CONTRACT No. A920

PASSAIC VALLEY SEWERAGE COMMISSION
600 WILSON AVENUE
NEWARK, NEW JERSEY 07105

CONTRACT AND SPECIFICATIONS

FOR

ADMINISTRATION BUILDING REHABILITATION PROJECT

NJEIT PROJECT No. S340689-25

FEBRUARY 2014
Revised October 2014

JOHN S. ROLAK, JR., P.E.
N.J. Professional Engineer - Lic. No. 29108

Hatch Mott MacDonald

Passaic Valley Sewerage Commission
Newark, Essex County, New Jersey
Administration Building Rehabilitation Project
Contract No. A920
Addendum #2
March 26, 2015

To All Concerned:

The original contract documents for the above referenced contract are amended as noted in this addendum. The addendum shall become part of the contract document and is to be attached thereto:

1. SECTION 03542 CEMENT-BASED SELF-LEVELING UNDERLAYMENT in DIVISION 03 – CONCRETE of the technical specifications is hereby deleted and removed from the contract work.

2. The attached PLAN FOR ASBESTOS ABATEMENT – PVSC ADMINISTRATION BUILDING dated 03/26/15 has been incorporated into the contract documents.

3. SECTION 00900 SCOPE OF CONTRACT – SC2.00 Work Included in Base Bid Item 2.00, Rehabilitation of Administration Building.

   Delete Section i. in its entirety and substitute the following:

   i. Demolition - Work shall include site clearing, all demolition work associated with the building interior/exterior as noted on the plans or as required to complete the intent of the project, including but not limited to removal of existing partitions, walls, ceilings, floor tile/mastic, plumbing/piping system, HVAC system, electrical and fire suppression systems, and associated appurtenances as needed or required including the cost of removal and disposal of same in accordance with all applicable laws and regulations.

SCOPE FOR ASBESTOS ABATEMENT – PVSC ADMINISTRATION BUILDING
March 26, 2015

General: Approximately 60 sf of asbestos floor tile and mastic have been noted in the previously provided Eagle Industrial Hygiene Associates, Inc. Report. Upon further review it has been determined that the existing asbestos floor tiles and mastic as noted should be removed. All costs associated with this work shall be included in Bid Item 2.

Intent Of Drawings And Plan: The Appendix to Addendum 1 located at the rear of the Contract Documents (Report by Eagle Industrial Hygiene Associates, Inc.), should be referenced for the purpose of illustrating the general character and extent of the work. Not all areas as noted within the report are to be abated under this plan. Plans illustrating the general area of asbestos floor tile and mastic removal on the 1st and 2nd floor are located herein. The Engineer shall decide as to the meaning or intention of any portion of the work plan and drawings and where the same may be found obscure or in dispute, the Engineer shall have the right to correct any errors or omissions therein.

Summary of Work: All work shall be performed by abatement contractors and abatement workers and supervisors accredited to perform work within the State of New Jersey regardless of removal methodology. In addition, all abatement work shall be performed in adherence with all applicable current New Jersey State & EPA NESHAPS regulations. These regulations are herein considered part of this work plan, and overrule any part or parts of this plan found to be less stringent in nature or scope. When turned over to the Abatement Contractor, all work areas, if applicable, shall be isolated by the Abatement Contractor from occupied areas by the installation of 2 layers of 6-mil poly critical barriers over doors and windows separating occupied from unoccupied areas including installed air filtration devices. All demolition waste generated by the Abatement Contractor during the course of this project shall be disposed of by same as asbestos-containing, non-friable Category 1 waste.

This workplan is applicable for the removal of floor tile and associated mastic beneath metal and wood stud partitions and in open areas. (approximately 60 sq. ft.). Refer to:

A101 Demo Basement Floor Plan (No abatement required)

A102 Demo First Floor Plan (Abatement Required)
Conference Room #108
Legal Services Room #123
Secretary Room # 124
Secretary File Storage Room # 125
Conference Room # 126
Human Resources Room #130
Human Resource Manager Room # 31

A103 Demo Second Floor Plan (Abatement Required)

Limited to areas where concrete slab is to be opened and at shaft wall modifications where tested positive to contain Asbestos within Eagle testing report.

ABATEMENT METHODOLOGY:

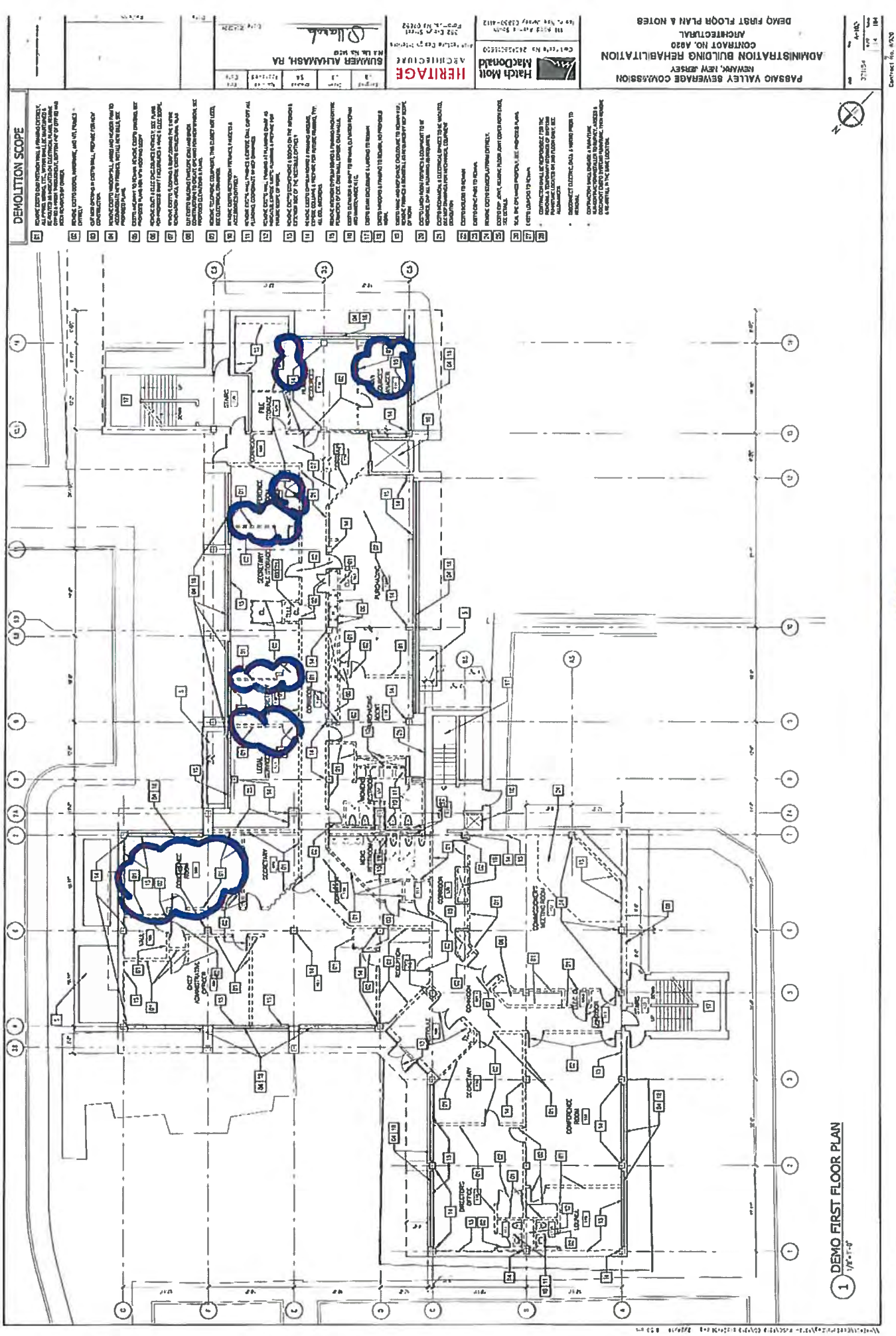
General Notes

1) If applicable, the abatement work area shall be accessed through a single entrance in the 6-mil polyethylene sheeting.

Specific Notes

The floor tile/mastic removal in the first floor work area shall include the following:

1) The Abatement Contractor shall remove wall framing, base plates and floor anchorage in a manner that will not render the VAT friable. Special precautions must be taken to prevent disturbance of VAT and Mastic.
2) The Abatement Contractor shall remove applicable floor tile/mastic using non-friable methodology. Non-friable methodology is hereby defined as using heat from infrared machines, or using dry ice or liquid nitrogen.
3) Mastic shall be removed using chemical solvent methods only. Mastic remover solvent selected for use by the abatement contractor shall be of the "low odor" type and approved by the Owner's Representative prior to use. No citric acid based mastic removers shall be approved. All floor surfaces where mastic removal solvent is applied shall be thoroughly neutralized according to the instructions of the solvent manufacturer.
4) All floor tile abatement work areas shall be isolated from non-abatement zones (if applicable) by the placement within the work areas of double layer 6-mil polyethylene sheeting critical barriers attached separately over all HVAC units, apertures and any other physical access paths to a clean area.
5) A 6-mil polyethylene sheeting "splash barrier" shall be placed on wall surfaces as appropriate.
6) All floor tiles and mastic waste shall be double bagged in standard 6-mil asbestos disposal bags lining lockable-lid type fiberboard drums, appropriately labeled.


PASSAIC VALLEY SEWERAGE COMMISSION
NEWARK, NEW JERSEY
ADMINISTRATION BUILDING REHABILITATION
CONTRACT NO. A820
ARCHITECTURAL
DEMO FIRST FLOOR PLAN & NOTES
Hatch Mott MacDonald
HERITAGE ARCHITECTURE
SUMMER ALI-HAMASH, RA
DEMOLITION SCOPE
1 DEMO FIRST FLOOR PLAN
1/8"=1'-0"
- ABATEMENT APPROX. AREAS TO BE CONFIRMED

ADDENDUM #1
ATTACHMENTS

MATERIAL SAMPLE ASBESTOS INSPECTION REPORT PREPARED BY EAGLE INDUSTRIAL HYGIENE ASSOCIATES, INC., DATED 1/13/15.

Hatch Mott MacDonald

FAX

Passaic Valley Sewerage Commission
Newark, Essex County, New Jersey
Administration Building Rehabilitation
Contract No. A920
April 7, 2015
Clarification #6

The following clarification is being provided to all potential bidders. Please note that this is not an addendum and that the bid date of April 8, 2015 has not been changed.

Clarification for the Allowance for Additional Authorized Work – Please note that the amount written in words ("One Hundred Thousand") shall be used for tabulating the Total Bid Price. All bids received will be evaluated using $100,000 for this allowance item.

John Rolak

Tel 973-912-2521

Stephanie Farley

Tel 973-912-2450

Recd 4/7/15

Hatch Mott MacDonald
Infrastructure and Environment
111 Wood Avenue South, Iselin, New Jersey 08830-4112 T 973.912.2521 F 973.912.2602
www.hatchmott.com

Passaic Valley Sewerage Commission
Newark, Essex County, New Jersey
Administration Building Rehabilitation
Project
Contract No. A920
Clarification #5
March 31, 2015

To All Concerned:

The following clarification is being provided to all potential bidders. Please note that this is not an addendum and that the bid date of April 8, 2015 has not been changed.

Clarification for the use of Terrazzo Tile and Resinous Matrix Terrazzo - The Resinous Matrix Terrazzo is to be used to patch and repair areas that may be damage during the demolition process, where no new flooring is proposed. Tiling will be used for all other areas specified and installation of the Terrazzo tiles will be the same as for the porcelain tiles, which is covered under Spec section 09300 Tiling.

Clarification for Total Bid Price on Page 00300-6 of the Bid Form – The total bid price shall include the sum of Items No. 1 through Item No.6.

Clarification for the Cost of Painting, Wall Finishes & Flooring on the 1st floor - The cost associated with this work shall be included under the lump sum Base Bid Item 2.00 Rehabilitation of the Administration Building, Complete.

Passaic Valley Sewerage Commission
Newark, Essex County, New Jersey
Administration Building Rehabilitation Project
Contract No. A920
Clarification #4
March 23, 2015

To All Concerned:

The following clarification is being provided to all potential bidders. Please note that this is not an addendum and that the bid date of April 8, 2015 has not been changed.

The following questions were asked during the pre-bid site visit conducted on March 18th. The following outlines the answers as provided at that time or are currently being provided:

1. **Question:** What permits are needed and who is responsible for obtaining permits. Will the City of Newark Building Department be conducting any inspections and approving construction.
   Answer: There are no permits required for this project and the City of Newark will not be conducting any inspections nor providing any approvals for this project.

2. **Question**: Is or will the building be occupied during the project?
   Answer: The building is unoccupied with the exception of the computer room on the 2nd floor, which must remain in operation throughout the project.

3. **Question**: Do workers need to pass through security every day?
   Answer: Yes all workers need to pass through security on a daily basis.

4. **Question:** Is there any asbestos in the building?
   Answer: A report on asbestos is included in the Appendix of the Specifications.

5. **Question:** Can provisions be made for a follow up pre-bid site visit?
   Answer: Yes, a follow up site visit has been scheduled for March 26th at 1:00PM. Anyone interested in attending shall call Stephanie Farley of HMM at 973-912-2450 by 2:00PM on March 25th with the company name, person attending, and a direct phone number so that the necessary arrangements can be made with PVSC. The site visit will not be held unless interested parties respond as noted above.

Passaic Valley Sewerage Commission
Newark, Essex County, New Jersey
Administration Building Rehabilitation
Project
Contract No. A920
Clarification #3
March 16, 2015

To All Concerned:

The following clarification is being provided to all potential bidders. Please note that this is not an addendum and that the bid date of April 8, 2015 has not been changed.

Clarification regarding compliance with the Project Labor Agreement Act (P.L. 2002, Chapter 44)

The following question was received:

"From my understanding of The Project Labor Agreement Act (P.L. 2002, Chapter 44), any project estimated to exceed 5 million dollars in value should automatically require a Project Labor Agreement (sub-section C.52:38-2, No. 2). However, upon inspection of the specifications for the project, no such agreement is mentioned. Please advise on what steps should be taken next in order to be compliant with New Jersey laws."

The contractor's question [above] has been reviewed by PVSC Counsel.

Counsel has advised that the provision referenced by the prospective bidder is permissible, not mandatory. Further, "water & sewer plants" are exceptions to the definition of Public Works project for the purpose of this provision.

Therefore, a Project Labor Agreement is not required for Contract No. A920

Passaic Valley Sewerage Commission
Newark, Essex County, New Jersey
Administration Building Rehabilitation
Project
Contract No. A920
Clarification #2
March 10, 2015

To All Concerned:

The following clarification is being provided to all potential bidders. Please note that this is not an addendum and that the bid date of April 8, 2015 has not been changed.

Clarification for depth of proposed site piping – All piping shown on Sheet S-1 shall be installed with a minimum depth of 4'of cover unless otherwise approved. Tie-ins to existing facilities should also be anticipated to be approximately 4 feet below existing grade.

Passaic Valley Sewerage Commission
Newark, Essex County, New Jersey
Administration Building Rehabilitation Project
Contract No. A920
Clarification #1
February 27, 2015

To All Concerned:

The following clarification is being provided to all potential bidders. Please note that this is not an addendum and that the bid date of April 8, 2015 has not been changed.

Clarification for the time of the Pre-Bid Meeting - A pre-bid meeting and tour of the Project Area will be held March 18, 2015 at 10 a.m. The meeting will take place at PVSC's Main Conference Room, 2nd Floor, OEM Building, with site visit to follow. Bidders are strongly recommended to attend the pre-bid meeting (as discussed within Section 00100) and site visit.

PASSAIC VALLEY SEWERAGE COMMISSION
NEWARK, NEW JERSEY

ADMINISTRATION BUILDING REHABILITATION PROJECT

CONTRACT NO. A920

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SECTION 00010

INVITATION TO BID

Notice is hereby given for receiving sealed Proposals by the Passaic Valley Sewerage Commission (PVSC) for:

CONTRACT NO. A920
ADMINISTRATION BUILDING REHABILITATION

Proposals to be enclosed in opaque sealed envelopes, addressed to the Passaic Valley Sewerage Commission, Main Training Room, Warehouse Building, 600 Wilson Avenue, Newark, New Jersey 07105, with name and address of Bidder, Contract Numbers, Contract Name and Bid Opening Date plainly marked outside. Bids will be accepted by mail. They must be sealed and identified as indicated above, enclosed in a mailing envelope with proper postage, and received during the time set for receiving bids. Sealed Bid Proposals shall be received by PVSC's (address above) on Apr 8, 2015 until 10:00 in the morning, prevailing time for public opening and reading. Bids shall be opened publicly and read aloud after the closing time, 10:00 a.m. All interested parties are invited to attend. The bid opening will take place at PVSC's Main Training Room, Warehouse Building. Bids may be withdrawn or modified prior to the time for the opening of bids or the authorized postponement thereof. No bid may be withdrawn for a period of 60 calendar days after the date of the opening of bids. PVSC reserves the right to reject any and all Bids and waive any Bid informalities, defects or irregularities when it has sound documented business reasons which are in the best interest of PVSC and the project, in accordance with applicable law or regulations. Any award will be made to the lowest responsible bidder.

