96 inches. Comply with requirements for plywood backing panels specified in Division 06 Section "Rough Carpentry".

2.3 EQUIPMENT FRAMES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. ADC.
 - 2. Aim Electronics; a brand of Emerson Electric Co.
 - 3. AMP; a Tyco International Ltd. company.
 - 4. Cooper B-Line, Inc.
 - 5. Hubbell Premise Wiring.
 - 6. KRONE Incorporated.
 - 7. Leviton Voice & Data Division.
 - 8. Middle Atlantic Products, Inc.
 - 9. Nordex/CDT; a subsidiary of Cable Design Technologies.
 - 10. Ortronics, Inc.
 - 11. Panduit Corp.
 - 12. Siemon Co. (The).
- B. General Frame Requirements:
 - 1. Distribution Frames: Freestanding, modular-steel units designed for telecommunications terminal support and coordinated with dimensions of units to be supported.
 - 2. Module Dimension: Width compatible with EIA 310 standard, 19-inch panel mounting.
 - 3. Finish: Manufacturer's standard, baked-polyester powder coat.
- C. Cable Management for Equipment Frames:
 - 1. Metal, with integral wire retaining fingers.
 - 2. Baked-polyester powder coat finish.
 - 3. Vertical cable management panels shall have front and rear channels, with covers.
 - 4. Provide horizontal crossover cable manager at the top of each relay rack, with a minimum height of two rack units each.

2.4 POWER STRIPS

- A. Power Strips: Comply with UL 1363.
 - 1. Rack mounting.
 - 2. Six, 15-A, 120-V ac, NEMA WD 6, Configuration 5-15R receptacles.
 - 3. LED indicator lights for power and protection status.
 - 4. LED indicator lights for reverse polarity and open outlet ground.
 - 5. Circuit Breaker and Thermal Fusing: When protection is lost, circuit opens and cannot be reset.
 - 6. Circuit Breaker and Thermal Fusing: Unit continues to supply power if protection is lost.
 - 7. Cord connected with 15-foot line cord.
 - 8. Rocker-type on-off switch, illuminated when in on position.
 - 9. Peak Single-Impulse Surge Current Rating: 33 kA per phase.
 - 10. Protection modes shall be line to neutral, line to ground, and neutral to ground. UL 1449 clamping voltage for all 3 modes shall be not more than 330 V.

2.5 GROUNDING

- A. Comply with requirements in Division 26 Section "Grounding and Bonding for Electrical Systems". for grounding conductors and connectors.
- B. Telecommunications Main Bus Bar:
 - 1. Connectors: Mechanical type, cast silicon bronze, solderless exothermic-type wire terminals, and long-barrel, two-bolt connection to ground bus bar.
 - 2. Ground Bus Bar: Copper, minimum 1/4 inch thick by 4 inches wide with 9/32-inch holes spaced 1-1/8 inches apart.
 - 3. Stand-Off Insulators: Comply with UL 891 for use in switchboards, 600 V. Lexan or PVC, impulse tested at 5000 V.
- C. Comply with ANSI-J-STD-607-A.

2.6 LABELING

A. Comply with TIA/EIA-606-A and UL 969 for a system of labeling materials, including label stocks, laminating adhesives, and inks used by label printers.

PART 3 - EXECUTION

3.1 ENTRANCE FACILITIES

- A. Contact telecommunications service provider and arrange for installation of demarcation point, protected entrance terminals, and a housing when so directed by service provider.
- B. Install underground pathways complying with recommendations in TIA/EIA-569-A, "Entrance Facilities" Article.
- 3.2 Install underground entrance pathway complying with Division 26 Section "Raceway and Boxes for Electrical Systems".
 - A. Comply with NECA 1.

- B. Comply with BICSI TDMM for layout and installation of communications equipment rooms.
- C. Cable Trays: Comply with NEMA VE 2 and TIA/EIA-569-A-7.
- D. Bundle, lace, and train conductors and cables to terminal points without exceeding manufacturer's limitations on bending radii. Install lacing bars and distribution spools.

3.3 FIRESTOPPING

- A. Comply with requirements in Division 07 Section "Penetration Firestopping". Comply with TIA/EIA-569-A, Annex A, "Firestopping".
- B. Comply with BICSI TDMM, "Firestopping Systems" Article.

3.4 GROUNDING

- A. Install grounding according to BICSI TDMM, "Grounding, Bonding, and Electrical Protection" Chapter.
- B. Comply with ANSI-J-STD-607-A.
- C. Locate grounding bus bar to minimize the length of bonding conductors. Fasten to wall allowing at least 2-inch clearance behind the grounding bus bar. Connect grounding bus bar with a minimum No. 4 AWG grounding electrode conductor from grounding bus bar to suitable electrical building ground.
- D. Bond metallic equipment to the grounding bus bar, using not smaller than No. 6 AWG equipment grounding conductor.
 - 1. Bond the shield of shielded cable to the grounding bus bar in communications rooms and spaces.

3.5 IDENTIFICATION

- A. Identify system components, wiring, and cabling complying with TIA/EIA-606-A. Comply with requirements in Division 26 Section "Identification for Electrical Systems. "Comply with requirements in Division 09 Section "Interior Painting" for painting backboards. For fire-resistant plywood, do not paint over manufacturer's label.
- B. See Division 27 Section "Communications Horizontal Cabling" for additional identification requirements. See Evaluations for discussion of TIA/EIA standard as it applies to this Section. Paint and label colors for equipment identification shall comply with TIA/EIA-606-A for Class 2 level of administration.
- C. Labels shall be preprinted or computer-printed type.

END OF SECTION

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. Pathways.
 - 2. UTP cabling.
 - 3. Cable connecting hardware, patch panels, and cross-connects.
 - 4. Telecommunications outlet/connectors.
 - 5. Cabling system identification products.
 - 6. Cable management system.
- B. Related Sections include the following:
 - 1. Division 26 Sections:
 - a. "Common Work Results for Electrical".
 - b. "Raceways and Boxes for Electrical Systems".
 - c. "Identification for Electrical Systems".

1.3 DEFINITIONS

- A. BICSI: Building Industry Consulting Service International.
- B. Consolidation Point: A location for interconnection between horizontal cables extending from building pathways and horizontal cables extending into furniture pathways.
- C. Cross-Connect: A facility enabling the termination of cable elements and their interconnection or cross-connection.
- D. EMI: Electromagnetic interference.
- E. IDC: Insulation displacement connector.
- F. Cable Tray: A fabricated structure consisting of two longitudinal side rails connected by individual transverse members (rungs).
- G. LAN: Local area network.
- H. Outlet/Connectors: A connecting device in the work area on which horizontal cable or outlet cable terminates.
- I. RCDD: Registered Communications Distribution Designer.
- J. UTP: Unshielded twisted pair.