No bid will be received unless in writing on the forms furnished, and unless accompanied by bid security in the form of a bid bond, cashier's check, or a certified check made payable to the PVSC in an amount equal to 10% of the amount of the total bid, but not exceeding $20,000, executed by a Surety Company duly authorized to do business in the State of New Jersey. The successful Bidder must furnish a 100 percent construction performance bond, and a 100 percent construction payment bond and a maintenance bond with a surety company acceptable to the Owner. Complete instruction for preparing Bids and a maintenance bond are included in the Bidding Documents.

Work to be performed under Contract No. A920 includes furnishing all labor, materials, supplies, equipment and other facilities required by the Contract Documents for the rehabilitation of the PVSC's Administration Building. The work on this project will be performed under a single overall Contract comprising site work, general construction work, architectural work, plumbing work, mechanical work and electrical work.

A pre-bid meeting and tour of the Project Area will be held Mar 18, 2015. The meeting will take place at PVSC's Main Conference Room, 2nd Floor, OEM Building, with site visit to follow. Bidders are strongly recommended to attend the pre-bid meeting (as discussed within Section 00100) and site visit.

Copies of the Bidding Documents will be available at the offices of the ENGINEER, HATCH MOTT MACDONALD, 111 WOOD AVENUE SOUTH, ISELIN, NEW JERSEY, 08830 on the date of this advertisement, during regular business hours, 8:00 a.m. and 4:45 p.m. Contact is Mr. John S. Rolak, Jr., P.E, of Hatch Mott MacDonald (Ph. 973-379-3400 and Fax 973-912-2632). Cost of complete full-sized Bidding Documents is $200.00 per set (non-refundable) for each set of contract documents ordered payable by business check to Passaic Valley Sewerage Commission. Bidding Documents and drawings

will be available for examination at the office of the Engineer. If for any reason, the Contract is not awarded, refunds of the Bidding Documents fee will be immediately returned to Bidders when the Bidding Documents are returned in reasonable condition within 90 days of notice that the Contract has not been awarded.

All Bidders and their subcontractors of any tier, shall be registered with the New Jersey Department of Labor pursuant to the Public Works Contractor Registration Act, P.L. 1999, c238. A copy of the Bidder's registration certificate shall be provided with each bid.

The Contract is expected to be funded in part with the funds from the Federal Emergency Management Agency, New Jersey Department of Environmental Protection and the New Jersey Environmental Infrastructure Trust. Neither the United States nor the State of New Jersey, the New Jersey Environmental Infrastructure Trust, nor any of their departments, agencies, or employees is, or will be, a party to the Contract or any lower tier contract or subcontract. The Contract or Subcontract will be subject to regulations contained in N.J.A.C. 7:22-3.1 et seq., 4.1 et seq., 5.1 et seq., 9.1 et seq. and 10 et seq., New Jersey Local Public Contracts Law, Department of Labor Current Wage Rate Determination, Prevailing Wage Act, Contract Work Hours and Safety Standard Act, Copland Act, Davis Bacon Act, Buy American Clause, Debarment and Suspension, and Socially and Economically Disadvantaged (SED) (N.A.J.C. 7:22-9).

All bids shall include a commitment to the use of small, minority, women's and labor surplus area businesses and shall be in conformity with N.J.A.C. 7:22-3.17(a)(24) with a goal of not less than 10% participation of small business enterprises owned and controlled by socially and economically disadvantaged individuals (SED's). Further details regarding required SED participation are included in the Information for Bidders and the Supplemental General Conditions.

Bidders will be subject to penalties for falsification in accordance with the statutory provisions contained in N.J.S.A. 40A:11-33 to 34 ("New Jersey Local Public Contracts Law").

Passaic Valley Sewerage Commission
Gregory A. Tramontozzi, Esq.
General Counsel / Acting Clerk

SECTION 00100

INSTRUCTIONS TO BIDDERS

1.01 Defined Terms

Terms used in these Instructions to Bidders have the meanings assigned to them in the General Conditions and Supplemental General Conditions (Specification Sections 00700 and 00800). The "OWNER" is the Passaic Valley Sewerage Commission. The "ENGINEERS" are identified in the Invitation to Bid. The term "Bidder" means one who submits a bid directly to OWNER, as distinct from a sub-bidder, who submits a bid to a Bidder. The term "Successful Bidder" means the Bidder to whom OWNER (on the basis of OWNER'S evaluation) makes an award. The term "Bidding Documents" includes the Contract and Specifications, Contract Drawings and all Addenda issued prior to receipt of Bids.

1.02 Copies of Bidding Documents

A. Complete sets of the Bidding Documents may be obtained from the ENGINEER as described in the Invitation to Bid. Bidding Documents will be available for examination at the OWNER'S office.

B. Complete sets of the Bidding Documents must be used in preparing Bids; neither OWNER nor ENGINEER assumes any responsibility for errors or misinterpretations resulting from the use of incomplete sets of Bidding Documents.

C. OWNER and ENGINEER in making copies of Bidding Documents available on the above terms do so only for the purpose of obtaining Bids on the work and do not confer a license or grant for any other use.

1.03 Qualifications of Bidders

A. To demonstrate qualifications to perform the Work, each Bidder must submit with his Bid a fully completed Bidder's Qualification Form (Specification Section 00400). Failure to submit a completed Bidder's Qualification Form may lead to rejection of the Bid. The information supplied by the Bidder on the Bidder's Qualification Form will be used to ascertain the Bidder's history, reputation, organization and capacity for satisfactory and faithful performance of their work and work of a similar character and will not otherwise be made public, except as provided by law.

B. OWNER may make such additional investigation as it deems necessary to determine the qualifications of Bidder to perform the Work and Bidder shall furnish to OWNER all such information and data for this purpose as OWNER may request. OWNER reserves the right to reject any Bid if the evidence submitted by, or investigation of, such Bidder fails to satisfy the OWNER that such Bidder is properly qualified to carry out the obligations of the Agreement, and to complete the Work contemplated therein. Conditional Bids may not be accepted.

1.04 Examination of Contract Documents and Site

A. It is the responsibility of each Bidder before submitting a Bid to (a) examine the Bidding Documents thoroughly, (b) consider Federal, State and local Laws and Regulations that may affect cost, progress, performance or furnishing of the Work, (c) study and carefully correlate Bidder's observations with the Bidding Documents, (d) notify ENGINEER of all conflicts, errors or discrepancies in the Bidding Documents.

B. On request, OWNER will provide each Bidder access to the site to conduct such investigation and tests, as each Bidder deems necessary for submission of Bidder's Bid.

C. The submission of a Bid will constitute an incontrovertible representation by Bidder that Bidder has complied with every requirement of the Bidding Documents, that without exception the Bid is premised upon performing and, furnishing the Work required by the Bidding Documents and such means, methods, techniques, sequences or procedures of construction as may be indicated in or required by the Bidding Documents, and that the Bidding Documents are sufficient in scope and detail to indicate and convey understanding of all terms and conditions for performance and furnishing of the Work.

D. The specifications provide model numbers, styles or other product references available from various dated and current manufacturer's product literature. In the event such model numbers styles or references no longer exist, the CONTRACTOR is to provide the named manufacturer's most current replacement product available at the time of bid and suitable for the intended application, or the equivalent product of an equal manufacturer. Verification will be required that the referenced equipment is no longer available from the manufacturer.

1.05 Interpretations and Addenda

A. All questions about the meaning or intent of the Bidding Documents are to be directed to ENGINEER in writing. In addition, questions will also be accepted verbally at the prebid meeting. Interpretations or clarifications and replies considered necessary by ENGINEER, and approved by NJDEP, in response to such questions will be issued by Addenda mailed or delivered to all parties recorded by ENGINEER as having received the Bidding Documents. Questions received less than ten (10) working days prior to the date for opening of Bids may not be answered. Only questions answered by formal written Addenda will be binding. Verbal and other interpretations or clarifications will be without legal effect.

B. Addenda may also be issued to modify the Bidding Documents as deemed advisable by OWNER or ENGINEER, and as approved by NJDEP. Notice of revisions or addenda to advertisement or Bid Documents relating to Bids shall, no later than seven (7) working days, prior to the date for acceptance of Bids, be made available by notification in writing by Certified Mail, fax, etc. to any person who has submitted a Bid or who has received the Bidding Documents (NJSA 40A: 11-23). Issued addenda become part of the Contract Documents.

1.06 Bid Security

With his Bid, each Bidder shall deliver a Bid Security as stated in the Invitation to Bid and meeting the requirements of the General Conditions and Supplemental General Conditions

(Specification Sections 00700 and 00800). The total Bid (Including Allowances) is the basis for establishing the amount of Bid Security. The Bid Security shall be payable via a certified or bank cashier's check drawn to the order of PVSC or in the form of a Bid Bond executed by a Surety Company duly authorized to do business in the state of New Jersey. The Bid Security shall be in the amount of the lesser of 10% of the amount of the total bid or $20,000.

OWNER shall award the contract or reject all Bids within such time as may be specified in the Invitation to Bid, except that the Bids of any Bidders who consent thereto may, at the request of the OWNER, be held for consideration for such longer period as may be agreed. All Bid Security, except the security of the three (3) apparent lowest responsible Bidders, shall be returned unless otherwise required by the Bidder, within ten (10) working days after the opening of the Bids and the Bids and such Bidders shall be considered as withdrawn. Within three (3) working days after the awarding and signing of the contract and the approval of the contractor's Performance Bond, the Bid Security of the remaining unsuccessful Bidders shall be returned to them (NJSA 40A: 11-24).

1.07 Contract Time

The numbers of days within which, or the dates by which, the Work is to be substantially completed (the Contract Time) are set forth in the Contract Documents.

1.08 Damages

Provisions for damages are set forth in the Contract Documents.

1.09 Substitutes or "Or Equal" Items

The procedure for submission of any such application by the CONTRACTOR and Consideration by ENGINEER is set forth in Article 6, Section 6.05 of the General Conditions and Supplemental General Conditions.

1.10 Subcontractors, Suppliers, and Others

A. The Bidder shall comply with N.J.S.A. 40A: 11-16, as amended by L1997, C408.

B. If OWNER or ENGINEER after due investigation has reasonable objection to any proposed Subcontractor, Supplier, other person or organization, either may before the Notice of Award is given, request the apparent Successful Bidder to submit an acceptable substitute without an increase in Bid-price. If apparent Successful Bidder declines to make any such substitution, OWNER may award the contract to the next lowest Bidder, that proposes to use acceptable Subcontractors, Suppliers and other persons and organizations. The declining to make requested substitutions will not constitute grounds for sacrificing the Bid Security of any Bidder.

Bidder shall submit with its Bid the "Subcontractor listing" Form in Specification Section 00401. If requested by N.J.S.A. 40A: 11-16, Bidder shall also submit a certificate as provided therein.

1.11 Bid Form

A. A Bid Form for each Contract is included with the Bidding Documents in Specification Section 00300. All blanks on the applicable Bid Form must be completed in ink or by typewriter.

B. Attention is directed to the fact that a complete set of Bidding and Contract forms are bound within these Bidding Documents. These forms can be detached.

C. Bids by corporations must be executed in the corporate name by the president or a vice-president (or other corporate officer accompanied by evidence of authority to sign) and the corporate seal must be affixed and attested by the secretary or an assistant secretary. The corporate address and state of incorporation must be shown below the signature.

D. Bids by partnerships must be executed in the partnership name and signed by a partner, whose title must appear under the signature, and the official address of the partnership must be shown together with the places of residence for each partner.

E. Bids by individuals must be executed in the name of individual and shall include his business address and place of residence.

F. Bids by limited liability companies must be executed in the LLC's name and signed by the managing member, whose title must appear under his signature. The LLC's address and State of formation must be shown below the signature. If a Member other then the managing member of the LLC executes the bid such signature shall be accompanied by evidence of authority to sign.

G. The Bid constitutes an acknowledgement of receipt of all Addenda, the numbers and dates of which shall be filled in on the Specification Section 00307 Form.

H. The address, telephone and fax numbers for communications regarding the Bid must be shown.

I. All names must be typed or printed below the signature, which must be ink to be considered.

J. A statement of Ownership form and Non-collusion Affidavit must be signed by the Bidder in order for the bid to be considered complete.

1.12 Submission of Bids

Bids shall be submitted at the time and place indicated in the Invitation to Bid and shall be enclosed in an opaque sealed envelope, marked as instructed in the Invitation to Bid and with the name and address of the Bidder and accompanied by the Bid security and other required documents. If the Bid is sent through the mail or other delivery system, the sealed envelope shall be enclosed in a separate envelope with the notation "Bid Enclosed" on the face of it.

1.13 Modification and Withdrawal of Bids

A. Bids may be modified or withdrawn by an appropriate document duly executed (in the manner that a Bid must be executed) and delivered to the place where Bids are to be submitted at any time prior to the opening of Bids.

B. Requests for withdrawal of bids after Bid opening due to clerical error shall be made in accordance with appropriate laws.

1.14 Opening of Bids

Bids will be opened as stated in the Invitation to Bid.

1.15 Bids to Remain Subject to Acceptance

All Bids will remain subject to acceptance for sixty (60) calendar days after the day of the Bid opening, but OWNER may, in its sole discretion, release any Bid and return the Bid security prior to that date.

1.16 Rejection of Proposal

The OWNER at its discretion may reject any or all Bids or parts thereof only when it has sound documented business reasons which are in the best interest of the OWNER, the project and the New Jersey Environmental Infrastructure Financing Program. A Bid Proposal may be rejected if the Bid shows any omission, alterations of form, addition or deductions not called for, conditional or uninvited alternate bids, or irregularities of any kind. However, the OWNER reserves the right to waive any informalities, defects or irregularities in Bid proposals.

No contract for work shall be awarded to a contractor or subcontractor who is included on the New Jersey State Treasurer's list of debarred, suspended and disqualified bidders. Submission of false, deceptive, or fraudulent statements or information by bidders shall result in bid rejection or, if applicable, revocation of an awarded contract. Additionally, any such bidder will be subject to the criminal and/or civil penalties provided by all applicable state and federal laws.

1.17 Award of Contract

A. OWNER may reject bids when it has sound, documented business reasons which are in the best interest of the OWNER. OWNER reserves the right to waive any and all informalities not involving price, time or changes in the Work and to negotiate, to the extent permitted by applicable law contract terms with the Successful Bidder, and the right to disregard all nonconforming, nonresponsive, unbalanced or conditional Bids. Discrepancies in the multiplication of units of Work and unit prices will be resolved in favor of the unit prices. Discrepancies between the indicated sum of any column of figures and the correct sum thereof will be resolved in favor of the correct sum. Discrepancies between works and figures will be resolved in favor of words and any summations or multiplications recalculated.

B. In evaluating Bids, OWNER will consider the qualifications of the Bidders, whether or not the Bids comply with the prescribed requirements, and such alternates, prices and other data, as may be requested in the Bid Form prior to the Notice of Award.

C. OWNER may consider the qualifications and experience of Subcontractors, Suppliers, and other persons and organizations proposed for those portions of the Work as to which

the identity of Subcontractors, Suppliers, and other persons and organizations must be submitted. OWNER also may consider the operating costs, maintenance requirements, performance data and guarantees of major items of materials and equipment proposed for incorporation in the Work when such data is required to be submitted prior to the Notice of Award.

D. OWNER may conduct such investigations as OWNER deems necessary to assist in the evaluation of any Bid and to establish the responsibility, qualifications and financial ability of Bidders, proposed Subcontractors, Suppliers and other persons and organizations to perform and furnish the Work in accordance with the Contract Documents to OWNER'S satisfaction within the prescribed time.

E. If the Contract is to be awarded, it will be awarded to the lowest responsible Bidder.

1.18 Contract Security

Article 5 of the General Conditions and the Supplemental General Conditions set forth OWNER'S requirements as to Performance and Payment Bonds (Specification Section 00600). When the Successful Bidder delivers the executed Contract to OWNER, it must be accompanied by the required Performance and Payment Bonds, Insurance, Environmental Maintenance Bond, and Maintenance Bond.

1.19 Signing of Contract

When OWNER gives a Notice of Award to the Successful Bidder, it will be accompanied by the required number of unsigned counterparts of the Contract with all other written Contract Documents attached. Within ten (10) working days thereafter CONTRACTOR shall sign and deliver the required number of counterparts of the Contract and attached documents to OWNER with the required Bonds. Thereafter OWNER shall deliver one (1) fully signed counterpart to CONTRACTOR.

If Successful Bidder shall fail or neglect to sign and execute the Contract and bonds with ten (10) working days after Notice of Award, such failure or neglect may be deemed to be an abandonment and breach of Contract by the Bidder and shall be just cause for an annulment of the award and action for breach of contract. Upon such abandonment, OWNER shall have the authority to make an award to another Bidder or re-advertise for Bids. In addition, OWNER may exclude Bidder from bidding on subsequent PVSC projects for such a period, as the OWNER may deem appropriate. Further, the Bidder improperly failing to execute the contract shall be liable for all damages incurred, including but not limited to:

- The increased contract price incurred in awarding the contract to another Contractor.
- For an amount for any delay caused in said failure at the liquidated per diem rate for delay damages set forth in the Contract.
- The increased administrative and/or consultant costs incurred as a result of said failure.

It is understood and agreed by said Bidder that, upon notice of said failure, the surety shall pay the OWNER the amount provided for the Proposal Guarantee in accordance with the provisions of the Proposal and the OWNER shall be entitled to collect on any certified checks or Proposal, or Performance and Payment Bonds posted as security for execution.

1.20 Pre-bid Meeting

A pre-bid meeting and tour of the Project Area will be held as stated in the Invitation to Bid. The pre-bid meeting is strongly encouraged, not mandatory. Representatives of OWNER and ENGINEER will be present to receive questions verbally on the Project. No technical questions will be answered at the meeting. ENGINEER will transmit to all prospective Bidders of record such Addenda as ENGINEER considers necessary in response to questions arising at the meeting.

1.21 Sales Tax

The OWNER is exempt from payment of sales tax on all materials to be incorporated into the project. CONTRACTOR shall follow requirements in Article 6 of the General Conditions on sales tax.

1.22 Retainage

Provisions concerning retainage are set forth in the General Conditions and Supplemental General Conditions.

1.23 Nondiscrimination Provisions

Bidders are required to comply with all applicable Federal and State Statutes, Rules and Regulations including but not limited to Title VI of the Civil Rights Act of 1964, as amended (42 USC 2000d-2000D-4A) and the discrimination and affirmative action provisions of NJSA 10:2-1 through 10:2-4, the New Jersey Law against Discrimination, NJSA 10: 5-1, et seq., and the rules and regulations promulgated pursuant thereto. Bidders must submit with their bid a signed affidavit stating that it shall comply with the affirmative action program (Specification Section 00306).

Successful Bidders shall, submit a list of all subcontractors who will perform work on the project and written signed statements from authorized agents of the labor pools with which they will or may deal for employees on the work, together with supporting information to the effect that said labor pools will affirmatively cooperate in or offer no hindrance to the recruitment, employment, and equal treatment of employees seeking employment and performing work under the contract or, a certification as to what efforts have been made to secure such statements when such agents or labor pools have failed or refused to furnish same prior to the award of the Contract.

1.24 Collusive Bids

The proposal of any Bidder or Bidders who engage in collusive bidding shall be rejected. Any bidder who submits more than one proposal in such manner as to make it appear that the proposals submitted are on a competitive basis from different parties shall be considered a collusive bidder. The OWNER may reject the Bid proposals of any collusive Bidder upon Bid opening. However, nothing in this section shall prevent a Bidder from superseding a Bid proposal by a subsequent proposal delivered prior to Bid opening which expressly revokes the previous Bid.

1.25 Wage Determination Rates

Federal Labor Standards and Federal Wage Rates

The Contractor and all Subcontractors shall comply with all applicable Regulations of the Secretary of Labor, made pursuant to the Anti-Kickback Act of June 30, 1940, 40 U.S.C. 276(c) and any amendments or modifications hereto. The Contractor and all Subcontractors shall furnish the Owner the weekly Statements of Compliance. In the case of Subcontractors, the Contractor shall cause appropriate provisions to be inserted in any subcontracts for the work which he may let to ensure compliance with said Anti-Kickback Act by all Subcontractors subject thereto, and the Contractor shall be responsible for the submissions of all Statements of Compliance required of Subcontractors by said Anti-Kickback Act except as the Secretary of Labor may specifically provide for reasonable limitations, variations, and exemptions from the requirements thereof. These regulations are part of this Contract and are incorporated by reference into the Contract Documents as if set forth at length herein. Payroll and Anti-Kickback Statements shall be submitted weekly for each and every Subcontractor on the project subject thereto and shall be permitted on a form equal to Form WH-347.

The Contractor and all Subcontractors shall pay to all laborers and mechanics employed for the construction covered by this Contract the minimum rates of pay as determined by the Secretary of Labor in accordance with the Act of March 3, 1931, as amended, known as the David-Bacon Act (40 U.S.C. 276(a) through 276(a-5). Furthermore, the Contractor and Subcontractor shall adhere to the applicable stipulations and provisions published by the United States Environmental Protection Agency, entitled, "Labor Standards Provisions for Federally Assisted Construction Contracts". The applicable Federal Wage Rate Determinations, as prepared by the Secretary of Labor and the "Labor Standards" are incorporated by reference into the Contract Documents as if set forth at length herein.

State Wage Rates

The successful bidder will be required to comply with all provisions of prevailing wage rates as determined by the New Jersey Department of Labor.

The CONTRACTOR's attention is directed to the prevailing wage rates contained in Exhibit 1 and to the applicable provisions of the New Jersey Prevailing Wage Act, Chapter 150, of the Laws of 1963 as amended, governing the prevailing rates of wages for workmen who are employed on this project. All applicable provisions of said Prevailing Wage Act and Amendments thereto shall be considered part of this Contract and made a part hereof. The Contractor shall pay not less than the prevailing wage rate to workers employed in the performance of any contract for the project, in accordance with the rate determined by the Commissioner of New Jersey Department of Labor pursuant to N.J.S. A. 34:11-56.25 et seq. OR the United States Secretary of Labor pursuant to 29 CFR Part 5, whichever is greater. The Contractor shall refer to Exhibit 3 of the Supplemental General Conditions for the requirements of the Davis-Bacon Act.

The Bidder does also declare and represent that in the event of any change of such prevailing rates at any time before the execution and delivery of the Contract between the Bidder and the OWNER for the work of construction of the project, or at any time thereafter, the new rates, if applicable, will become minimum rates for work performed thereafter under said Contract. No increase in the Contract price shall be claimed by the Bidder and no such increase will be granted by the OWNER as a result of such change.

In the event it is found that any employee of the Contractor or any subcontractor covered by the contract, has been paid a rate of wages less than the minimum wage required to be paid by the contract, the Owner 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 and his sureties shall be liable to the local government for any excess costs occasioned thereby.

1.26 Construction Drawings and Specifications Provided by ENGINEER

After the award and prior to signing of the Contract, the OWNER will furnish the successful Bidder with a complete set of conformed drawings "Issued for "Construction". After the Contract has been awarded the CONTRACTOR will be furnished with five (5) sets of conformed drawings "Issued for Construction" and five (5) sets of the Specifications. The CONTRACTOR may purchase additional sets at cost.

1.27 Special Legal Requirements

This Contract will be awarded pursuant to the authority of PVSC's authorizing statute N.J.S.A. 50A:14-1 et seq. ("Authorizing Statute"). Where the Authorizing Statute is silent, it is PVSC's policy to be guided by the provisions of New Jersey Local Public Contracts Law, N.J.S.A. 40A:11 et seq.

Bidders are required to make the good faith efforts to assure that disadvantaged business enterprises, women's business enterprises and labor surplus area firms are used when possible as specified in 40 CFR part 33.

The Contract or Subcontract will be subject to regulations contained in N.J.A.C. 7:22-3.1 et seq., 4.1 et seq., 5.1 et seq., 9.1 et seq. and 10 et seq., New Jersey Local Public Contracts Law, Department of Labor Current Wage Rate Determination, Prevailing Wage Act, Contract Work Hours and Safety Standard Act, Copland Act, Davis Bacon Act, Buy American Clause, Debarment and Suspension, and Socially and Economically Disadvantaged (SED) (N.A.J.C. 7:22-9).

All bids shall include a commitment to the use of small, minority, women's and labor surplus area businesses and shall be in conformity with N.J.A.C. 7:22-3.17(a)(24) and 7:22-4.17(a) with a goal of not less than 10% participation of small business enterprises owned and controlled by socially and economically disadvantaged individuals (SED's). Further details regarding required SED participation are included in the Information for Bidders and the Supplemental General Conditions.

Starting in January 2007, 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.

Bidder shall submit with their bid an executed "Two-Year Vendor Certification and Disclosure of Political Contributions" form (a copy of which can found at http://www.state.nj.us/treasury/purchase/forms/eo134/c51_eo117_cd_02_10_09.pdf) if the

Contractor does not have Two-Year Certification at the time of the Bid, as required by Executive Order 117.

1.28 American Goods and Products to be Used where Possible

N.J.S.A. 40A:11-18 only manufactured and farm products of the United States, whenever available, will be used in the Work.

1.29 Public Works Contractor Registration

No contractor shall bid on any contract for public work as defined in section 2 of P.L.1963, c.150 (C.34:11-56.26), amended 2003, c.91., s.2., unless the contractor is registered pursuant to this act. No contractor shall list a subcontractor in a bid proposal for the contract unless the subcontractor is registered pursuant to P.L.1999, c.238 (C.34:11-56.48 et seq.) at the time the bid is made. No contractor or subcontractor, including a subcontractor not listed in the bid proposal, shall engage in the performance of any public work subject to the contract, unless the contractor or subcontractor is registered pursuant to that act. The Bidder shall submit a copy of the Certificate of Registration issued by the Commissioner of Labor with the Bid.

Each contractor shall, after the bid is made and prior to the awarding of the contract, submit to the public entity the certificates of registration for all subcontractors listed in the bid proposal. Applications for registration shall not be accepted as a substitute for a certificate of registration for the purposes of this section, as required by L.1999,c.238,s.8; amended 2003, c.91., s.4.

1.30 New Jersey Business Registration Requirements

In accordance with P.L. 2004, c.57, no contract shall be entered into by any contracting agency unless the contractor provides proof of business registration at the time a bid is submitted in response to a request for bids. Proof of business registration shall be a copy of a Business Registration Certificate issued by the New Jersey Department of the Treasury, Division of Revenue.

As part of the Bid submission, the Bidder shall include the proofs of all named or listed subcontractors in the Bid including subcontractors listed for minority business enterprise utilization. A Bidder's failure to submit copies of its business registration and the business registrations of the named subcontractors at the time specified by the contracting unit for the receipt of the bids shall be deemed a fatal defect that shall render the bid proposal unresponsive and that cannot be cured by the contracting agency pursuant to N.J.S.A. 40A:11-23.2.

The contractor shall provide written notice to its subcontractors and suppliers of the responsibility to submit proof of business registration to the contractor for submission to Owner/Engineer. The requirement of proof of business registration extends down through all levels (tiers) of the project for all contracts with a value greater than 15 percent of the Owner's bid threshold.

Before final payment on the contract is made by the contracting agency, the contractor shall submit an accurate list and the proof of business registration of each subcontractor or supplier used in the fulfillment of the contract, or shall attest that no subcontractors were used. Contractor shall submit subcontractors' business registration certificate to Owner/Engineer prior to executing subcontract with any subcontractor/vendor who knowingly supplies goods or services to a public agency if the value is greater than 15 percent of the Owner's bid threshold.

For the term of the contract, the contractor and each of its affiliates and a subcontractor and each of its affiliates [N.J.S.A. 52:32-44(g)(3)] shall collect and remit to the Director, New Jersey Division of Taxation, the use tax due pursuant to the Sales and Use Tax Act on all sales of tangible personal property delivered into this State, regardless of whether the tangible personal property is intended for a contract with a contracting agency.

A business organization that fails to provide a copy of a business registration as required pursuant to section 1 of P.L.2001, c.134 (C.52:32-44 et al.) or subsection e. or f. of section 92 of P.L.1977, c.110 (C.5:12-92), or that provides false business registration information under the requirements of either of those sections, shall be liable for a penalty of $25 for each day of violation, not to exceed $50,000 for each business registration copy not properly provided under a contract with a contracting agency.

1.31 Investment Activities in Iran

In accordance with N.J.S.A. 52:32-58, Bidder shall certify and submit with their bid as set forth therein on a form of Certification promulgated by State of New Jersey Division of Purchase and Property entitled "Disclosure of Investment Activities in Iran". The form of Certification and accompanying list dated January 28, 2013 can be found at http://www.state.nj.us/treasury/purchase/forms/DPA_Form_Packet.pdf (page 6 of 17) and http://www.state.nj.us/treasury/purchase/pdf/Chapter25List.pdf, respectively. **It is the responsibility of Bidder to insure that the most up to date list issued by the Division of Purchase and Property is attached to the Certification submitted with this Bid.**

1.32 Eligible Socially and Economically Disadvantaged (SED) Firms

This Contract is funded in part by New Jersey Environmental Infrastructure financing programs and the successful bidder must comply with all the provisions of N.J.A.C. 7:22-9.1 et. seq. for the participation of small business enterprises owned and controlled by socially and economically disadvantaged individuals. In accordance with the provisions of N.J.S.A. 58:11-26, N.J.A.C. 7:22-3.17(a)24 and 4.17(a)24, the Contractor (and Subcontractors) shall comply with all the provisions of N.J.A.C. 7:22-9.

The Owner has submitted a SED Utilization Plan to the NJDEP Office of Equal Opportunity and Public Contract Assistance (NJDEP OEOPCA) in which the Owner commits to the use of socially and economically disadvantaged (SED) firms with a goal of 10% of the value of the work under the Contract and, in conformity with N.J.A.C. 7:22-3.17, the Contractor shall submit its own SED Utilization Plan to the NJDEP OEOPCA, with a copy to Owner, within thirty (30) days of Contract award indicating how its goal will be achieved by the Contractor for the duration of the Project, in accordance with N.J.A.C. 7:22-3.17 and 7:22-9, et seq. Detailed information is contained in the pages of the Contract Documents, entitled "Supplemental General Conditions".

1.33 NJDEP and Environmental Infrastructure Trust Right to Stop Work

The NJDEP may order work to be stopped under this Contract for good cause pursuant to N.J.A.C. 7:22-3.43 and 7:22-4.43. Such stoppage may be treated under the clauses of this Contract, entitled "Suspension of Work, Delay and No Damages for Delay" and/or "Rights of Owner to Terminate the Contract or Give a Three (3)-Day Deficiency Notice".

1.34 Access to the Work and Records

The representatives of the Federal Department of Labor, the New Jersey Department of Environmental Protection and the New Jersey Department of Labor and any other governmental entity having jurisdiction shall be afforded access to the work and project records under this contract. The Contractor shall provide proper facilities for such access and inspection.

1.35 Debarment

No recipient shall enter into a contract for work on environmental infrastructure facilities with any person debarred, suspended or disqualified from Department contracting pursuant N.J.A.C. 7:1D-2.

Recipients shall insert in every contract for work on a project a clause stating that the contractor may be debarred, suspended or disqualified from contracting on any project financially assisted by the State or the Department if the contractor commits any of the acts listed in N.J.A.C. 7:1D-2.2.

The recipient, prior to acceptance of Trust loan moneys, shall certify that no contractor or subcontractor is included on the State Treasurer's list of the debarred, suspended or disqualified bidders as a result of action by a State Agency in addition to that of the Department of Environmental Protection. If Trust loan moneys are used for disbursement to a debarred firm, the Trust reserves the right to immediately terminate (N.J.A.C. 7:22-4.44) the Trust loan and /or take such other action pursuant to N.J.A.C. 7:1D-2 as is appropriate.

Whenever a bidder is debarred, suspended or disqualified from Department contracting pursuant to N.J.A.C. 7:1D-2, the recipient may take into account the loss of Trust loan moneys under these regulations which result from awarding a contract to such bidder, in determining whether such bidder is the lowest responsive and responsible bidder pursuant to law, and the recipient may advise prospective bidders that these procedures shall be followed.