1.4 HORIZONTAL CABLING DESCRIPTION

- A. Horizontal cable and its connecting hardware provide the means of transporting signals between the telecommunications outlet/connector and the horizontal cross-connect located in the communications equipment room. This cabling and its connecting hardware are called "permanent link", a term that is used in the testing protocols.
 - 1. TIA/EIA-568-B.1 requires that a minimum of two telecommunications outlet/connectors be installed for each work area.
 - 2. Horizontal cabling shall contain no more that one transition point or consolidation point between the horizontal cross-connect and the telecommunications outlet/connector.
 - 3. Bridged taps and splices shall not be installed in the horizontal cabling.
 - 4. Splitters shall not be installed as part of the optical fiber cabling.
- B. A work area is approximately 100 sq. ft., and includes the components that extend from the telecommunications outlet/connectors to the station equipment.
- C. The maximum allowable horizontal cable length is 295 feet. This maximum allowable length does not include an allowance for the length of 16 feet to the workstation equipment. The maximum allowable length does not include an allowance for the length of 16 feet in the horizontal cross-connect.

1.5 PERFORMANCE REQUIREMENTS

A. General Performance: Horizontal cabling system shall comply with transmission standards in TIA/EIA-568-B.1 for Category 6, when tested according to test procedures of this standard.

1.6 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings:
 - 1. System Labeling Schedules: Electronic copy of labeling schedules, in software and format selected by Owner.
 - 2. System Labeling Schedules: Electronic copy of labeling schedules that are part of the cabling and asset identification system of the software.
 - 3. Cabling administration drawings and printouts.
 - 4. Wiring diagrams to show typical wiring schematics, including the following:
 - a. Cross-connects.
 - b. Patch panels.
 - c. Patch cords.
 - 5. Cross-connects and patch panels. Detail mounting assemblies and show elevations and physical relationship between the installed components.
- C. Qualification Data: For Installer, qualified layout technician, installation supervisor, and field inspector.
- D. Source quality-control reports.
- E. Field quality-control reports.

F. Maintenance Data: For splices and connectors to include in maintenance manuals.

1.7 QUALITY ASSURANCE

- A. Installer Qualifications: Cabling Installer must have personnel certified by BICSI on staff.
 - 1. Layout Responsibility: Preparation of Shop Drawings by an RCDD.
 - 2. Installation Supervision: Installation shall be under the direct supervision of Registered Technician, who shall be present at all times when Work of this Section is performed at Project site.
 - 3. Testing Supervisor: Currently certified by BICSI as an RCDD to supervise on-site testing.
- B. Testing Agency Qualifications: An NRTL.
 - 1. Testing Agency's Field Supervisor: Currently certified by BICSI as an RCDD to supervise on-site testing.
- C. Surface-Burning Characteristics: As determined by testing identical products according to ASTM E 84 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - 1. Flame-Spread Index: 25 or less.
 - 2. Smoke-Developed Index: 50 or less.
- D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- E. Telecommunications Pathways and Spaces: Comply with TIA/EIA-569-A.
- F. Grounding: Comply with ANSI-J-STD-607-A.
- 1.8 DELIVERY, STORAGE AND HANDLING
 - A. Test cables upon receipt at Project site.
 - 1. Test each pair of UTP cable for open and short circuits.

1.9 PROJECT CONDITIONS

- A. Environmental Limitations: Do not deliver or install cables and connecting materials until wet work in spaces is complete and dry, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.
- 1.10 COORDINATION
 - A. Coordinate layout and installation of telecommunications pathways and cabling with Owner's telecommunications and LAN equipment and service suppliers.
 - B. Coordinate telecommunications outlet/connector locations with location of power receptacles at each work area.

1.11 EXTRA MATERIALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Patch-Panel Units: One of each type.
 - 2. Device Plates: One of each type.

PART 2 - PRODUCTS

2.1 PATHWAYS

- A. General Requirements: Comply with TIA/EIA-569-A.
- B. Cable Support: NRTL labeled for support of Category 6 cabling, designed to prevent degradation of cable performance and pinch points that could damage cable.
 - 1. Support brackets with cable tie slots for fastening cable ties to brackets.
 - 2. Lacing bars, spools, J-hooks, and D-rings.
 - 3. Straps and other devices.
- C. Conduit and Boxes: Comply with requirements in Division 26 Section "Raceway and Boxes for Electrical Systems". Flexible metal conduit shall not be used.
 - 1. Outlet boxes shall be no smaller than 4 inch square, and 2-1/8 inches deep. Provide all trim rings required to install in wall.

2.2 BACKBOARDS

A. Backboards: Plywood, fire-retardant treated, 3/4 by 48 by 96 inches. Comply with requirements in Division 06 Section "Rough Carpentry" for plywood backing panels.

2.3 UTP CABLE

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Belden CDT Inc.; Electronics Division.
 - 2. Berk-Tek; a Nexans company.
 - 3. Mohawk; a division of Belden CDT.
 - 4. Nordex/CDT; a subsidiary of Cable Design Technologies.
 - 5. Superior Essex Inc.
 - 6. SYSTIMAX Solutions; a CommScope, Inc. brand.
- B. Description: 100-ohm, 4-pair UTP, covered with a thermoplastic jacket.
 - 1. Comply with ICEA S-90-661 for mechanical properties.
 - 2. Comply with TIA/EIA-568-B.1 for performance specifications.
 - 3. Comply with TIA/EIA-568-B.2, Category 6.
 - 4. Listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with UL 444 and NFPA 70 for the following types:
 - a. Communications, General Purpose: Type CM or CMG.
 - b. Communications, Plenum Rated: Type CMP, complying with NFPA 262.
 - c. Communications, Riser Rated: Type CMR, complying with UL 1666.

- d. Communications, Limited Purpose: Type CMX.
- e. Multipurpose: Type MP or MPG.
- f. Multipurpose, Plenum Rated: Type MPP, complying with NFPA 262.
- g. Multipurpose, Riser Rated: Type MPR or MPP, complying with UL 1666.
- C. Color: Voice cables shall have white outer jacket. Data cables shall have blue outer jacket.