Any person included on the State Treasurer's list as a result of action by a State agency, who is or may become a bidder on any contract which is or shall be funded by a Trust loan under this subchapter, may present information to the Trust why this section should not apply to such person. If the Trust determines that it is essential to the public interest and files a finding thereof with the New Jersey Attorney General, the Trust may grant an exception from the application of this section with respect to a particular contract, in keeping with N.J.A.C. 7:1D-2.9. In the alternative, the Trust may suspend or debar any such person, or take such action as may be appropriate, pursuant to N.J.A.C. 7:1D-2.

1.36 Office of the State Comptroller

Pursuant to Executive Order No. 125, signed by Governor Christie on February 8, 2013, the Office of the State Comptroller ("OSC") is required to make all approved State contracts for the allocation and expenditure of federal reconstruction resources available to the public by posting such contracts on an appropriate State website. Such contracts are posted on the New Jersey Sandy Transparency website located at:
http://nj.gov/comptroller/sandytransparency/contracts/sandy/. This contract amendment is subject to the requirements of Executive Order No. 125. Accordingly, the OSC will post a copy of the contract amendment on the Sandy Transparency website.

END OF SECTION

SECTION 00200

CHECK LIST FOR BIDDERS

A. Failure to submit any items on the checklist below, the receipt of which is mandated by N.J.S.A. 40A:11-1 et seq. will constitute cause for the Bid to be rejected. Failure to submit any other item on the checklist below may be cause for the Bid to be rejected.

Item	Description of Item	Contract Section	Initial if Completed
1	Bid Form	00300	
2	Bid Bond or Certified Check (Bid Guarantee Required by NJSA 40A:11-21)	00301	
3	Consent of Surety (NJSA 40A:11-22)	00302	
4	Surety Disclosure Statement & Certification	00302A	
5	Bidder's Affidavit	00303	
6	Non-Collusion Affidavit	00304	
7	Statement of Ownership (NJSA 52:25-24.2)	00305	
8	Affirmative Action Affidavit	00306	
9	If applicable, Acknowledgement of Receipt of Notices or Revisions or Addenda Of an Advertisement, Specifications or Changes to Bid Document Form	00307	
10	Certification of Nonsegregated Facilities	00308	
11	Certification of Bidder's Status	00309	
12	Bidder's Qualification Form	00400	
13	Subcontractor Listing (NJSA 40A: 11-16)	00401	
14	Business Registration Certificate (NJSA 52:32-44)	(00100, paragraph1.30)	
15	Executive Order 117 Certification	(00100, paragraph 1.27)	
16	Public Works Contractor Registration	00402	
17	Certificate of Equal Opportunity	00403	
18	Certification of Affirmative Action Plan Contractors and Subcontractors	00404	
19	Disclosure of Investment Activities in Iran (N.J.S.A. 52:32-58)	(00100, paragraph1.31)	
20	Certification for American Iron and Steel Requirements of P.L. 113-76, Consolidated Appropriations Act, 2014	00405	

The undersigned hereby acknowledges and has submitted the above listed requirements.

Name of Contractor	Signature of Representative
	Print:
	Title:
	Date:

Note: This form is to help the bidder in preparing his proposal. All information must be filled out in this Section.

END OF SECTION

SECTION 00300

BID FORM

To: PASSAIC VALLEY SEWERAGE COMMISSION:

Bid Submitted For: CONTRACT NO. A920 – ADMINISTRATION BUILDING REHABILITATION PROJECT

Pursuant to and in compliance with your Invitation to Bid and the Instructions to Bidders relating thereto, the undersigned hereby proposes to furnish all labor, materials, supplies, equipment and other facilities necessary or proper for or incidental to the above Contract, as required by and in strict accordance with the Bidding Documents for the amount named in the proposal hereinafter described. In making this proposal the Bidder hereby declares that all provisions of Addenda which have been issued have been complied with in preparing bids.

Name of Bidder:

_____

Bidder:

_____

(Individual, Partnership ,Corporation, Joint Venture; L.L.C. as case may be)

Bidder's Business Address:

_____

Telephone No.: _____ Fax No.: _____

Date of Bid: _____

(If Bidder is an Individual, fill in the following blanks:)

Name of Individual:

_____

Residence of Individual:

_____

(If Bidder is a Partnership, fill in the following blanks:)

Name and Title of Partner:

_____

_____

(If Bidder is a Corporation, fill in the following blanks:)

Organized under the laws of the State of:

_____

_____

_____

Name and Residence of President:

_____

_____

Name and title of person signing this bid form if not President (copy of authority to sign must be attached)

_____

_____

Name and Residence of Secretary:

_____

_____

(If Bidder is a Limited Liability Company, fill in the following blanks:)

Formed under the laws of the State of :

_____

_____

Name of Managing Member:

_____

_____

Name and title of person signing this bid form if other then Managing Member (copy of authority to sign must be attached)

_____

_____

The undersigned, as Bidder, declares that he/she is authorized to sign this Bid Form on behalf of Bidder ; that he/she has carefully examined the annexed proposed form of contract and bond and the drawings therein referred to; and that he proposes and agrees, if this proposal is accepted, to contract with the Passaic Valley Sewerage Commission (PVSC), in the form of the copy of the Contract deposited in the office of the PVSC, to perform all the work described in the Contract Specifications in the manner and time therein prescribed, and according to the requirements of the Engineer as therein set forth, and that he will take in full payment therefor the sums, exclusive of all taxes, proposed herein.

If this proposal shall be accepted by the PVSC, and the undersigned shall fail to contract as aforesaid, as specified in the General Conditions according to the address herewith given, that the contract is ready for signature, then the PVSC may at their option determine that the bidder has abandoned the contract and thereupon the proposal and acceptance shall be null and void, and the certified check and/or Bid Bond and the proceeds thereof for _____dollars (Bid Security) accompanying this proposal shall become the property of the PVSC and additionally the bidder shall be liable to PVSC for any and all damages accruing to PVSC by reason of said default; otherwise the accompanying check and/or Bid Bond, shall be returned to the undersigned.

Signature of Bidder with residence and business address:

_____
_____
_____
_____
_____

Dated: _____ Corporate Seal:

Attest:_____

Name:_____

Print:_____

Title:_____

Other (Specify):_____

THE BIDDER AFFIRMS AND DECLARES:

A. That he has carefully examined the site of the work and that, from his own personal investigations and research, has satisfied himself as to the nature and location of the work; the character, quality and quantity of existing materials. All difficulties likely to be encountered; the kind and extent of labor, equipment, other facilities needed for the performance of the work; the general and local conditions; and all other items and conditions which may, in any way, affect the work or its performance.

B. The Bidder also declares that he has carefully examined and fully understands all the component parts of this Contract, that the work can be performed as called for by the Contract, and that he will execute the Contract and will completely perform it in strict accordance with its terms for the prices.

C. That the Bidder will execute work for the Allowance items as directed by the Engineer. It is also understood and agreed that the Final Contract Payment for allowance Items will be based upon such actual payments, and not on the approximate amount cited herein.

D. That the Bidder declares the attached "Qualification Form" is in all respects a true and complete statement of the qualifications and financial condition of the Bidder.

E. The price is exclusive of N.J. State and Federal Taxes.

F. Prices shall also include all transportation charges on materials removed from site and charges pertaining to disposal and other costs pertaining to the execution of the work.

G. He shall maintain for the duration of the work to be done under this contract, insurance in the amounts specified in the Contract. Upon execution of the Contract, the contractor shall furnish all certificates of insurance as required and set forth herein.

H. That he understands and agrees to the conditions for liquidated damages.

I. Upon completion, inspection and acceptance by P.V.S.C. of the work, CONTRACTOR shall turn over to P.V.S.C. the Maintenance Bond (Specification Section 00601) for the one (1) year Correction Period specified in the Contract Documents.

J. The Bidder has clearly marked on the outside of the sealed envelope that contains his/her bid, the Bidder’s name, contract name and number, and bid opening date.

DETERMINATION OF LOW BID. Determination of low bid will be made by comparing the total estimated bid price, which shall include the lump sum bid price and allowance.

A BID ON CONTRACT NO. A920

ADMINISTRATION BUILDING REHABILITATION PROJECT

ITEM	QUANTITY	LUMP SUM OR UNIT PRICE WRITTEN IN WORDS	BID PRICE WRITTEN IN FIGURES	
			Dollars	Cents
1	LUMP SUM	MOBILIZATION Lump Sum (Must be written in words) FOR_____ Dollars Cents		
2	LUMP SUM	REHABILITATION OF THE ADMINISTRATION BUILDING, COMPLETE Lump Sum (Must be written in words) FOR_____ Dollars Cents		
3	ALLOWANCE	ALLOWANCE FOR AUDIO VISUAL DESIGN & IMPLEMENTATION FOR_____ONE HUNDRED THOUSAND__ _____ Dollars Cents	$100,000	00
4	ALLOWANCE	ALLOWANCE FOR SIGNS FOR_____TEN THOUSAND_____ _____ Dollars Cents	$10,000	00
5	ALLOWANCE	ALLOWANCE FOR PAINTING, WALL FINISHES & FLOORING ON 2ND FLOOR FOR_____FIFTY THOUSAND_____ _____ Dollars Cents	$50,000	00

6	ALLOWANCE	ALLOWANCE FOR ADDITIONAL AUTHORIZED WORK FOR_____ONE HUNDRED FORTY THOUSAND_____ Dollars Cents	$140,000	00

TOTAL BID PRICE (Sum of Item No. 1 through No. 6) (in Figures) $_____
Amount Written:

_____Dollars and _____Cents

The **"Additional Work Items"** allowance is intended to provide for work that may later be determined to be necessary for the completion of the project but is not covered in the bid specifications. Written authorization by the OWNER for utilization of any part of the contingency allowances for any such work shall be required.

SECTION 00301

BID BOND

KNOW ALL MEN BY THESE PRESENTS that we, the undersigned, _____, as Principal; and _____ Surety, are hereby held and firmly bound unto the Passaic Valley Sewerage Commission in the penal sum of_____ for the payment of which, well and truly to be made, we hereby jointly and severally bind ourselves, our heirs, executors, administrators, successors and assigns.

Signed this _____ day of _____ 20___.

The condition of the above obligation is such that whereas the Principal has submitted to the Passaic Valley Sewerage Commission a certain Bid, attached hereto, and hereby made a part hereof, to enter into a contract in writing, to:

CONTRACT NO. A920 – ADMINISTRATION BUILDING REHABILITATION

NOW THEREFORE,

A. If said Bid shall be rejected, or, in the alternate,

B. If said Bid shall be accepted and the Principal shall execute and deliver a contract in the form of CONTRACT attached hereto (properly completed in accordance with said Bid) and shall furnish a bond for his faithful performance of said CONTRACT, and shall in all other respects perform the agreement created by the acceptance of said Bid.

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

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

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

Principal:_____

Surety: _____ by:_____

SECTION 00302

CONSENT OF SURETY

KNOW ALL MEN BY THESE PRESENTS, that for and in consideration of the sum of $1.00, lawful money of the United States, the receipt whereof is hereby acknowledged, paid the undersigned corporation, and for other valuable consideration, the_____ _____(Name of Surety) corporation organized and existing under the laws of the State of _____ and licensed to do business in the State of New Jersey, certifies and agrees, that if CONTRACT NO. A920 – ADMINISTRATION BUILDING REHABILITATION is awarded to _____ undersigned corporation will execute the Bond or Bonds as required by the CONTRACT Documents and will become surety in the full amount of the CONTRACT price for the faithful performance of the contract and for payment of all persons supplying labor or furnishing materials in connection hence with.

Signature of Surety by:_____

Print Name:_____

Title:_____

Address:_____

_____

_____

_____

(To be accompanied by the usual proof of authority of officers of surety company to execute the same.)

SURETY DISCLOSURE STATEMENT AND CERTIFICATION

Surety(ies) on the attached bond, hereby certifies(y) the following:

(1) The surety meets the applicable capital and surplus requirements of R.S. 17:17-6 or R.S. 17:17-7 as of the surety's most current annual filing with the New Jersey Department of Insurance.

(2) The capital (where applicable) and surplus, as determined in accordance with the applicable laws of this State, of the surety(ies) participating in the issuance of the attached bond is (are) in the following amount(s) as of the calendar year ended December 31, _____ (most recent calendar year for which capital and surplus amounts are available), which amounts have been certified as indicated by certified public accountants (indicating separately for each surety that surety's capital and surplus amounts, together with the name and address of the firm of certified public accounts that shall have certified those amounts):

(3) (a) With respect to each surety participating In the Issuance of the attached bond that has received from the United States Secretary of the Treasury a certificate of authority pursuant to 31 U.S.C. § 9305, the underwriting limitation established therein and the date as of which that limitation was effective Is as follows (indicating for each such surety that surety's underwriting limitation and the effective date thereof):

(b) With respect to each surety participating in the issuance of the attached bond that has not received such a certificate of authority from the United States Secretary of the Treasury, the underwriting limitation of that surety as established pursuant to R.S. 17:18-9 as of (date on which such limitation was so established) Is as follows (indicating for each such surety that surety's underwriting limitation and the date on which that limitation was established):

(4) The amount of the bond to which this statement and certification is attached is:
$_____

SURETY DISCLOSURE STATEMENT AND CERTIFICATION (continued)

(5) If, by virtue of one or more contracts of reinsurance, the amount of the bond indicated under item (4) above exceeds the total underwriting limitation of all sureties on the bond as set forth in items (3)(a) or (3)(b) above, or both, then for each such contract of reinsurance:

(a) The name and address of each such reinsurer under that contract and the amount of that reinsurer's participation in the contract is as follows:

;and

(b) Each surety that is party to any such contract of reinsurance certifies that each reinsurer listed under item (5)(a) satisfies the credit for reinsurance requirement established under P.L1993, c.243 ~17:51f3...1 et seq.) and any applicable regulations in effect as of the date on which the bond to which this statement and certification is attached shall have been filed with the appropriate public agency.

CERTIFICATE
(to be completed by an authorized certifying agent
for each surety on the bond)

I_____(Name of Agent), as _____(Title of Agent) for _____(Name of Surety). a corporation/mutual insurance company/other (circle one) domiciled in _____(state of domicile). DO HEREBY CERTIFY that, to the best of my knowledge, the foregoing statements made by me are true, and ACKNOWLEDGE that, if any of those statements are false, this bond is VOIDABLE.

_____
(Signature of certifying agent)

_____
(Printed name of certifying agent)

_____
(Title of certifying agent)

SECTION 00303

BIDDER'S AFFIDAVIT

State of)
ss:
County of)

_____ being duly sworn, deposes and says that he resides at

_____ that he is the _____
(Title)

of _____
(Name of Bidder)

who signed the above Proposal or Bid, that he was duly authorized to sign, and that the Bid is a true offer of the Bidder, and the seal attached is the seal of the Bidder and that all the declarations and statements contained in the Bid are true to the best of his knowledge and belief.

_____
(Affiant)

Sworn to and subscribed before me

this _____ day of _____, 201__

_____
Notary Public in and for

_____ County, _____

My Commission Expires

_____, 20___

SECTION 00304

NON-COLLUSION AFFIDAVIT

STATE OF NEW JERSEY, COUNTY OF _____ss.:

I,_____, of the City of _____in the County of _____and the State of _____of full age, being duly sworn according to law on my oath depose and say that:

I am_____of the firm of _____the bidder making the Bid for the above-named contract, and that I executed the said Bid with full authority so to do; that said bidder has not, directly or indirectly, entered into any agreement, participated in any collusion, or otherwise taken any action in restraint of free, competitive bidding in connection with the within Contract; and that all statements contained in said Bid and in this Affidavit are true and correct, and made with full knowledge that the **Passaic Valley Sewerage Commission** relies upon the truth of the statements contained in said Bid and in the statements contained in this Affidavit in awarding the Contract.

I further warrant that no person or selling agency has been employed or retained to solicit or secure such Contract upon an agreement or understanding for a commission, percentage, brokerage or contingent fee, except bona fide employees or bona fide established commercial or selling agencies maintained by the bidder for the purpose of securing business.

For breach or violation of this warranty the Owner shall have the right to annul the Contract without liability or in its discretion to deduct from the Contract price or consideration the full amount of such commission, percentage, brokerage or contingent fee.

_____
(Affiant)

Sworn to and subscribed before me

this _____ day of _____, 20___

_____
Notary Public in and for

_____ County, _____

My Commission Expires

_____, 20____

SECTION 00305

STATEMENT OF OWNERSHIP

Under the provisions of the State Law (NJSA 52:25-24.2. Chapter 33 of the Laws of 1977), a Bidder must file a statement of ownership prior to or with the Bid. The statement must contain the names and addresses of all owners of ten percent (10%) or more of the stock of whatever class of the corporation, or the names of individual partners in the partnership, who own ten percent (10%) or greater interest in the partnership, as the case may be. In order for your Bid to be considered, you must list below the names and addresses of those meeting the criteria of the law:

1. Partners with 10% or greater interest.

   If none, so indicate. Do not leave this space blank:

   Name Addresses

2. Owners of 10% or more of the stock of the corporation including stock of all classes.

   If none, so indicate. Do not leave this space blank:

   Name Addresses

3. Owners of 10% or more of membership interest in limited liability company:

If none, so indicate. Do not leave this space blank:

Name	Addresses

4. If, under item 2, the name of a partnership, corporation or limited liability company is listed, list below the names of individual partners and/or stockholders of whatever class who own a 10% or greater interest in the partnership, corporation or limited liability company listed under item 2. Disclosure shall be continued until names and address of every non-corporate stockholder, individual partner or member exceeding the 10% membership criteria established in the cited statute has been listed:

If none, so indicate. Do not leave this space blank.

Names	Addresses

Signature:_____
(person who signs Bid proposal)

NOTE: Your attention is directed to the fact that failure to complete the statement of ownership form is a non-waivable deficiency and the Commission in the event of non compliance are required as a matter of law to reject your Bid. All of the information requested is strictly required. Each question must be answered either by providing the requested information or if the answer to the question is "none", that must be written in. If required, attach additional sheets to list all names.

SECTION 00306

AFFIRMATIVE ACTION AFFIDAVIT

(to be completed by firms with more than 50 employees)

_____of the firm of _____
(name)

being sworn according to law on his oath deposes and says that:

1. I am authorized to make this affidavit on behalf of:

   _____
   (name of firm)

2. In addition an agreement to comply with an Affirmative Action Program for equal employment opportunity heretofore submitted as part of any pre-qualification statement, or under other conditions of this contract for a similar program, I/we do hereby further affirm that I/we will comply with the rules and regulations which will be promulgated by the State Treasurer as of the effective date therefor pursuant to the Affirmative Action Law (P.L. 1975, c. 127), as amended.

_____
Name and Title

_____
Signature of Authorized Representative

Subscribed and sworn to
before me this _____

day of _____ 201__.

_____
Seal Notary Public of New Jersey

AFFIRMATIVE ACTION AFFIDAVIT

(to be completed by firms with fewer than 50 employees)

I _____, of the (City, Town, Borough) of _____ in the County of _____, State of _____, of full age, being duly sworn according to law on my oath depose and say that:

1 . I am _____, of the firm of _____, a bidder making a proposal upon

CONTRACT NO. A920 – ADMINISTRATION BUILDING REHABILITATION

2. _____ does not have 50 employees or more inclusive of all officers and employees of every type.

3. I am familiar with the affirmative action requirements of P.L. 1975, c. 127 and rules and regulations issued by the Treasurer, State of New Jersey, pursuant thereto.

4. _____ has complied with all the affirmative action requirements of the State of New Jersey, including those required by the P.L. 1975. c. 127 and rules and regulations issued by the Treasurer, State of New Jersey, pursuant thereto.

5. I am aware that if _____ does not comply with P.L. 1975, c. 127 and rules and regulations issued pursuant thereto, that no monies will be paid by the State of New Jersey, County of _____, (City, Town, Borough) of _____ until an affirmative action plan is approved. I am also aware that the contract may be terminated and the _____, may be debarred from all public contracts, for a period of up to five (5) years.

6. In the event my workforce increases to 50 employees, I must contact the State Affirmative Action Office and complete an Employee Information Report.

_____
Name and Title

_____
Signature of Authorized Representative

Subscribed and sworn to
before me this _____

day of _____, 201__.

_____
Seal Notary Public of New Jersey

SECTION 00307

ACKNOWLEDGEMENT OF RECEIPT OF CHANGES TO BID DOCUMENTS FORM

PASSAIC VALLEY SEWERAGE COMMISSION

ADMINISTRATION BUILDING REHABILITATION	A920
(Name of Construction Project)	(Contract No.)

The undersigned bidder hereby acknowledges receipt of the following notices, revisions, or addenda to the bid advertisement, specifications or bid documents. By indicating date of receipt, bidder acknowledges the submitted bid takes into account the provisions of the notices, revision or addendum. Note that the PVSC's record of notice to bidders shall take precedence and that failure to include provisions of changes in a bid proposal may be submit for rejection of the bid.

Addendum No.	How Received (mail, fax, Pick-up, etc)	Date Received

Acknowledgement by bidder:

Name of Bidder:_____

By Authorized Representative:

Signature:_____

Printed Name and Title:_____

Date:_____

SECTION 00308

CERTIFICATION OF NONSEGREGATED FACILITIES

(Applicable to state-assisted construction contracts and related subcontracts exceeding $10,000 which are not exempt from the Equal Opportunity clause.)

The state-assisted construction contractor certifies that he does not maintain or provide for his employees any segregated facilities at any of his establishments, and that he does not permit his employees to perform their services at any location, under his control, where segregated facilities are maintained. The state-assisted construction contractor certifies further that he will not maintain or provide for his employees any segregated facilities at any of his establishments, and that he will not permit his employees to perform their services at any location, under his control, where segregated facilities are maintained. The state-assisted construction contractor 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 wash rooms, restaurants and other eating areas, time clocks, locker rooms and other storage or dressing areas, parking lots, drinking fountains, recreation or entertainment areas, transportation, and housing facilities provided for employees which are segregated by explicit directive or are in fact segregated on the basis of race, creed, color, or national origin, because of habit, local custom, or otherwise. The state-assisted construction contractor agrees that (except where he has obtained identical certifications from proposed subcontractors for specific time periods) he will obtain identical certifications from proposed subcontractors prior to the award of subcontracts exceeding $10,000 which are not exempt from the provisions of the Equal Opportunity clause, and that he will retain such certifications in his files.

_____ _____

Signature Date

_____ _____

Name and Title of Signer (Please Type)

NOTE: The penalty for making false statements in offers is prescribed in 18 USC 1001.

SECTION 00309

CERTIFICATION OF BIDDER'S STATUS ON
THE STATE TREASURER'S LIST OF
DEBARRED, SUSPENDED AND DISQUALIFIED BIDDERS

STATE OF _____

COUNTY OF _____

I, _____ of the City of, in the State of, _____ full age, being duly sworn according to law on my oath depose and say that:

I am _____of the firm of _____, the bidder making the Bid for the above named project; that I executed the said Bid, this affidavit and all other bidding documents with full authority to do so; and that said bidder is not now at the time of submission of this bid included on the State of New Jersey Treasurer's List of Debarred, Suspended and Disqualified Bidders.

By:_____ Date: _____
Deponent's Signature

_____
Deponent's Printed Name and Title

Subscribed and sworn to _____

before me this _____ day of _____, 20___.

_____
Notary Public of
My Commission expires _____,20___.

SECTION 00400

BIDDER'S QUALIFICATION FORM

1. Name of Contractor _____

2. How many years experience have you had in construction work of the same general type as this Contract? _____

3. Give information about the construction experience of the principals of your present organization who will be involved in the Contract:

Individual's Name	Present Position in Organization	Years of Construction Experience	Size and Type of Work	Proposed Position For This Contract

4. Give information about your present contract workload, or contracts to which you are committed:

Contract Price	Type of Construction	Location Of Work	Percentage Complete	Expected Completion Date	Name and Phone No. of Owner

5. Has your organization, or any other partner thereof, failed to complete a construction contract?____yes ____no

6. **Provide five (5) references of projects similar in scope and size to that required under this Contract.** Give only engineers, architects or owner's representatives for whom you have done similar work.

Name	Business Address	Telephone	Project

_____

_____

_____

_____

_____

_____

_____

7. Is any litigation pending or threatened against your organization?
_____

8. Has your organization been denied award of any construction project where it was the lowest bidder? _____

If yes, give details: _____

_____

_____

_____

_____

_____

_____

_____

9. Give as reference a surety company or companies regarding your organization's financial responsibility and general reliability:

Name of Surety Company _____
Name of Local Agent (if different)

_____

_____

_____

_____

Local Address: _____

_____

_____

_____

Telephone _____

Person familiar with Bidder's account: _____

_____

_____

10. Attach a financial statement, audited if available, including your organization's latest balance sheet and income statement, prepared in accordance with generally accepted accounting principles. (This statement shall be for the local firm submitting the Bid, unless the local firm is a branch or subsidiary for which separate accounts are not available, in which case the statement shall be for the organization(s) which will contract to be a guarantor of any contract resulting from this Bid. Attach a notarized statement of an officer of that organization describing the relationship to the local firm, and stating that the organization will act as guarantor of the local firm's contracts.) Any financial statement shall include:

A. Assets list:

1. Current Assets (e.g., cash, joint venture accounts, accounts receivable, notes receivable, accrued income, deposits, materials inventory and prepaid expenses) _____

2. Net Fixed Assets _____

3. Other Assets _____

4. Total Assets (the sum of Al, A2 and A3) _____

B. Liabilities List:

1. Current Liabilities (e.g., accounts payable, notes payable, accrued expenses, provisions for income taxes, advances, accrued salaries and accrued payroll taxes)
_____

2. Other Liabilities (e.g., capital, capital stock, authorized and outstanding share par values, earned surplus and retained earnings)
_____

3. Total Liabilities (the sum of B1 and B2)
_____

C. Net Worth (A4 minus B3) _____

D. Billings: State the firm's average annual billings for the five years prior to the date of this Bid and the total billings for the six months prior to the date of this Bid.

_____
_____
_____
_____
_____

E. State the name and address of the person or firm preparing this financial statement.

_____

F. State the name and address of the person or firm (if any) auditing this financial statement. If this statement was not audited, state "not audited".

_____

11. Give the names and telephone numbers of personnel in your organization authorized to participate in discussions of the proposed contract

Name	Telephone

SECTION 00401

SUBCONTRACTOR LISTING

Failure to complete this Section is cause for the bid to be rejected (See NJSA 40A:11-16).

Before submitting his bid, the Bidder shall completely familiarize himself with Section 40A:11-16 of the New Jersey Local Public Contracts Law (New Jersey Statutes Annotated 40A:11-16). On contracts for the erection, alteration or repair of any public building, if the Bidder will use subcontractors for the plumbing work and gas fitting and all kindred work, steam and hot water heating and ventilating apparatus, steam power plants and kindred work, electrical work, structural steel and ornamental iron work he shall list below the name and address of each subcontractor to be used for these respective and kindred categories of work.

WORK CATEGORY	NAME	ADDRESS
Plumbing and Gas Fitting and all kindred work		
Steam Power Plants, Steam and Hot Water Heating and Ventilating Apparatus and all kindred work		
Electrical Work		
Structural Steel and Ornamental Iron Work		

(Attach additional pages as required)

NOTE: Submission of the names and addresses of the subcontractors required by N.J.S.A. 40A:11-16 is essential and nonwaiveable. The names and addresses for subcontractors must be provided for each work category above, otherwise the bid will be deemed nonresponsive. Where **more than one** subcontractor is named for a work category, the bidder must identify, in the Bid, the scope of work that is to be performed by each subcontractor, as required by P.L. 1997, c. 408. Failure to comply with these statutory requirements will result in the Bid being deemed nonresponsive.

_____

Name and Title of Authorized Representative

_____

Signature of Authorized Representative

SECTION 00402

PUBLIC WORKS CONTRACTOR REGISTRATION

1. In accordance with "The Public Works Contractor Registration Act," P.L., 1999, c238 (N.J.S.A. 34:11 – 56.48 et seq.) amended by P.L. 2003, C091

   "No contractor shall bid on any contract for public work as defined in section 2 of P.L. 1963, c150 (C34:11 – 56.26) unless the contractor is registered pursuant in this act. No contractor shall list a subcontractor in a bid proposal for the contract unless the subcontractor is registered pursuant to P.L. 1999, c238 (C34:11 – 56.48 et seq.) at the time the bid is made. No contractor or subcontractor, including a subcontractor not listed in the bid proposal, shall engage in the performance of any public work subject to the contract, unless the contractor is registered pursuant to that act." (N.J.S.A./ 34:11 – 56.51)"

   "Contractor means 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," P.L., 1963, c.150, (C.34:11 – 56.25 et seq.) and includes any subcontractor or lower tier subcontractor of a contractor defined herein" (N.J.S.A./ 34:11 – 56.50)

2. Proof of registration is required before an award can be made:

   "Each contractor shall, after the bid is made and prior the awarding of the contract, submit to the public entity the certificates of registration for all subcontractors listed in the bid proposal. Applications for registration shall not be accepted as a substitute for a certificate of registration for the purposes of this section." (N.J.S.A. 34:11-56.55)

3. On and after August 16, 2003 Contractors and their listed subcontractors bidding on covered work shall provide proof of the required registration prior to the contract award. [As practical matter, proof of registration should be submitted with the Bid]

4. By signing this form, the Contractor certifies that they shall provide proof of the required registration prior to the contract award.

_____ _____

(Signature) (Date)

_____

(Name and Title of Signer - Please Type)

END OF SECTION

SECTION 00403

CERTIFICATE OF EQUAL OPPORTUNITY

To: _____
Name of Union or Organization of Workers

The undersigned currently hold contract(s) numbered _____ with

_____ which has received funds from the New Jersey Environmental Infrastructure Trust or (a) subcontract(s) with a prime contractor of the (grantee).

You are advised that under the provisions of the above contract(s) or subcontract(s) and in accordance with the President's Executive Orders 11246 and 11375, the undersigned is obliged not to discriminate against any employee or applicant for employment because of age, race, creed, color, national origin, ancestry, marital status, sex, affectional or sexual orientation. The undersigned will take affirmative action to ensure that such applicants are recruited and employed, and that employees are treated during employment without regard to their age, race, creed, color, national origin, ancestry, marital status, sex, affectional or sexual orientation. Such action 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 undersigned 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.

This notice is furnished you pursuant to the provisions of the above contract(s) or subcontract(s) and Executive Orders 11246 and 11375.

_____ _____

_____ /s/_____
Contractor or Subcontractor

_____
Date

Copies of this notice will be posted by the undersigned in conspicuous places available to employees or applicants for employment.

- END OF SECTION -

SECTION 00404

CERTIFICATION OF AFFIRMATIVE ACTION PLAN
FOR
CONTRACTOR AND SUBCONTRACTORS

Bidder's Name:_____

Address:_____

The Bidder hereby certifies that it shall comply with and shall require its subcontractors to comply with the discrimination and affirmative action provisions of N.J.S.A. 10:2-1 through 10:2-4, the New Jersey Law Against Discrimination (N.J.S.A. 10:5 et seq.) and the rules and regulations promulgated pursuant thereto, including but not limited to N.J.A.C. 17:27-1 et seq.

An affirmative action plan for construction contractors and subcontractors shall consist of the following elements:

1. Provisions in the construction contract containing language required by N.J.A.C. 17:27-3, 4(a) and N.J.A.C. 17:27-7.4, or

2. 41 CFR Part 60-2 and any existing Federally approved or sanctioned affirmative action program.

_____ _____
(Date)

_____
(Signature)

SECTION 00405

CERTIFICATION FOR

AMERICAN IRON AND STEEL REQUIREMENTS OF P.L. 113-76

CONSOLIDATED APPROPRIATIONS ACT, 2014

The Bidder acknowledges to and for the benefit of the Bayonne Municipal Utilities Authority and the State of New Jersey that it understands the goods and services under this Agreement are being funded with monies made available by the Clean Water State Revolving Fund and/or Drinking Water State Revolving Fund that have statutory requirements commonly known as "American Iron and Steel;" that requires all the iron and steel products used in the project to be produced in the United States ("American Iron and Steel Requirement") including iron and steel products provided by the Bidder pursuant to this Agreement. The Bidder hereby represents and warrant to and for the benefit of the Owner and the State that (a) the Bidder has reviewed and understands the American Iron and Steel Requirement, (b) all of the iron and steel products used in the project will be and/or have been produced in the United States in a manner that complies with the American Iron and Steel Requirement, unless a waiver of the requirement is approved, and (c) the Bidder will provide any further verified information, certification or assurance of compliance with this paragraph, or information necessary to support a waiver of the American Iron and Steel Requirement, as may be requested by the Owner or the State. Notwithstanding any other provision of this Agreement, any failure to comply with this paragraph by the Bidder shall permit the Owner or State to recover as damages against the Bidder any loss, expense, or cost (including without limitation attorney's fees) incurred by the Owner or State resulting from any such failure (including without limitation any impairment or loss of funding, whether in whole or in part, from the State or any damages owed to the State by the Owner). While the Bidder has no direct contractual privity with the State, as a lender to the Owner for the funding of this project, the Owner and the Bidder agree that the State is a third-party beneficiary and neither this paragraph (nor any other provision of this Agreement necessary to give this paragraph force or effect) shall be amended or waived without the prior written consent of the State.