2.4 UTP CABLE HARDWARE

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Hubbell Premise Wiring.
 - 2. Leviton Voice & Data Division.
 - 3. Panduit Corp.
 - 4. Siemon Co. (The).
 - 5. SYSTIMAX Solutions; a CommScope, Inc. brand.
 - 6. Tyco Electronics/AMP Netconnect; Tyco International Ltd.
- B. General Requirements for Cable Connecting Hardware: Comply with TIA/EIA-568-B.2, IDC type, with modules designed for punch-down caps or tools. Cables shall be terminated with connecting hardware of same category or higher.
- C. Connecting Blocks: 110-style IDC for Category 6. Provide blocks for the number of cables terminated on the block, plus 25 percent spare. Integral with connector bodies, including plugs and jacks where indicated.
- D. Cross-Connect: Modular array of connecting blocks arranged to terminate building cables and permit interconnection between cables.
 - 1. Number of Terminals per Field: One for each conductor in assigned cables.
- E. Patch Panel: Modular panels housing multiple-numbered jack units with IDC-type connectors at each jack for permanent termination of pair groups of installed cables.
 - 1. Number of Jacks per Field: One for each four-pair UTP cable indicated.
- F. Jacks and Jack Assemblies: Modular, color-coded, eight-position modular receptacle units with integral IDC-type terminals.
- G. Patch Cords: Factory-made, four-pair cables; terminated with eight-position modular plug at each end.
 - 1. Patch cords shall have bend-relief-compliant boots and color-coded icons to ensure Category 6 performance. Patch cords shall have latch guards to protect against snagging.
 - 2. Patch cords shall have color-coded boots for circuit identification.
 - 3. Provide patch cables for each cable terminated on patch panels. Patch cables lengths shall be distributed as follows: 4 foot (50% of total); 7 foot (40% of total); and 10 (10% of total).

2.5 TELECOMMUNICATIONS OUTLET/CONNECTORS

- A. Jacks: 100-ohm, balanced, twisted-pair connector; four-pair, eight-position modular. Comply with TIA/EIA-568-B.1, Category 6.
- B. Workstation Outlets: Four-port-connector assemblies mounted in single faceplate.
 - 1. Plastic Faceplate: High-impact plastic. Coordinate color with Division 26 Section "Wiring Devices".
 - 2. For use with snap-in jacks accommodating any combination of UTP cords.
 - a. Flush mounting jacks, positioning the cord at a 45-degree angle.
 - 3. Legend: Snap-in, clear-label covers and machine-printed paper inserts.
 - 4. Voice jacks shall be white color and data jacks shall be blue color.

2.6 GROUNDING

- A. Comply with requirements in Division 26 Section "Grounding and Bonding for Electrical Systems" for grounding conductors and connectors.
- B. Comply with ANSI-J-STD-607-A.

2.7 IDENTIFICATION PRODUCTS

- A. Comply with TIA/EIA-606-A and UL 969 for labeling materials, including label stocks, laminating adhesives, and inks used by label printers.
- B. Comply with requirements in Division 26 Section "Identification for Electrical Systems".

2.8 SOURCE QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to evaluate cables.
- B. Factory test UTP on reels according to TIA/EIA-568-B.1.
- C. Factory test UTP cables according to TIA/EIA-568-B.2.
- D. Cable will be considered defective if it does not pass tests and inspections.
- E. Prepare test and inspection reports.

PART 3 - EXECUTION

- 3.1 ENTRANCE FACILITIES
 - A. Coordinate backbone cabling with the protectors and demarcation point provided by communications service provider.

3.2 WIRING METHODS

A. Wiring Method: Install cables in raceways, jayhooks, and cable trays except within consoles, cabinets, desks, and counters and except in accessible ceiling spaces, in attics, and in gypsum board partitions where unenclosed wiring method may be used. Conceal raceway and cables except in unfinished spaces.

- 1. Install plenum cable in environmental air spaces, including plenum ceilings.
- 2. Comply with requirements for raceways and boxes specified in Division 26 Section "Raceway and Boxes for Electrical Systems".
- B. Wiring Method: Conceal conductors and cables in accessible ceilings, walls, and floors where possible.
- C. Wiring within Enclosures: Bundle, lace, and train cables to terminal points with no excess and without exceeding manufacturer's limitations on bending radii. Provide and use lacing bars and distribution spools.

3.3 INSTALLATION OF PATHWAYS

- A. Comply with requirements for demarcation point, pathways, cabinets, and racks specified in Division 27 Section "Communications Equipment Room Fittings". Drawings indicate general arrangement of pathways and fittings.
- B. Comply with TIA/EIA-569-A for pull-box sizing and length of conduit and number of bends between pull points.
- C. Comply with requirements in Division 26 Section "Raceway and Boxes for Electrical Systems" for installation of conduits and wireways.
- D. Install manufactured conduit sweeps and long-radius elbows whenever possible.
- E. Pathway Installation in Communications Equipment Rooms:
 - 1. Position conduit ends adjacent to a corner on backboard where a single piece of plywood is installed, or in the corner of room where multiple sheets of plywood are installed around perimeter walls of room.
 - 2. Install cable trays to route cables if conduits cannot be located in these positions.
 - 3. Secure conduits to backboard when entering room from overhead.
 - 4. Extend conduits 3 inches above finished floor.
 - 5. Install metal conduits with grounding bushings and connect with grounding conductor to grounding system.
- F. Backboards: Install backboards with 96-inch dimension vertical. Butt adjacent sheets tightly, and form smooth gap-free corners and joints.

3.4 INSTALLATION OF CABLES

- A. Comply with NECA 1.
- B. General Requirements for Cabling:
 - 1. Comply with TIA/EIA-568-B.1.
 - 2. Comply with BICSI ITSIM, Ch. 6, "Cable Termination Practices".
 - 3. Install 110-style IDC termination hardware unless otherwise indicated.
 - 4. MUTOA shall not be used as a cross-connect point.
 - 5. Consolidation points may be used only for making a direct connection to telecommunications outlet/connectors:
 - a. Do not use consolidation point as a cross-connect point, as a patch connection, or for direct connection to workstation equipment.

- b. Locate consolidation points for UTP at least 49 feet from communications equipment room.
- 6. Terminate conductors; no cable shall contain unterminated elements. Make terminations only at indicated outlets, terminals, cross-connects, and patch panels.
- 7. Cables may not be spliced. Secure and support cables at intervals not exceeding 30 inches and not more than 6 inches from cabinets, boxes, fittings, outlets, racks, frames, and terminals.
- 8. Install lacing bars to restrain cables, to prevent straining connections, and to prevent bending cables to smaller radii than minimums recommended by manufacturer.
- 9. Bundle, lace, and train conductors to terminal points without exceeding manufacturer's limitations on bending radii, but not less than radii specified in BICSI ITSIM, "Cabling Termination Practices" Chapter. Install lacing bars and distribution spools.
- 10. Do not install bruised, kinked, scored, deformed, or abraded cable. Do not splice cable between termination, tap, or junction points. Remove and discard cable if damaged during installation and replace it with new cable.
- 11. Cold-Weather Installation: Bring cable to room temperature before dereeling. Heat lamps shall not be used for heating.
- 12. In the communications equipment room, install a 10-foot-long service loop on each end of cable.
- 13. Pulling Cable: Comply with BICSI ITSIM, Ch. 4, "Pulling Cable". Monitor cable pull tensions.
- C. UTP Cable Installation:
 - 1. Comply with TIA/EIA-568-B.2.
 - 2. Do not untwist UTP cables more than 1/2 inch from the point of termination to maintain cable geometry.
- D. Open-Cable Installation:
 - 1. Install cabling with horizontal and vertical cable guides in telecommunications spaces with terminating hardware and interconnection equipment.
 - 2. Suspend UTP cable not in a wireway or pathway a minimum of 8 inches above ceilings by cable supports not more than 60 inches apart.
 - 3. Cable shall not be run through structural members or in contact with pipes, ducts, or other potentially damaging items.
- E. Group connecting hardware for cables into separate logical fields.
- F. Separation from EMI Sources:
 - 1. Comply with BICSI TDMM and TIA/EIA-569-A for separating unshielded copper voice and data communication cable from potential EMI sources, including electrical power lines and equipment.
 - 2. Separation between open communications cables or cables in nonmetallic raceways and unshielded power conductors and electrical equipment shall be as follows:
 - a. Electrical Equipment Rating Less Than 2 kVA: A minimum of 5 inches.
 - b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 12 inches.
 - c. Electrical Equipment Rating More Than 5 kVA: A minimum of 24 inches.

- 3. Separation between communications cables in grounded metallic raceways and unshielded power lines or electrical equipment shall be as follows:
 - a. Electrical Equipment Rating Less Than 2 kVA: A minimum of 2-1/2 inches.
 - b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 6 inches.
 - c. Electrical Equipment Rating More Than 5 kVA: A minimum of 12 inches.
- 4. Separation between communications cables in grounded metallic raceways and power lines and electrical equipment located in grounded metallic conduits or enclosures shall be as follows:
 - a. Electrical Equipment Rating Less Than 2 kVA: No requirement.
 - b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 3 inches.
 - c. Electrical Equipment Rating More Than 5 kVA: A minimum of 6 inches.
- 5. Separation between Communications Cables and Electrical Motors and Transformers, 5 kVA or HP and Larger: A minimum of 48 inches.
- 6. Separation between Communications Cables and Fluorescent Fixtures: A minimum of 5 inches.

3.5 FIRESTOPPING

- A. Comply with requirements in Division 07 Section "Penetration Firestopping".
- B. Comply with TIA/EIA-569-A, Annex A, "Firestopping".
- C. Comply with BICSI TDMM, "Firestopping Systems" Article.
- 3.6 GROUNDING
 - A. Install grounding according to BICSI TDMM, "Grounding, Bonding, and Electrical Protection" Chapter.
 - B. Comply with ANSI-J-STD-607-A.
 - C. Locate grounding bus bar to minimize the length of bonding conductors. Fasten to wall allowing at least 2-inch clearance behind the grounding bus bar. Connect grounding bus bar with a minimum No. 4 AWG grounding electrode conductor from grounding bus bar to suitable electrical building ground.
 - D. Bond metallic equipment to the grounding bus bar, using not smaller than No. 6 AWG equipment grounding conductor.

3.7 IDENTIFICATION

- A. Identify system components, wiring, and cabling complying with TIA/EIA-606-A. Comply with requirements for identification specified in Division 26 Section "Identification for Electrical Systems".
 - 1. Administration Class: 1.
 - 2. Color-code cross-connect fields. Apply colors to voice and data service backboards, connections, covers, and labels.
- B. Using cable management system software specified in Part 2, develop Cabling Administration Drawings for system identification, testing, and management. Use unique,

alphanumeric designation for each cable and label cable, jacks, connectors, and terminals to which it connects with same designation. At completion, cable and asset management software shall reflect as-built conditions. Identification for each component shall comply with the Owner's telecommunication standards.

- C. Comply with requirements in Division 09 Section "Interior Painting" for painting backboards. For fire-resistant plywood, do not paint over manufacturer's label.
- D. Paint and label colors for equipment identification shall comply with TIA/EIA-606-A for Class 2 level of administration, including optional identification requirements of this standard.
- E. Cable Schedule: Post in prominent location in each equipment room and wiring closet. List incoming and outgoing cables and their designations, origins, and destinations. Protect with rigid frame and clear plastic cover. Furnish an electronic copy of final comprehensive schedules for Project.
- F. Cabling Administration Drawings: Show building floor plans with cabling administrationpoint labeling. Identify labeling convention and show labels for telecommunications closets, backbone pathways and cables, entrance pathways and cables, terminal hardware and positions, horizontal cables, work areas and workstation terminal positions, grounding buses and pathways, and equipment grounding conductors. Follow convention of TIA/EIA-606-A. Furnish electronic record of all drawings, in software and format selected by Owner.
- G. Cable and Wire Identification:
 - 1. Label each cable within 4 inches of each termination and tap, where it is accessible in a cabinet or junction or outlet box, and elsewhere as indicated.
 - 2. Each wire connected to building-mounted devices is not required to be numbered at device if color of wire is consistent with associated wire connected and numbered within panel or cabinet.
 - 3. Label each terminal strip and screw terminal in each cabinet, rack, or panel.
 - a. Individually number wiring conductors connected to terminal strips, and identify each cable or wiring group being extended from a panel or cabinet to a building-mounted device shall be identified with name and number of particular device as shown.
 - b. Label each unit and field within distribution racks and frames.
 - 4. Identification within Connector Fields in Equipment Rooms and Wiring Closets: Label each connector and each discrete unit of cable-terminating and connecting hardware. Where similar jacks and plugs are used for both voice and data communication cabling, use a different color for jacks and plugs of each service.
- H. Labels shall be preprinted or computer-printed type with printing area and font color that contrasts with cable jacket color but still complies with requirements in TIA/EIA-606-A.
 - 1. Cables use flexible vinyl or polyester that flex as cables are bent.

3.8 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- B. Perform tests and inspections.