_____ _____

Date Signature of Bidder

- END OF SECTION -

SECTION 00500

CONTRACT NO. A920
PASSAIC VALLEY SEWERAGE COMMISSION
600 WILSON AVENUE
NEWARK, NEW JERSEY 07105

CONTRACT AGREEMENT

ADMINISTRATION BUILDING REHABILITATION

THIS AGREEMENT, made and executed this _____ day of _____, 20___, by and between the PASSAIC VALLEY SEWERAGE COMMISSION, a corporate body politic of the State of New Jersey, hereinafter called the "OWNER", acting through its Chairman, and _____, a corporation chartered under the laws of the State of _____partnership, individual with principal offices at_____ _____ hereinafter called the "CONTRACTOR". OWNER and CONTRACTOR, in consideration of the mutual covenants, hereinafter set forth, agree as follows:

Article 1 - Work

In consideration of the payments to be made as hereinafter provided, and of the performance by OWNER of all the matters and things to be performed by OWNER and herein provided; CONTRACTOR agrees, at its own sole cost and expense, to perform all the labor and services and to furnish all labor, materials, plant and equipment necessary to complete, and to complete in good, substantial, workmanlike and approved manner, all the Work as specified, described or indicated in the Contract Documents, as defined herein and Addenda within the time hereinafter specified and in accordance with the terms, conditions and provisions of the Contract Documents and Addenda.

Article 2 - ENGINEER

The Project has been designed by HATCH MOTT MACDONALD, 111 WOOD AVENUE SOUTH, NEW JERSEY, NEW JERSEY, 08830, who are hereinafter called ENGINEER and who are to act as OWNER's representative, assume all duties and responsibilities and have the rights and authority assigned to ENGINEER in the Contract Documents in connection with completion of the Work in accordance with the Contract Documents.

Article 3 - Contract Times

The CONTRACTOR shall commence work on the day specified in the Notice to Proceed. TIME BEING OF THE ESSENCE of this Contract. The CONTRACTOR shall prosecute the work diligently and uninterruptedly, at a rate to ensure completion sufficient for final acceptance of all work within 365 consecutive calendar days from the day of the CONTRACTOR's receipt of the written Notice to Proceed. THE CONTRACTOR shall comply with all provisions in the Contract Documents regarding intermediate times of completion of construction.

The CONTRACTOR shall complete certain minimum amounts of work under this Contract by specified times as shown in the following Schedule of Intermediate Completion Times.

Intermediate Completion Time, In Consecutive Calendar Days Contractor's Receipt of Written Notice to Proceed	Minimum Percentage Dollar Value of Work to be Completed Under the Contract (Percentage of Completion)
300	85%
365	100%

Time is of the essence for final completion of all work within the time period starting from the CONTRACTOR's receipt of the Notice to Proceed and for intermediate completion of the work by the above Intermediate Completion Times.

Article 4 - Contract Price

OWNER shall pay CONTRACTOR for completion of the Work in accordance with the Contract Documents in current funds at the prices agreed upon in the CONTRACTOR's Bid Form attached to this Agreement.

Article 5 - Payment Procedures

OWNER will make partial payments on account of the Contract in accordance with the provisions of Article 14 in the General Conditions.

Article 6 - CONTRACTOR's Representations

In order to induce OWNER to enter into this Agreement, CONTRACTOR makes the following representations:

6.1 CONTRACTOR has familiarized itself with the nature and extent of the Contract Documents, Work, site, locality, and all local conditions and Laws and Regulations that in any manner may affect cost, progress, performance of or furnishing of the Work.

6.2 CONTRACTOR has given ENGINEER written notice of all conflicts, errors or discrepancies that he has discovered in the Contract Documents and the written resolution thereof by ENGINEER is acceptable to CONTRACTOR.

6.3 CONTRACTOR is financially solvent and is experienced and competent to perform the type of work or to furnish the plant, materials, supplies or equipment to be performed or furnished by him.

Article 7 - Liquidated Damages and other DAMAGES

The OWNER and CONTRACTOR recognize that TIME IS OF THE ESSENCE of this Agreement and that OWNER will suffer financial loss if the Work is not completed within the Contract Time specified in Article 3, plus any extensions thereof allowed in accordance with the General Conditions. Because some of this damage is difficult or impossible to calculate or estimate, the parties agree that the Contractor shall pay OWNER liquidated damages in the amounts set forth in the Contract Agreement in lieu of the above stated actual damage. The Contractor agrees that as liquidated damages (but not as a penalty) for delay beyond the Contract Times specified in Article 3 above, (Exclusive of Additional) architectural/engineering services as provided for below, the Contractor shall pay the Owner for:

7.1 Each and every calendar day that the Contractor is not in compliance with the Contract Times and Milestones, the sum of Three Thousand Dollars ($3,000.00), which sum is hereby agreed upon, not as a penalty but as liquidated damages, which the parties hereto have agreed to be proper and reasonable, and which the Owner will suffer by reason of such default. The Owner shall assess liquidated damages on each of the contract milestones given in Article 3. The Owner reserves the right to retain and/or release liquidated damages until the Contractor has corrected the delay in the schedule or has met subsequent milestones.

7.2 In addition to liquidated damages the CONTRACTOR shall pay to the OWNER all costs incurred by the OWNER for additional architectural and engineering services required as a result of the delay. This amount, above and beyond the specified liquidated damages amount, shall be determined by and be equal to the actual architectural and engineering services invoices received by the OWNER. Copies of such invoices will be provided to CONTRACTOR. CONTRACTOR shall pay to the OWNER via reduction made by owner from the CONTRACTOR monthly payment request the full amount of each invoice. If unpaid contract balance is insufficient to reimburse OWNER the additional architectural and engineering services invoice amount, CONTRACTOR shall pay OWNER directly any amount not covered by deductions from the contract balance within 30 calendar days from the CONTRACTOR's receipt of a copy of each invoice from the OWNER.

7.3 In the event the Contractor by delay or otherwise has caused Owner damages beyond the amount specified in the liquidated damage provision of any contract between the Owner and Contractor, the Owner shall have the right to seek damages for said additional monies and shall not be limited by any said liquidated damage provision for the amount to be recovered. In addition, the Owner shall have the right to withhold from monies due or to become due the Contractor an amount sufficient to completely pay for said additional damages.

Provided, that CONTRACTOR shall not be charged with liquidated damages or any excess cost when the delay in completion of the Work is for reasons included in Article 12 of the General Conditions. Further, that CONTRACTOR shall, furnish OWNER the required

notification of such delays in accordance with Article 12 of the General Conditions.

Article 8 - Contract Documents

The Contract Documents which comprise the Contract between OWNER and CONTRACTOR are attached hereto and made a part hereof and consist of the following:

1) Invitation To Bid.
2) Instructions To Bidders.
3) Bid and any post Bid documentation submitted prior to the Notice of Award.
4) This Agreement and Notice to Proceed.
5) Construction Performance Bond, Construction Payment Bond and other required Bonds.
6) Certificate of Insurance.
7) Standard General Conditions, EJCDC Document C700, 2007 edition.
8) Supplementary Conditions.
9) Specifications (as listed in Table of Contents).
10) All drawings (Site and Traffic) inclusive.
11) Addenda numbers _____ to _____, inclusive.
12) Any modification, including Change Orders, duly delivered after execution of Agreement.

Article 9 - Miscellaneous

9.1 Terms used in this Agreement which are defined in Article 1 of the General Conditions will have the meanings indicated in the General Conditions.

9.2 No assignment by a party hereto of any rights under or interests in the Contract Documents will be binding on another party hereto without the written consent of the party sought to be bound; and specifically but without limitation moneys that may become due and moneys that are due may not be assigned without such consent (except to the extent that the effect of this restriction may be limited by law), and unless specifically stated to the contrary in any written consent to an assignment no assignment will release or discharge the assignor from any duty or responsibility under the Contract Documents.

9.3 OWNER and CONTRACTOR each binds itself, its partners, successors, assigns and legal representatives to the other party hereto, its partners, successors, assigns and legal representatives in respect of all covenants, agreements and obligations contained in the Contract Documents.

9.4 This Agreement shall be construed in accordance with the laws of the State of New Jersey.

9.5 CONTRACTOR agrees that:

A. It hereby voluntarily and irrevocably submits itself to the jurisdiction and venue of any court of competent jurisdiction over the subject matter of this Agreement located within the State of New Jersey in which any litigation is brought based on or arising out of this Agreement.

B. Any legal process or notice connected with any litigation may be served on CONTRACTOR by United States registered mail, postage prepaid, addressed to CONTRACTOR at its address stated in this Agreement for the furnishing of notices to CONTRACTOR or at CONTRACTOR's last known address, and that service in such manner shall constitute good and valid service of process upon CONTRACTOR.

C. CONTRACTOR hereby waives any defense which might be available to it in any such litigation based on or alleging lack of jurisdiction or venue, or, if process is served in the manner provided in subparagraph "B" immediately above, invalid service of process, and that it will duly enter its appearance in any such action.

D. This Agreement may be presented in court as conclusive evidence of the foregoing agreement.

IN WITNESS WHEREOF: The parties hereto have executed this agreement the day and year first above mentioned.

PASSAIC VALLEY SEWERAGE COMMISSION

(SEAL) BY: _____

ATTEST BY:_____
PASSAIC VALLEY SEWERAGE COMMISSION

_____
CONTRACTOR NAME

BY: _____
CONTRACTOR

(SEAL)

ATTEST BY:_____
CONTRACTOR

Note: If CONTRACTOR is a corporation, an affidavit giving the principal the right to sign the Agreement must accompany the executed Agreement.

_____
NAME OF CORPORATION:

BY: _____

(CORPORATE SEAL)

ATTEST BY:_____

(ADD TYPED OR PRINTED NAMES OF OFFICER AND ATTESTING WITNESS)

Date:_____

SECTION 00600
PERFORMANCE AND PAYMENT BONDS

KNOW ALL MEN BY THESE PRESENTS, that we, the undersigned, _____, as Principal and _____, a corporation organized and existing under the laws of the State of _____, as surety, are held and firmly bound unto the Passaic Valley Sewerage Commission as hereinafter set forth, in the full and just several sums of:

(a) _____ (One hundred percent (100%) of the amount of the contract) for faithful PERFORMANCE of the Contract No. A920 – ADMINISTRATION BUILDING REHABILITATION;

b) _____ (One hundred percent (100%) of the amount of the contract) for PAYMENT of labor and materials

Signed this _____ day of _____ 201___ .

THE CONDITION OF THE ABOVE OBLIGATION IS SUCH THAT, WHEREAS, the above named principal did on the _____ day of _____, 20__, enter into a contract with the Passaic Valley Sewerage Commission, which said contract is made a part of this bond the same as through set forth herein; NOW, if the said principal shall sell and faithfully do and perform the things agreed by the said principal to be done and performed according to the terms of said contract, and shall pay all lawful claims of subcontractors, materialmen, laborers, persons, firms or corporations for labor performed or materials, provisions, provender or other supplies or teams, fuels, oils, implements or machinery furnished, used or consumed in the carrying forward performing or undertaking shall be for the benefit of any subcontractor, materialman, laborer, person, firm or corporation having a just claim, as well as for the obligee herein; then this obligation shall be void; otherwise the same shall remain in full force and effect; being expressly understood and agreed that the liability of the surety for any and all claims hereunder shall in no event exceed the penal amount of this obligation as herein stated. The said surety hereby stipulates and agrees that no modifications, omissions or additions in or to the terms of the said contract or in or to the plans or specifications therefore shall in any way affect the obligation of said surety on its bond.

IN WITNESS WHEREOF, the said _____
as principal has caused its corporate seal to be hereto affixed and these presents to be signed by _____ its _____ and attested by _____ its _____ and the said _____ as surety, has caused its corporate seal to be hereto affixed and these presents to be signed by its _____ and attested by its _____ this _____ day of _____ 20_ __.

By: _____

Attest: _____

Attest: _____

SECTION 00601

MAINTENANCE BOND

KNOW ALL MEN BY THESE PRESENTS, that we _____, hereinafter

called Principal, as Principal, and _____, a corporation of the State of

_____, hereinafter called Surety, as Surety, are held and firmly bound unto

_____, hereinafter called

Obligee in the sum of _____ DOLLARS, lawful money of the United States of America, to be paid to the said Obligee, or its successors or assigns, to the payment of which sum well and truly to be made, we do bind ourselves, our heirs, executors, administrators, successors and assigns, jointly and severally, firmly by these presents.

SIGNED, sealed and dated this _____ day of _____, 201__

WHEREAS, the Principal entered into a contract with the said Obligee, dated _____

_____ for_____

_____ and

WHEREAS, the Obligee requires that these presents be executed on or before the final completion and acceptance of said contract and

WHEREAS said contract was completed and accepted on the _____ day of

_____, 201___.

NOW, THEREFORE, THE CONDITION OF THIS OBLIGATION IS SUCH, that if the Principal shall remedy, without cost to the Obligee, any defects which may develop during a period of _____ from the date of completion and acceptance of the work performed under the contract, caused by defective or inferior materials or workmanship, then this obligation shall be void; otherwise it shall be and remain in full force and effect.

Attest:

_____ By: _____
Principal

Attest:

_____ By: _____
Surety

SECTION 00602

ENVIRONMENTAL MAINTENANCE BOND

KNOW ALL MEN BY THESE PRESENTS: that _____

_____
(Name of Contractor) (Address of Contractor)

_____ a _____
Corporation, Partnership or Individual

hereinafter called Principal, and_____
(Name of Surety)

_____
hereinafter called Surety, are held and firmly bound unto

_____
(Name of Owner)

_____
(Address of Owner)

hereinafter called OWNER, in the penal sum of _____ dollars $_____, in lawful money of the United States, for the payment of which sum will and truly to be made, we bind ourselves, successors, and assigns jointly and severally, firmly by these presents.

THE CONDITION OF THIS OBLIGATION is such that whereas, the Principal entered into a certain contract with the OWNER, dated the _____day of _____20____, a copy of which is hereto attached and made a part hereof for the construction of:

CONTRACT NO. A920

ADMINISTRATION BUILDING REHABILITATION

PASSAIC VALLEY SEWERAGE COMMISSION
600 WILSON AVENUE
NEWARK, NEW JERSEY 07105

NOW, THEREFORE, if the Principal shall well, truly and faithfully perform its duties, all the undertakings, covenants, terms, conditions, and agreements of said contract during the original term thereof, and any extensions thereof which may be granted by the OWNER, with or without notice of the Surety and during the one year guaranty period, and during the one year following the guaranty period, and if he shall satisfy all claims and demands incurred under such contract with respect to Environmental sections of the Specifications and shall fully indemnify and save harmless the OWNER from all costs and damages which it may suffer by reason of failure to do so, and shall reimburse and repay the OWNER all outlay and expense which the OWNER may incur in making good any default; then this obligation shall be void; otherwise to remain in full force and effect.

PROVIDED, FURTHER, that the said Surety for value received hereby stipulates and agrees that no change, extension of time, alteration or addition to the terms of the contract or to the WORK to be performed thereunder or the SPECIFICATIONS accompanying the same shall in any way affect its obligation on this BOND, and it does hereby waive notice of any such change, extension of time, alteration or addition to the terms of the contract or to the WORK or to the SPECIFICATIONS.

PROVIDED, FURTHER, that no final settlement between the OWNER and the CONTRACTOR shall abridge the right of any beneficiary hereunder, whose claim may be unsatisfied.

IN WITNESS WHEREOF, this instrument is executed in _____counterparts,
(number)
each one of which shall be deemed an original, this the _____day of _____, 20_____.