- C. Tests and Inspections:
 - 1. Visually inspect UTP cable jacket materials for NRTL certification markings. Inspect cabling terminations in communications equipment rooms for compliance with color-coding for pin assignments, and inspect cabling connections for compliance with TIA/EIA-568-B.1.
 - 2. Visually confirm Category 6, marking of outlets, cover plates, outlet/connectors, and patch panels.
 - 3. Visually inspect cable placement, cable termination, grounding and bonding, equipment and patch cords, and labeling of all components.
 - 4. UTP Performance Tests:
 - a. Test for each outlet and MUTOA. Perform the following tests according to TIA/EIA-568-B.1 and TIA/EIA-568-B.2:
 - 1) Wire map.
 - 2) Length (physical vs. electrical, and length requirements).
 - 3) Insertion loss.
 - 4) Near-end crosstalk (NEXT) loss.
 - 5) Power sum near-end crosstalk (PSNEXT) loss.
 - 6) Equal-level far-end crosstalk (ELFEXT).
 - 7) Power sum equal-level far-end crosstalk (PSELFEXT).
 - 8) Return loss.
 - 9) Propagation delay.
 - 10) Delay skew.
 - 5. Final Verification Tests: Perform verification tests for UTP and optical fiber systems after the complete communications cabling and workstation outlet/connectors are installed.
 - a. Voice Tests: These tests assume that dial tone service has been installed. Connect to the network interface device at the demarcation point. Go offhook and listen and receive a dial tone. If a test number is available, make and receive a local, long distance, and digital subscription line telephone call.
 - b. Data Tests: These tests assume the Information Technology Staff has a network installed and is available to assist with testing. Connect to the network interface device at the demarcation point. Log onto the network to ensure proper connection to the network.
- D. Document data for each measurement. Data for submittals shall be printed in a summary report that is formatted similar to Table 10.1 in BICSI TDMM, or transferred from the instrument to the computer, saved as text files, and printed and submitted.
- E. End-to-end cabling will be considered defective if it does not pass tests and inspections.
- F. Prepare test and inspection reports.

END OF SECTION

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes fire alarm systems.
 - 1. Fire Alarm Control Panel.
 - 2. Manual Fire Alarm Boxes.
 - 3. System Smoke Detectors.
 - 4. System Heat Detectors.
 - 5. Notification Appliances.
 - 6. Remote Annunciator.
 - 7. Addressable Interface Device.
 - 8. Digital Alarm Communicator Transmitter.
 - 9. Wire and Cable.
- B. Related Sections include the following:
 - 1. Division 08 Section "Door Hardware" for door closers and holders with associated smoke detectors, electric door locks, and release devices that interface with the fire alarm system.

1.2 DEFINITIONS

- A. FACP: Fire alarm control panel.
- 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.

1.3 SYSTEM DESCRIPTION

A. Noncoded, addressable system; automatic sensitivity control of smoke detectors; multiplexed signal transmission dedicated to fire alarm service only.

1.4 PERFORMANCE REQUIREMENTS

- A. Comply with NFPA 72.
- B. Fire alarm signal initiation shall be by one or more of the following devices:
 - 1. Manual stations.
 - 2. Heat detectors.
 - 3. Smoke detectors.
 - 4. Verified automatic alarm operation of smoke detectors and heat detectors.
 - 5. Automatic sprinkler system water flow.
- C. Fire alarm signal shall initiate the following actions:
 - 1. Alarm notification appliances shall operate continuously.
 - 2. Identify alarm at the FACP and remote annunciators.
 - 3. Transmit an alarm signal to a UL listed Central Station.

- 4. Unlock electric door locks in designated egress paths.
- 5. Release fire and smoke doors held open by magnetic door holders.
- 6. Shut down the large diameter ceiling fans within the Arena.
- 7. Record events in the system memory.
- 8. Record events by the system printer.
- D. Duct Detector signal shall initiate the following actions:
 - 1. Shut down associated air handling unit.
 - 2. Close smoke dampers in the associated air handling unit's duct system.
- E. Supervisory signal initiation shall be by one or more of the following devices or actions:
 - 1. Operation of a fire-protection system valve tamper switch.
 - 2. Operation of a duct mounted smoke detector.
 - 3. Loss of communication with any panel on a network.
- 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 FACP.
 - 4. Ground or a single break in FACP internal circuits.
 - 5. Abnormal ac voltage at the FACP.
 - 6. A break in standby battery circuitry.
 - 7. Failure of battery charging.
 - 8. Abnormal position of any switch at the FACP or annunciator.
- G. System Trouble and Supervisory Signal Actions: Annunciate at the FACP and remote annunciators. Record the event on system printer.
- H. Activation of carbon monoxide detector shall initiate a local alarm with integral sounder and send a supervisory signal to the control panel.

1.5 SUBMITTALS

- A. Product Data: For each type of product indicated.
- 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. Device Address List: Coordinate with final system programming.

- 4. System riser diagram with device addresses, conduit sizes, and cable and wire types and sizes.
- 5. Wiring Diagrams: Power, signal, and control wiring. Include diagrams for equipment and for system with all terminals and interconnections identified. Show wiring color code.
- 6. Batteries: Size calculations.
- 7. 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.
- 8. Alarm Signaling Service: Equipment rack or console layout, grounding schematic, amplifier power calculation, and single-line connection diagram.
- 9. Floor Plans: Indicate final outlet locations showing address of each addressable device. Show size and route of cable and conduits.
- C. Qualification Data: For Installer.
- D. Field quality-control test reports.
- E. Operation and Maintenance Data: For fire alarm system to include in emergency, operation, and maintenance manuals. Comply with NFPA 72, Appendix A, recommendations for Owner's manual. Include abbreviated operating instructions for mounting at the FACP.
- F. Submittals to Authorities Having Jurisdiction: In addition to distribution requirements for submittals specified in Division 01 Section "Submittals," 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. On receipt of comments from authorities having jurisdiction, submit them to Architect for review.
- G. Documentation:
 - 1. Approval and Acceptance: Provide the "Record of Completion" form according to NFPA 72 to Owner, Architect.
 - 2. Record of Completion Documents: Provide the "Permanent Records" according to NFPA 72 to Owner, Architect. Format of the written sequence of operation shall be the optional input/output matrix.
 - a. Hard copies on paper to Owner, Architect.
 - b. Electronic media may be provided to Architect.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: Personnel shall be trained and certified by manufacturer for installation of units required for this Project.
- B. Installer Qualifications: Work of this Section be performed by a UL-listed company.
- C. Installer Qualifications: Personnel certified by NICET as Fire Alarm Level III.
- D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

1.7 PROJECT CONDITIONS

- A. Interruption of Existing Fire Alarm Service: Do not interrupt fire alarm service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary guard service according to requirements indicated:
 - 1. Notify Architect, Construction Manager, Owner no fewer than 7 days in advance of proposed interruption of fire alarm service.
 - 2. Do not proceed with interruption of fire alarm service without Architect's, Construction Manager's, Owner's written permission.

1.8 SEQUENCING AND SCHEDULING

- A. Equipment Removal: Remove existing equipment in renovation area and return devices to Owner.
- B. Connect provided fire alarm panel to the existing fire alarm panels and systems. Program existing fire alarm control panels to annunciate to provided fire alarm panel and annunciator.

1.9 EXTRA MATERIALS

- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Lamps for Remote Indicating Lamp 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 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. Keys and Tools: One extra set for access to locked and tamperproofed components.
 - 6. Audible and Visual Notification Appliances: One of each type installed.
 - 7. Fuses: Two of each type installed in the system.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Notifier.
 - 2. Siemens.
 - 3. Simplex.
 - 4. Silent Knight.
 - 5. Or Approved Equal.
2.2 FACP

- A. General Description:
 - 1. Modular, power-limited design with electronic modules, UL 864 listed.
 - 2. Addressable initiation devices that communicate device identity and status.
 - a. Smoke sensors shall additionally communicate sensitivity setting and allow for adjustment of sensitivity at the FACP.
 - b. Temperature sensors shall additionally test for and communicate the sensitivity range of the device.
 - 3. Addressable control circuits for operation of mechanical equipment.
- B. Alphanumeric Display and System Controls: Arranged for interface between human operator at the FACP 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 40 characters, minimum.
 - 2. Keypad: Arranged to permit entry and execution of programming, display, and control commands; and to indicate control commands to be entered into the system for control of smoke-detector sensitivity and other parameters.
- C. Circuits:
 - 1. Signaling Line Circuits: NFPA 72, Class B.
 - a. System Layout: Install no more than 10 strobes on each signaling line circuit.
 - b. Provide power booster to serve strobes as required.
 - 2. Notification-Appliance Circuits: NFPA 72, Class B, Style.
 - 3. Actuation of alarm notification appliances, annunciation, smoke control, shall occur within 10 seconds after the activation of an initiating device.
 - 4. Electrical monitoring for the integrity of wiring external to the FACP 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 shut down.
- D. Smoke-Alarm Verification:
 - 1. Initiate audible and visible indication of an "alarm verification" signal at the FACP.
 - 2. Activate a listed and approved "alarm verification" sequence at the FACP and the detector.
 - 3. Record events by the system printer.
 - 4. Sound general alarm if the alarm is verified.
 - 5. Cancel FACP indication and system reset if the alarm is not verified.
- E. Notification-Appliance Circuit:
 - 1. Audible appliances shall sound in a three-pulse temporal pattern, as defined in NFPA 72.

- 2. Visual alarm appliances shall flash in synchronization where multiple appliances are in the same field of view, as defined in NFPA 72.
- F. Elevator Recall:
 - 1. Elevator recall shall be initiated only by one of the following alarm-initiating devices:
 - a. Elevator lobby detectors except the lobby detector on the designated floor.
 - b. Smoke detector in elevator machine room.
 - c. Smoke detectors in elevator hoistway.
 - 2. Elevator controller shall be programmed to move the cars to the alternate recall floor if lobby detectors located on the designated recall floors are activated.
 - 3. Water-flow alarm connected to sprinkler in an elevator shaft and elevator machine room shall shut down elevators associated with the location without time delay.
 - a. Water-flow switch associated with the sprinkler in the elevator pit may have a delay to allow elevators to move to the designated floor.
- G. Door Controls: Door hold-open devices that are controlled by smoke detectors at doors in smoke-barrier walls shall be connected to fire-alarm system.
- H. 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.
- I. Alarm Silencing, Trouble, and Supervisory Alarm Reset: Manual reset at the FACP and remote annunciators, after initiating devices are restored to normal.
 - 1. Silencing-switch operation halts alarm operation of notification appliances and activates an "alarm silence" light. Display of identity of the alarm zone or device is retained.
 - 2. Subsequent alarm signals from other devices or zones reactivate notification appliances until silencing switch is operated again.
 - 3. When alarm-initiating devices return to normal and system reset switch is operated, notification appliances operate again until alarm silence switch is reset.
- J. 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 FACP 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.
- K. Remote Smoke-Detector Sensitivity Adjustment: Controls shall select specific addressable smoke detectors for adjustment, display their current status and sensitivity settings, and control of changes in those settings. Allow controls to be used to program repetitive, time-scheduled, and automated changes in sensitivity of specific detector groups. Record sensitivity adjustments and sensitivity-adjustment schedule changes in system memory and make a print-out of the final adjusted values on the system printer.
- L. Transmission to Remote Alarm Receiving Station: Automatically transmit alarm, trouble, and supervisory signals to a remote alarm station through a digital alarm communicator transmitter and telephone lines.

- M. Service Modem: Ports shall be RS-232 for system printer and for connection to a dial-in terminal unit.
 - 1. The dial-in port shall allow remote access to the FACP for programming changes and system diagnostic routines. Access by a remote terminal shall be by encrypted password algorithm.
- N. 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 initiate the printing of a list of existing alarm, supervisory, and trouble conditions in the system and a historical log of events.
- O. Primary Power: 24-V dc obtained from 120-V ac service and a power-supply module. Initiating devices, notification appliances, signaling lines, trouble signal, supervisory and digital alarm communicator transmitter shall be powered by the 24-V dc source.
 - 1. The alarm current draw of the entire fire alarm system shall not exceed 80 percent of the power-supply module rating.
- P. Secondary Power: 24-V dc 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.
- Q. Surge Protection:
 - 1. Install surge protection on normal ac power for the FACP and its accessories.
 - 2. Install surge protectors recommended by FACP manufacturer. Install on all system wiring external to the building housing the FACP.
- R. Instructions: Computer printout or typewritten instruction card mounted behind a plastic or glass cover in a stainless-steel or aluminum frame. Include interpretation and describe appropriate response for displays and signals. Briefly describe the functional operation of the system under normal, alarm, and trouble conditions.

2.3 MANUAL FIRE ALARM BOXES

- A. Description: UL 38 listed; finished in red with molded, raised-letter operating instructions in contrasting color. Station shall show visible indication of operation. Mounted 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 FACP.
 - 2. Station Reset: Key- or wrench-operated switch.
- B. Protective covers for boxes in detention areas shall be by Safety Technology International, (STI) or approved equal.

2.4 SYSTEM SMOKE DETECTORS

- A. General Description:
 - 1. UL 268 listed, operating at 24-V dc, nominal.
 - 2. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to the FACP.
 - 3. Multipurpose type, containing the following:
 - a. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to the FACP.
 - b. Photoelectric Smoke Sensor
 - 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 do 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. Remote Control: Unless otherwise indicated, detectors shall be analogaddressable type, individually monitored at the FACP for calibration, sensitivity, and alarm condition, and individually adjustable for sensitivity from the FACP.
 - a. Rate-of-rise temperature characteristic shall be selectable at the FACP for 15 or 20 deg F (8 or 11 deg C) per minute.
 - b. Fixed-temperature sensing shall be independent of rate-of-rise sensing and shall be settable at the FACP to operate at 135 or 155 deg F (57 or 68 deg C).
 - c. Provide multiple levels of detection sensitivity for each sensor.
 - 8. Detector covers for detention areas. Provide 14 ga. steel cover UL listed for use with provided smoke detectors. Cover shall have perforations to allow air movement through cover to detector. Covers shall be by Tri-Star Detention or approved equal.
- 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.
- 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 24-V dc, nominal.
 - 3. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to the FACP.