ATTEST: _____
(Principal)

_____
(Principal) Secretary

(SEAL) BY:_____

_____
(Address)

_____

_____
Witness as to Principal

_____
(Address)

_____

_____
(Surety)

ATTEST: By:_____
Attorney-In-Fact

_____ _____
Witness as to Surety (Address)

_____ _____
(Address)

_____

NOTE: Date of BOND must not be prior to date of Contract. If CONTRACTOR is all partners should execute BOND.

The Environmental Maintenance Bond shall be supplied in the amount of $25,000 or 50% of the bid price for the materials needed to fulfill the environmental specifications, whichever is greater, when the contract documents are finalized.

IMPORTANT: Surety companies executing BONDS must appear on the Treasury Department's most current list (Circular 570 as amended) and be authorized to transact business in the State where the PROJECT is located.

This document has important legal consequences; consultation with an attorney is encouraged with respect to its use or modification. This document should be adapted to the particular circumstances of the contemplated Project and the controlling Laws and Regulations.

STANDARD GENERAL CONDITIONS OF THE CONSTRUCTION CONTRACT

Prepared by

ENGINEERS JOINT CONTRACT DOCUMENTS COMMITTEE

and

Issued and Published Jointly by

ACEC
American Council of Engineering Companies

ASCE American Society of Civil Engineers

National Society of Professional Engineers
Professional Engineers in Private Practice

AMERICAN COUNCIL OF ENGINEERING COMPANIES

ASSOCIATED GENERAL CONTRACTORS OF AMERICA

AMERICAN SOCIETY OF CIVIL ENGINEERS

PROFESSIONAL ENGINEERS IN PRIVATE PRACTICE
A Practice Division of the
NATIONAL SOCIETY OF PROFESSIONAL ENGINEERS

Endorsed by

CSI

CONSTRUCTION SPECIFICATIONS INSTITUTE

These General Conditions have been prepared for use with the Suggested Forms of Agreement Between Owner and Contractor (EJCDC C-520 or C-525, 2007 Editions). Their provisions are interrelated and a change in one may necessitate a change in the other. Comments concerning their usage are contained in the Narrative Guide to the EJCDC Construction Documents (EJCDC C-001, 2007 Edition). For guidance in the preparation of Supplementary Conditions, see Guide to the Preparation of Supplementary Conditions (EJCDC C-800, 2007 Edition).

STANDARD GENERAL CONDITIONS OF THE CONSTRUCTION CONTRACT

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ARTICLE 1 – DEFINITIONS AND TERMINOLOGY

1.01 *Defined Terms*

A. Wherever used in the Bidding Requirements or Contract Documents and printed with initial capital letters, the terms listed below will have the meanings indicated which are applicable to both the singular and plural thereof. In addition to terms specifically defined, terms with initial capital letters in the Contract Documents include references to identified articles and paragraphs, and the titles of other documents or forms.

1. *Addenda*—Written or graphic instruments issued prior to the opening of Bids which clarify, correct, or change the Bidding Requirements or the proposed Contract Documents.

2. *Agreement*—The written instrument which is evidence of the agreement between Owner and Contractor covering the Work.

3. *Application for Payment*—The form acceptable to Engineer which is to be used by Contractor during the course of the Work in requesting progress or final payments and which is to be accompanied by such supporting documentation as is required by the Contract Documents.

4. *Asbestos*—Any material that contains more than one percent asbestos and is friable or is releasing asbestos fibers into the air above current action levels established by the United States Occupational Safety and Health Administration.

5. *Bid*—The offer or proposal of a Bidder submitted on the prescribed form setting forth the prices for the Work to be performed.

6. *Bidder*—The individual or entity who submits a Bid directly to Owner.

7. *Bidding Documents*—The Bidding Requirements and the proposed Contract Documents (including all Addenda).

8. *Bidding Requirements*—The advertisement or invitation to bid, Instructions to Bidders, Bid security of acceptable form, if any, and the Bid Form with any supplements.

9. *Change Order*—A document recommended by Engineer which is signed by Contractor and Owner and authorizes an addition, deletion, or revision in the Work or an adjustment in the Contract Price or the Contract Times, issued on or after the Effective Date of the Agreement.

10. *Claim*—A demand or assertion by Owner or Contractor seeking an adjustment of Contract Price or Contract Times, or both, or other relief with respect to the terms of the Contract. A demand for money or services by a third party is not a Claim.

11. *Contract*—The entire and integrated written agreement between the Owner and Contractor concerning the Work. The Contract supersedes prior negotiations, representations, or agreements, whether written or oral.

12. *Contract Documents*—Those items so designated in the Agreement. Only printed or hard copies of the items listed in the Agreement are Contract Documents. Approved Shop Drawings, other Contractor submittals, and the reports and drawings of subsurface and physical conditions are not Contract Documents.

13. *Contract Price*—The moneys payable by Owner to Contractor for completion of the Work in accordance with the Contract Documents as stated in the Agreement (subject to the provisions of Paragraph 11.03 in the case of Unit Price Work).

14. *Contract Times*—The number of days or the dates stated in the Agreement to: (i) achieve Milestones, if any; (ii) achieve Substantial Completion; and (iii) complete the Work so that it is ready for final payment as evidenced by Engineer's written recommendation of final payment.

15. *Contractor*—The individual or entity with whom Owner has entered into the Agreement.

16. *Cost of the Work*—See Paragraph 11.01 for definition.

17. *Drawings*—That part of the Contract Documents prepared or approved by Engineer which graphically shows the scope, extent, and character of the Work to be performed by Contractor. Shop Drawings and other Contractor submittals are not Drawings as so defined.

18. *Effective Date of the Agreement*—The date indicated in the Agreement on which it becomes effective, but if no such date is indicated, it means the date on which the Agreement is signed and delivered by the last of the two parties to sign and deliver.

19. *Engineer*—The individual or entity named as such in the Agreement.

20. *Field Order*—A written order issued by Engineer which requires minor changes in the Work but which does not involve a change in the Contract Price or the Contract Times.

21. *General Requirements*—Sections of Division 1 of the Specifications.

22. *Hazardous Environmental Condition*—The presence at the Site of Asbestos, PCBs, Petroleum, Hazardous Waste, or Radioactive Material in such quantities or circumstances that may present a substantial danger to persons or property exposed thereto.

23. *Hazardous Waste*—The term Hazardous Waste shall have the meaning provided in Section 1004 of the Solid Waste Disposal Act (42 USC Section 6903) as amended from time to time.

24. *Laws and Regulations; Laws or Regulations*—Any and all applicable laws, rules, regulations, ordinances, codes, and orders of any and all governmental bodies, agencies, authorities, and courts having jurisdiction.

25. *Liens*—Charges, security interests, or encumbrances upon Project funds, real property, or personal property.

26. *Milestone*—A principal event specified in the Contract Documents relating to an intermediate completion date or time prior to Substantial Completion of all the Work.

27. *Notice of Award*—The written notice by Owner to the Successful Bidder stating that upon timely compliance by the Successful Bidder with the conditions precedent listed therein, Owner will sign and deliver the Agreement.

28. *Notice to Proceed*—A written notice given by Owner to Contractor fixing the date on which the Contract Times will commence to run and on which Contractor shall start to perform the Work under the Contract Documents.

29. *Owner*—The individual or entity with whom Contractor has entered into the Agreement and for whom the Work is to be performed.

30. *PCBs*—Polychlorinated biphenyls.

31. *Petroleum*—Petroleum, including crude oil or any fraction thereof which is liquid at standard conditions of temperature and pressure (60 degrees Fahrenheit and 14.7 pounds per square inch absolute), such as oil, petroleum, fuel oil, oil sludge, oil refuse, gasoline, kerosene, and oil mixed with other non-Hazardous Waste and crude oils.

32. *Progress Schedule*—A schedule, prepared and maintained by Contractor, describing the sequence and duration of the activities comprising the Contractor's plan to accomplish the Work within the Contract Times.

33. *Project*—The total construction of which the Work to be performed under the Contract Documents may be the whole, or a part.

34. *Project Manual*—The bound documentary information prepared for bidding and constructing the Work. A listing of the contents of the Project Manual, which may be bound in one or more volumes, is contained in the table(s) of contents.

35. *Radioactive Material*—Source, special nuclear, or byproduct material as defined by the Atomic Energy Act of 1954 (42 USC Section 2011 et seq.) as amended from time to time.

36. *Resident Project Representative*—The authorized representative of Engineer who may be assigned to the Site or any part thereof.

37. *Samples*—Physical examples of materials, equipment, or workmanship that are representative of some portion of the Work and which establish the standards by which such portion of the Work will be judged.

38. *Schedule of Submittals*—A schedule, prepared and maintained by Contractor, of required submittals and the time requirements to support scheduled performance of related construction activities.

39. *Schedule of Values*—A schedule, prepared and maintained by Contractor, allocating portions of the Contract Price to various portions of the Work and used as the basis for reviewing Contractor's Applications for Payment.

40. *Shop Drawings*—All drawings, diagrams, illustrations, schedules, and other data or information which are specifically prepared or assembled by or for Contractor and submitted by Contractor to illustrate some portion of the Work.

41. *Site*—Lands or areas indicated in the Contract Documents as being furnished by Owner upon which the Work is to be performed, including rights-of-way and easements for access thereto, and such other lands furnished by Owner which are designated for the use of Contractor.

42. *Specifications*—That part of the Contract Documents consisting of written requirements for materials, equipment, systems, standards and workmanship as applied to the Work, and certain administrative requirements and procedural matters applicable thereto.

43. *Subcontractor*—An individual or entity having a direct contract with Contractor or with any other Subcontractor for the performance of a part of the Work at the Site.

44. *Substantial Completion*—The time at which the Work (or a specified part thereof) has progressed to the point where, in the opinion of Engineer, the Work (or a specified part thereof) is sufficiently complete, in accordance with the Contract Documents, so that the Work (or a specified part thereof) can be utilized for the purposes for which it is intended. The terms "substantially complete" and "substantially completed" as applied to all or part of the Work refer to Substantial Completion thereof.

45. *Successful Bidder*—The Bidder submitting a responsive Bid to whom Owner makes an award.

46. *Supplementary Conditions*—That part of the Contract Documents which amends or supplements these General Conditions.

47. *Supplier*—A manufacturer, fabricator, supplier, distributor, materialman, or vendor having a direct contract with Contractor or with any Subcontractor to furnish materials or equipment to be incorporated in the Work by Contractor or Subcontractor.

48. *Underground Facilities*—All underground pipelines, conduits, ducts, cables, wires, manholes, vaults, tanks, tunnels, or other such facilities or attachments, and any encasements containing such facilities, including those that convey electricity, gases, steam, liquid petroleum products, telephone or other communications, cable television, water, wastewater, storm water, other liquids or chemicals, or traffic or other control systems.

49. *Unit Price Work*—Work to be paid for on the basis of unit prices.

50. *Work*—The entire construction or the various separately identifiable parts thereof required to be provided under the Contract Documents. Work includes and is the result of performing or providing all labor, services, and documentation necessary to produce such construction, and furnishing, installing, and incorporating all materials and equipment into such construction, all as required by the Contract Documents.

51. *Work Change Directive*—A written statement to Contractor issued on or after the Effective Date of the Agreement and signed by Owner and recommended by Engineer ordering an

addition, deletion, or revision in the Work, or responding to differing or unforeseen subsurface or physical conditions under which the Work is to be performed or to emergencies. A Work Change Directive will not change the Contract Price or the Contract Times but is evidence that the parties expect that the change ordered or documented by a Work Change Directive will be incorporated in a subsequently issued Change Order following negotiations by the parties as to its effect, if any, on the Contract Price or Contract Times.

1.02 *Terminology*

A. The words and terms discussed in Paragraph 1.02.B through F are not defined but, when used in the Bidding Requirements or Contract Documents, have the indicated meaning.

B. *Intent of Certain Terms or Adjectives:*

1. The Contract Documents include the terms "as allowed," "as approved," "as ordered," "as directed" or terms of like effect or import to authorize an exercise of professional judgment by Engineer. In addition, the adjectives "reasonable," "suitable," "acceptable," "proper," "satisfactory," or adjectives of like effect or import are used to describe an action or determination of Engineer as to the Work. It is intended that such exercise of professional judgment, action, or determination will be solely to evaluate, in general, the Work for compliance with the information in the Contract Documents and with the design concept of the Project as a functioning whole as shown or indicated in the Contract Documents (unless there is a specific statement indicating otherwise). The use of any such term or adjective is not intended to and shall not be effective to assign to Engineer any duty or authority to supervise or direct the performance of the Work, or any duty or authority to undertake responsibility contrary to the provisions of Paragraph 9.09 or any other provision of the Contract Documents.

C. *Day:*

1. The word "day" means a calendar day of 24 hours measured from midnight to the next midnight.

D. *Defective:*

1. The word "defective," when modifying the word "Work," refers to Work that is unsatisfactory, faulty, or deficient in that it:

a. does not conform to the Contract Documents; or

b. does not meet the requirements of any applicable inspection, reference standard, test, or approval referred to in the Contract Documents; or

c. has been damaged prior to Engineer's recommendation of final payment (unless responsibility for the protection thereof has been assumed by Owner at Substantial Completion in accordance with Paragraph 14.04 or 14.05).

E. *Furnish, Install, Perform, Provide:*

1. The word "furnish," when used in connection with services, materials, or equipment, shall mean to supply and deliver said services, materials, or equipment to the Site (or some other specified location) ready for use or installation and in usable or operable condition.

2. The word "install," when used in connection with services, materials, or equipment, shall mean to put into use or place in final position said services, materials, or equipment complete and ready for intended use.

3. The words "perform" or "provide," when used in connection with services, materials, or equipment, shall mean to furnish and install said services, materials, or equipment complete and ready for intended use.

4. When "furnish," "install," "perform," or "provide" is not used in connection with services, materials, or equipment in a context clearly requiring an obligation of Contractor, "provide" is implied.

F. Unless stated otherwise in the Contract Documents, words or phrases that have a well-known technical or construction industry or trade meaning are used in the Contract Documents in accordance with such recognized meaning.

ARTICLE 2 – PRELIMINARY MATTERS

2.01 *Delivery of Bonds and Evidence of Insurance*

A. When Contractor delivers the executed counterparts of the Agreement to Owner, Contractor shall also deliver to Owner such bonds as Contractor may be required to furnish.

B. *Evidence of Insurance:* Before any Work at the Site is started, Contractor and Owner shall each deliver to the other, with copies to each additional insured identified in the Supplementary Conditions, certificates of insurance (and other evidence of insurance which either of them or any additional insured may reasonably request) which Contractor and Owner respectively are required to purchase and maintain in accordance with Article 5.

2.02 *Copies of Documents*

A. Owner shall furnish to Contractor up to ten printed or hard copies of the Drawings and Project Manual. Additional copies will be furnished upon request at the cost of reproduction.

2.03 *Commencement of Contract Times; Notice to Proceed*

A. The Contract Times will commence to run on the thirtieth day after the Effective Date of the Agreement or, if a Notice to Proceed is given, on the day indicated in the Notice to Proceed. A Notice to Proceed may be given at any time within 30 days after the Effective Date of the Agreement. In no event will the Contract Times commence to run later than the sixtieth day after the day of Bid opening or the thirtieth day after the Effective Date of the Agreement, whichever date is earlier.

2.04 *Starting the Work*

A. Contractor shall start to perform the Work on the date when the Contract Times commence to run. No Work shall be done at the Site prior to the date on which the Contract Times commence to run.

2.05 *Before Starting Construction*

A. *Preliminary Schedules:* Within 10 days after the Effective Date of the Agreement (unless otherwise specified in the General Requirements), Contractor shall submit to Engineer for timely review:

1. a preliminary Progress Schedule indicating the times (numbers of days or dates) for starting and completing the various stages of the Work, including any Milestones specified in the Contract Documents;

2. a preliminary Schedule of Submittals; and

3. a preliminary Schedule of Values for all of the Work which includes quantities and prices of items which when added together equal the Contract Price and subdivides the Work into component parts in sufficient detail to serve as the basis for progress payments during performance of the Work. Such prices will include an appropriate amount of overhead and profit applicable to each item of Work.

2.06 *Preconstruction Conference; Designation of Authorized Representatives*

A. Before any Work at the Site is started, a conference attended by Owner, Contractor, Engineer, and others as appropriate will be held to establish a working understanding among the parties as to the Work and to discuss the schedules referred to in Paragraph 2.05.A, procedures for handling Shop Drawings and other submittals, processing Applications for Payment, and maintaining required records.