- 4. Plug-in Arrangement: Detector and associated electronic components shall be mounted in a plug-in module that connects to a fixed base. The fixed base shall be designed for mounting directly to the air duct. Provide terminals in the fixed base for connection to building wiring.
 - a. Weatherproof Duct Housing Enclosure: UL listed for use with the supplied detector. The enclosure shall comply with NEMA 250 requirements for Type 4X.
- 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 status. Provide remote status and alarm indicator and test station where indicated and at ceiling below.
- 7. Each sensor shall have multiple levels of detection sensitivity.
- 8. Sampling Tubes: Design and dimensions as recommended by manufacturer for the specific duct size, air velocity, and installation conditions where applied.
- 9. Relay Fan Shutdown: Rated to interrupt fan motor-control circuit.

2.5 HEAT DETECTORS

- A. General: UL 521 listed.
- B. Heat Detector, Combination Type: Actuated by either a fixed temperature of 135 deg F (57 deg C) or rate-of-rise of temperature that exceeds 15 deg F (8 deg C) 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 FACP.

2.6 COMBINATION SMOKE/HEAT/CARBON MONOXIDE DETECTORS

- A. Combination smoke/heat/carbon monoxide detectors shall incorporate smoke and heat detectors (indicated in paragraphs above) with a base that includes integral carbon monoxide detector with local sounder.
- B. Sounder base shall be Temporal 4 tone.
- C. Devices shall be fully compatible with the existing addressable fire alarm circuit.

2.7 NOTIFICATION APPLIANCES

- A. Description: Equipped for mounting as indicated and with screw terminals for system connections. Devices shall have red finish.
 - 1. Combination Devices: Factory-integrated audible and visible devices in a singlemounting assembly.
- B. Horns: Electric-vibrating polarized type 24vdc; with provision for housing the operating mechanism behind a grille. Comply with UL 464. Horns shall produce a sound pressure level of 90 dBA, measured 10 feet from the horn, using the coded signal prescribed in UL 464 test protocol.

- C. Visible Alarm Devices: Xenon strobe lights listed under UL 1971, with clear or nominal white polycarbonate lens mounted on an aluminum faceplate. The word "FIRE" is engraved in minimum 1-inch- high letters on the lens.
 - 1. Rated Light Output: 15/30/75/110 candela, selectable in the field. Set candela rating to meet NFPA 72 requirements for the space installed.
 - 2. Strobe Leads: Factory connected to screw terminals.
 - 3. Flashing shall be temporal pattern, synchronized with other units.
- D. Covers for appliances is detention areas shall be by Safety Technology International, (STI) or approved equal.

2.8 MAGNETIC DOOR HOLDERS

- A. Description: Units are equipped for wall or floor mounting as indicated and are complete with matching door plate.
 - 1. Electromagnet: Requires no more than 3 W to develop 25-lbf (111-N) holding force.
 - 2. Wall-Mounted Units: Flush mounted, unless otherwise indicated.
 - 3. Rating: 120-V ac.
- B. Material and Finish: Match door hardware.

2.9 REMOTE ANNUNCIATOR

- A. Description: Duplicate annunciator functions of the FACP for alarm, supervisory, and trouble indications. Also, duplicate manual switching functions of the FACP, including acknowledging, silencing, resetting, and testing.
 - 1. Mounting: Flush cabinet, NEMA 250, Class 1.
- B. Display Type and Functional Performance: Alphanumeric display same as the FACP. Controls with associated LEDs permit acknowledging, silencing, resetting, and testing functions for alarm, supervisory, and trouble signals identical to those in the FACP.

2.10 ADDRESSABLE INTERFACE DEVICE

- A. Description: Microelectronic monitor module listed for use in providing a system address for listed alarm-initiating devices for wired applications with normally open contacts. Include address setting means on the module.
- B. Integral Relay: Capable of providing a direct signal to controlled equipment. Allow the control panel to switch the relay contacts on command.
- C. Monitor Module: Microelectronic module providing a system address for alarm-initiating devices for wired applications with normally open contacts.
- D. Integral Relay: Capable of providing a direct signal to elevator controller to initiate elevator recall.
 - 1. Allow the control panel to switch the relay contacts on command.
 - 2. Have a minimum of two normally open and two normally closed contacts available for field wiring.

- E. Control Module:
 - 1. Operate notification devices.
 - 2. Operate solenoids for use in sprinkler service.

2.11 DIGITAL ALARM COMMUNICATOR TRANSMITTER

- A. Digital alarm communicator transmitter shall be acceptable to the remote central station and shall comply with UL 632.
- B. Functional Performance: Unit shall be dual path type with IP and cellular connections. Unit shall receive an alarm, supervisory, or trouble signal from fire alarm control unit and automatically capture a dial tone through a cellular communicator and dial a preset number for a remote central station. When contact is made with central stations, signals shall be transmitted. Cellular shall operate over LTE, HSPA (4G), and HSPA (3G).
- C. Local functions and display at the digital alarm communicator transmitter shall include the following:
 - 1. Verification that both communication paths are available.
 - 2. Programming device.
 - 3. LED display.
 - 4. Manual test report function and manual transmission clear indication.
 - 5. Communications failure with the central station or fire alarm control unit.
- D. Digital data transmission shall include the following:
 - 1. Address of the alarm-initiating device.
 - 2. Address of the supervisory signal.
 - 3. Address of the trouble-initiating device.
 - 4. Loss of ac supply.
 - 5. Loss of power.
 - 6. Low battery.
 - 7. Abnormal test signal.
 - 8. Communication bus failure.
- E. Secondary Power: Integral rechargeable battery and automatic charger.
- F. Self-Test: Conducted automatically every 24 hours with report transmitted to central station, (LTE and IP).

2.12 NOTIFICATION APPLIANCE PANEL

- A. Panel shall provide up to 8 amps of power with up to four supervised reverse polarity circuits. Panel shall be UL listed and FM approved.
- B. Panel shall be activated by the hos fire alarm panel.
- C. Panel shall be capable of providing synchronization for all connected visible notification devices.
- D. Panel shall provide status monitoring of battery, input power, and earth faults.
- E. Alarms from the host panel shall activate all notification appliances panels circuits.

2.13 WIRE AND CABLE

- A. Wire and cable for fire alarm systems shall be UL listed and labeled as complying with NFPA 70, Article 760.
- B. Addressable Circuits: Twisted, shielded pair, fire rated not less than No. 18 AWG and size as recommended by system manufacturer.
 - Circuit Integrity Cable: Twisted shielded pair, NFPA 70 Article 760, Classification CI, for power-limited fire alarm signal service. UL listed as Type FPL and complying with requirements in UL 1424 and in UL 2196 for a 2-hour rating. Suitable for exposed installation in ceiling cavity.
- C. Non-Power-Limited Circuits: Solid-copper conductors with 600-V rated, 75 deg C, colorcoded insulation.
 - 1. Low-Voltage Circuits: No. 16 AWG, minimum.
 - 2. Line-Voltage Circuits: No. 12 AWG, minimum.
 - 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, UL listed for fire alarm and cable tray installation, plenum rated, and complying with requirements in UL 2196 for a 2-hour rating.

PART 3 - EXECUTION

- 3.1 EQUIPMENT INSTALLATION
 - A. Connecting to Existing Equipment: Verify that existing fire alarm system is operational before making changes or connections.
 - 1. Expand, modify, and supplement the existing control equipment as necessary to report alarm to new fire alarm panel. New system panel shall be capable of merging with the existing configuration without degrading the performance of either system.
 - B. Smoke or Heat Detector Spacing:
 - 1. Smooth ceiling spacing shall not exceed 30 feet (9 m).
 - 2. Spacing of heat detectors for irregular areas, for irregular ceiling construction, and for high ceiling areas, shall be determined according to Appendix A in NFPA 72.
 - 3. Spacing of heat detectors shall be determined based on guidelines and recommendations in NFPA 72.
 - 4. Install detention style covers for smoke detectors located within detention areas. Install per manufacturer's specifications. Utilize tamper resistant fasteners.
 - C. HVAC: Locate detectors not closer than 3 feet (1 m) from air-supply diffuser or return-air opening.
 - D. Duct Smoke Detectors: Comply with NFPA 72 and NFPA 90A. Install sampling tubes so they extend the full width of the duct. 2. Duct mounted smoke detectors associated with smoke dampers shall be installed within 5 feet of the damper to which they are associated. Provide additional relays to operate damper as required whether indicated on the drawings or not.

- 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. Audible Alarm-Indicating Devices: Install not less than 6 inches below the ceiling. Install bells and horns on flush-mounted back boxes with the device-operating mechanism concealed behind a grille.
- G. Visible Alarm-Indicating Devices: Install adjacent to each alarm audible device and at least 6 inches below the ceiling or no more than 80" above finished floor. Visual devices shall not be obscured by support beams or protrusions on walls. Visible devices shall not be located within three feet of wall mounted lights.
- H. Device Location-Indicating Lights: Locate in public space near the device they monitor.
- I. FACP: Surface mount with tops of cabinets not more than 72 inches above the finished floor.
- J. Annunciator: Install with top of panel not more than 72 inches above the finished floor.
- K. Install a cover on each smoke detector that is not placed in service during construction. Cover shall remain in place except during system testing. Remove cover prior to system turnover.
- L. All fire alarm components shall be flush mounted, except where specifically noted otherwise. Surface mounted devices shall be mounted on fire alarm manufacturer supplied back boxes. These boxes shall match the device color and finish.
- M. Appliances located within detection areas shall be provided with protective cover secured to wall.
- N. Provide all required power supplies to operate combination smoke/heat/carbon monoxide detectors and sounder bases.

3.3 WIRING INSTALLATION

- A. Install wiring according to the following:
 - 1. NECA 1.
 - 2. TIA/EIA 568-A.
- B. Wiring Method:
 - 1. Cables and raceways used for fire alarm circuits, and equipment control wiring associated with the fire alarm system, may not contain any other wire or cable. Fire alarm circuits shall be routed in conduit, except for circuits located within concealed ceiling cavities which may be plenum rated fire alarm cabling. Provide prober support for cabling within concealed ceiling cavities.
 - 2. Fire-Rated Cables: Use of 2-hour fire-rated fire alarm cables, NFPA 70 Types MI and CI, is not permitted.
 - 3. Signaling Line Circuits: Power-limited fire alarm cables may be installed in the same cable or raceway as addressable circuits.

- C. Wiring within 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.

3.4 CONNECTIONS

- A. For fire-protection systems related to doors in fire-rated walls and partitions and to doors in smoke partitions, comply with requirements in Section 087100 "Door Hardware." Connect hardware and devices to fire-alarm system.
 - 1. Verify that hardware and devices are listed for use with installed fire-alarm system before making connections.
- B. Make addressable connections with a supervised interface device to the following devices and systems. Install the interface device less than 36 inches from the device controlled. Make an addressable confirmation connection when such feedback is available at the device or system being controlled.
 - 1. Smoke dampers in air ducts of designated HVAC duct systems.
 - 2. Magnetically held-open doors.
 - 3. Electronically locked doors and access gates.
 - 4. Alarm-initiating connection to elevator recall system and components.
 - 5. Alarm-initiating connection to activate emergency lighting control.
 - 6. Alarm-initiating connection to activate emergency shutoffs for gas and fuel supplies.
 - 7. Supervisory connections at valve supervisory switches.
 - 8. Supervisory connections at elevator shunt-trip breaker.
 - 9. Data communication circuits for connection to building management system.
 - 10. Data communication circuits for connection to mass notification system.

3.5 IDENTIFICATION

- A. Identify system components, wiring, cabling, and terminals according to Division 26 Section "Identification for Electrical Systems."
- B. Install instructions frame in a location visible from the FACP.

3.6 GROUNDING

A. Ground the FACP and associated circuits; comply with IEEE 1100. Install a ground wire from main service ground to the FACP.

3.7 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust field-assembled components and equipment installation, including connections, and to assist in field testing. Report results in writing.
- B. Perform the following field tests and inspections and prepare test reports:
 - 1. Before requesting final approval of the installation, submit a written statement using the form for 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 Level III.
 - a. Include the existing system in tests and inspections.
 - 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.
 - a. Detectors that are outside their marked sensitivity range shall be replaced.
 - 5. Test and Inspection Records: Prepare according to NFPA 72, including demonstration of sequences of operation by using the matrix-style form in Appendix A in NFPA 70.

3.8 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, and one quarterly, periods.
- C. Annual Test and Inspection: One year after date of Substantial Completion, test the fire alarm system complying with the testing and visual inspection requirements in NFPA 72. Perform tests and inspections listed for monthly, quarterly, semiannual, and annual periods. Use forms developed for initial tests and inspections.

3.9 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.

END OF SECTION