B. At this conference Owner and Contractor each shall designate, in writing, a specific individual to act as its authorized representative with respect to the services and responsibilities under the Contract. Such individuals shall have the authority to transmit instructions, receive information, render decisions relative to the Contract, and otherwise act on behalf of each respective party.

2.07 *Initial Acceptance of Schedules*

A. At least 10 days before submission of the first Application for Payment a conference attended by Contractor, Engineer, and others as appropriate will be held to review for acceptability to Engineer as provided below the schedules submitted in accordance with Paragraph 2.05.A. Contractor shall have an additional 10 days to make corrections and adjustments and to complete and resubmit the schedules. No progress payment shall be made to Contractor until acceptable schedules are submitted to Engineer.

1. The Progress Schedule will be acceptable to Engineer if it provides an orderly progression of the Work to completion within the Contract Times. Such acceptance will not impose on Engineer responsibility for the Progress Schedule, for sequencing, scheduling, or progress of

the Work, nor interfere with or relieve Contractor from Contractor's full responsibility therefor.

2. Contractor's Schedule of Submittals will be acceptable to Engineer if it provides a workable arrangement for reviewing and processing the required submittals.

3. Contractor's Schedule of Values will be acceptable to Engineer as to form and substance if it provides a reasonable allocation of the Contract Price to component parts of the Work.

ARTICLE 3 – CONTRACT DOCUMENTS: INTENT, AMENDING, REUSE

3.01 *Intent*

A. The Contract Documents are complementary; what is required by one is as binding as if required by all.

B. It is the intent of the Contract Documents to describe a functionally complete project (or part thereof) to be constructed in accordance with the Contract Documents. Any labor, documentation, services, materials, or equipment that reasonably may be inferred from the Contract Documents or from prevailing custom or trade usage as being required to produce the indicated result will be provided whether or not specifically called for, at no additional cost to Owner.

C. Clarifications and interpretations of the Contract Documents shall be issued by Engineer as provided in Article 9.

3.02 *Reference Standards*

A. Standards, Specifications, Codes, Laws, and Regulations

1. Reference to standards, specifications, manuals, or codes of any technical society, organization, or association, or to Laws or Regulations, whether such reference be specific or by implication, shall mean the standard, specification, manual, code, or Laws or Regulations in effect at the time of opening of Bids (or on the Effective Date of the Agreement if there were no Bids), except as may be otherwise specifically stated in the Contract Documents.

2. No provision of any such standard, specification, manual, or code, or any instruction of a Supplier, shall be effective to change the duties or responsibilities of Owner, Contractor, or Engineer, or any of their subcontractors, consultants, agents, or employees, from those set forth in the Contract Documents. No such provision or instruction shall be effective to assign to Owner, Engineer, or any of their officers, directors, members, partners, employees, agents, consultants, or subcontractors, any duty or authority to supervise or direct the performance of the Work or any duty or authority to undertake responsibility inconsistent with the provisions of the Contract Documents.

3.03 *Reporting and Resolving Discrepancies*

A. *Reporting Discrepancies:*

1. *Contractor's Review of Contract Documents Before Starting Work*: Before undertaking each part of the Work, Contractor shall carefully study and compare the Contract Documents and check and verify pertinent figures therein and all applicable field measurements. Contractor shall promptly report in writing to Engineer any conflict, error, ambiguity, or discrepancy which Contractor discovers, or has actual knowledge of, and shall obtain a written interpretation or clarification from Engineer before proceeding with any Work affected thereby.

2. *Contractor's Review of Contract Documents During Performance of Work*: If, during the performance of the Work, Contractor discovers any conflict, error, ambiguity, or discrepancy within the Contract Documents, or between the Contract Documents and (a) any applicable Law or Regulation , (b) any standard, specification, manual, or code, or (c) any instruction of any Supplier, then Contractor shall promptly report it to Engineer in writing. Contractor shall not proceed with the Work affected thereby (except in an emergency as required by Paragraph 6.16.A) until an amendment or supplement to the Contract Documents has been issued by one of the methods indicated in Paragraph 3.04.

3. Contractor shall not be liable to Owner or Engineer for failure to report any conflict, error, ambiguity, or discrepancy in the Contract Documents unless Contractor had actual knowledge thereof.

B. *Resolving Discrepancies:*

1. Except as may be otherwise specifically stated in the Contract Documents, the provisions of the Contract Documents shall take precedence in resolving any conflict, error, ambiguity, or discrepancy between the provisions of the Contract Documents and:

   a. the provisions of any standard, specification, manual, or code, or the instruction of any Supplier (whether or not specifically incorporated by reference in the Contract Documents); or

   b. the provisions of any Laws or Regulations applicable to the performance of the Work (unless such an interpretation of the provisions of the Contract Documents would result in violation of such Law or Regulation).

3.04 *Amending and Supplementing Contract Documents*

A. The Contract Documents may be amended to provide for additions, deletions, and revisions in the Work or to modify the terms and conditions thereof by either a Change Order or a Work Change Directive.

B. The requirements of the Contract Documents may be supplemented, and minor variations and deviations in the Work may be authorized, by one or more of the following ways:

1. A Field Order;

2. Engineer's approval of a Shop Drawing or Sample (subject to the provisions of Paragraph 6.17.D.3); or

3. Engineer's written interpretation or clarification.

3.05 *Reuse of Documents*

A. Contractor and any Subcontractor or Supplier shall not:

1. have or acquire any title to or ownership rights in any of the Drawings, Specifications, or other documents (or copies of any thereof) prepared by or bearing the seal of Engineer or its consultants, including electronic media editions; or

2. reuse any such Drawings, Specifications, other documents, or copies thereof on extensions of the Project or any other project without written consent of Owner and Engineer and specific written verification or adaptation by Engineer.

B. The prohibitions of this Paragraph 3.05 will survive final payment, or termination of the Contract. Nothing herein shall preclude Contractor from retaining copies of the Contract Documents for record purposes.

3.06 *Electronic Data*

A. Unless otherwise stated in the Supplementary Conditions, the data furnished by Owner or Engineer to Contractor, or by Contractor to Owner or Engineer, that may be relied upon are limited to the printed copies (also known as hard copies). Files in electronic media format of text, data, graphics, or other types are furnished only for the convenience of the receiving party. Any conclusion or information obtained or derived from such electronic files will be at the user's sole risk. If there is a discrepancy between the electronic files and the hard copies, the hard copies govern.

B. Because data stored in electronic media format can deteriorate or be modified inadvertently or otherwise without authorization of the data's creator, the party receiving electronic files agrees that it will perform acceptance tests or procedures within 60 days, after which the receiving party shall be deemed to have accepted the data thus transferred. Any errors detected within the 60-day acceptance period will be corrected by the transferring party.

C. When transferring documents in electronic media format, the transferring party makes no representations as to long term compatibility, usability, or readability of documents resulting from the use of software application packages, operating systems, or computer hardware differing from those used by the data's creator.

ARTICLE 4 – AVAILABILITY OF LANDS; SUBSURFACE AND PHYSICAL CONDITIONS; HAZARDOUS ENVIRONMENTAL CONDITIONS; REFERENCE POINTS

4.01 *Availability of Lands*

A. Owner shall furnish the Site. Owner shall notify Contractor of any encumbrances or restrictions not of general application but specifically related to use of the Site with which Contractor must comply in performing the Work. Owner will obtain in a timely manner and pay for easements for permanent structures or permanent changes in existing facilities. If Contractor and Owner are unable to agree on entitlement to or on the amount or extent, if any, of any adjustment in the

Contract Price or Contract Times, or both, as a result of any delay in Owner's furnishing the Site or a part thereof, Contractor may make a Claim therefor as provided in Paragraph 10.05.

B. Upon reasonable written request, Owner shall furnish Contractor with a current statement of record legal title and legal description of the lands upon which the Work is to be performed and Owner's interest therein as necessary for giving notice of or filing a mechanic's or construction lien against such lands in accordance with applicable Laws and Regulations.

C. Contractor shall provide for all additional lands and access thereto that may be required for temporary construction facilities or storage of materials and equipment.

4.02 *Subsurface and Physical Conditions*

A. *Reports and Drawings:* The Supplementary Conditions identify:

1. those reports known to Owner of explorations and tests of subsurface conditions at or contiguous to the Site; and

2. those drawings known to Owner of physical conditions relating to existing surface or subsurface structures at the Site (except Underground Facilities).

B. *Limited Reliance by Contractor on Technical Data Authorized:* Contractor may rely upon the accuracy of the "technical data" contained in such reports and drawings, but such reports and drawings are not Contract Documents. Such "technical data" is identified in the Supplementary Conditions. Except for such reliance on such "technical data," Contractor may not rely upon or make any claim against Owner or Engineer, or any of their officers, directors, members, partners, employees, agents, consultants, or subcontractors with respect to:

1. the completeness of such reports and drawings for Contractor's purposes, including, but not limited to, any aspects of the means, methods, techniques, sequences, and procedures of construction to be employed by Contractor, and safety precautions and programs incident thereto; or

2. other data, interpretations, opinions, and information contained in such reports or shown or indicated in such drawings; or

3. any Contractor interpretation of or conclusion drawn from any "technical data" or any such other data, interpretations, opinions, or information.

4.03 *Differing Subsurface or Physical Conditions*

A. *Notice:* If Contractor believes that any subsurface or physical condition that is uncovered or revealed either:

1. is of such a nature as to establish that any "technical data" on which Contractor is entitled to rely as provided in Paragraph 4.02 is materially inaccurate; or

2. is of such a nature as to require a change in the Contract Documents; or

3. differs materially from that shown or indicated in the Contract Documents; or

4. is of an unusual nature, and differs materially from conditions ordinarily encountered and generally recognized as inherent in work of the character provided for in the Contract Documents;

then Contractor shall, promptly after becoming aware thereof and before further disturbing the subsurface or physical conditions or performing any Work in connection therewith (except in an emergency as required by Paragraph 6.16.A), notify Owner and Engineer in writing about such condition. Contractor shall not further disturb such condition or perform any Work in connection therewith (except as aforesaid) until receipt of written order to do so.

B. *Engineer's Review*: After receipt of written notice as required by Paragraph 4.03.A, Engineer will promptly review the pertinent condition, determine the necessity of Owner's obtaining additional exploration or tests with respect thereto, and advise Owner in writing (with a copy to Contractor) of Engineer's findings and conclusions.

C. *Possible Price and Times Adjustments:*

1. The Contract Price or the Contract Times, or both, will be equitably adjusted to the extent that the existence of such differing subsurface or physical condition causes an increase or decrease in Contractor's cost of, or time required for, performance of the Work; subject, however, to the following:

   a. such condition must meet any one or more of the categories described in Paragraph 4.03.A; and

   b. with respect to Work that is paid for on a unit price basis, any adjustment in Contract Price will be subject to the provisions of Paragraphs 9.07 and 11.03.

2. Contractor shall not be entitled to any adjustment in the Contract Price or Contract Times if:

   a. Contractor knew of the existence of such conditions at the time Contractor made a final commitment to Owner with respect to Contract Price and Contract Times by the submission of a Bid or becoming bound under a negotiated contract; or

   b. the existence of such condition could reasonably have been discovered or revealed as a result of any examination, investigation, exploration, test, or study of the Site and contiguous areas required by the Bidding Requirements or Contract Documents to be conducted by or for Contractor prior to Contractor's making such final commitment; or

   c. Contractor failed to give the written notice as required by Paragraph 4.03.A.

3. If Owner and Contractor are unable to agree on entitlement to or on the amount or extent, if any, of any adjustment in the Contract Price or Contract Times, or both, a Claim may be made therefor as provided in Paragraph 10.05. However, neither Owner or Engineer, or any of their officers, directors, members, partners, employees, agents, consultants, or subcontractors shall be liable to Contractor for any claims, costs, losses, or damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other

professionals and all court or arbitration or other dispute resolution costs) sustained by Contractor on or in connection with any other project or anticipated project.

4.04 *Underground Facilities*

A. *Shown or Indicated:* The information and data shown or indicated in the Contract Documents with respect to existing Underground Facilities at or contiguous to the Site is based on information and data furnished to Owner or Engineer by the owners of such Underground Facilities, including Owner, or by others. Unless it is otherwise expressly provided in the Supplementary Conditions:

1. Owner and Engineer shall not be responsible for the accuracy or completeness of any such information or data provided by others; and

2. the cost of all of the following will be included in the Contract Price, and Contractor shall have full responsibility for:

   a. reviewing and checking all such information and data;

   b. locating all Underground Facilities shown or indicated in the Contract Documents;

   c. coordination of the Work with the owners of such Underground Facilities, including Owner, during construction; and

   d. the safety and protection of all such Underground Facilities and repairing any damage thereto resulting from the Work.

B. *Not Shown or Indicated:*

1. If an Underground Facility is uncovered or revealed at or contiguous to the Site which was not shown or indicated, or not shown or indicated with reasonable accuracy in the Contract Documents, Contractor shall, promptly after becoming aware thereof and before further disturbing conditions affected thereby or performing any Work in connection therewith (except in an emergency as required by Paragraph 6.16.A), identify the owner of such Underground Facility and give written notice to that owner and to Owner and Engineer. Engineer will promptly review the Underground Facility and determine the extent, if any, to which a change is required in the Contract Documents to reflect and document the consequences of the existence or location of the Underground Facility. During such time, Contractor shall be responsible for the safety and protection of such Underground Facility.

2. If Engineer concludes that a change in the Contract Documents is required, a Work Change Directive or a Change Order will be issued to reflect and document such consequences. An equitable adjustment shall be made in the Contract Price or Contract Times, or both, to the extent that they are attributable to the existence or location of any Underground Facility that was not shown or indicated or not shown or indicated with reasonable accuracy in the Contract Documents and that Contractor did not know of and could not reasonably have been expected to be aware of or to have anticipated. If Owner and Contractor are unable to agree on entitlement to or on the amount or extent, if any, of any such adjustment in Contract Price

or Contract Times, Owner or Contractor may make a Claim therefor as provided in Paragraph 10.05.

4.05 *Reference Points*

A. Owner shall provide engineering surveys to establish reference points for construction which in Engineer's judgment are necessary to enable Contractor to proceed with the Work. Contractor shall be responsible for laying out the Work, shall protect and preserve the established reference points and property monuments, and shall make no changes or relocations without the prior written approval of Owner. Contractor shall report to Engineer whenever any reference point or property monument is lost or destroyed or requires relocation because of necessary changes in grades or locations, and shall be responsible for the accurate replacement or relocation of such reference points or property monuments by professionally qualified personnel.

4.06 *Hazardous Environmental Condition at Site*

A. *Reports and Drawings:* The Supplementary Conditions identify those reports and drawings known to Owner relating to Hazardous Environmental Conditions that have been identified at the Site.

B. *Limited Reliance by Contractor on Technical Data Authorized:* Contractor may rely upon the accuracy of the "technical data" contained in such reports and drawings, but such reports and drawings are not Contract Documents. Such "technical data" is identified in the Supplementary Conditions. Except for such reliance on such "technical data," Contractor may not rely upon or make any claim against Owner or Engineer, or any of their officers, directors, members, partners, employees, agents, consultants, or subcontractors with respect to:

1. the completeness of such reports and drawings for Contractor's purposes, including, but not limited to, any aspects of the means, methods, techniques, sequences and procedures of construction to be employed by Contractor and safety precautions and programs incident thereto; or

2. other data, interpretations, opinions and information contained in such reports or shown or indicated in such drawings; or

3. any Contractor interpretation of or conclusion drawn from any "technical data" or any such other data, interpretations, opinions or information.

C. Contractor shall not be responsible for any Hazardous Environmental Condition uncovered or revealed at the Site which was not shown or indicated in Drawings or Specifications or identified in the Contract Documents to be within the scope of the Work. Contractor shall be responsible for a Hazardous Environmental Condition created with any materials brought to the Site by Contractor, Subcontractors, Suppliers, or anyone else for whom Contractor is responsible.

D. If Contractor encounters a Hazardous Environmental Condition or if Contractor or anyone for whom Contractor is responsible creates a Hazardous Environmental Condition, Contractor shall immediately: (i) secure or otherwise isolate such condition; (ii) stop all Work in connection with such condition and in any area affected thereby (except in an emergency as required by

Paragraph 6.16.A); and (iii) notify Owner and Engineer (and promptly thereafter confirm such notice in writing). Owner shall promptly consult with Engineer concerning the necessity for Owner to retain a qualified expert to evaluate such condition or take corrective action, if any. Promptly after consulting with Engineer, Owner shall take such actions as are necessary to permit Owner to timely obtain required permits and provide Contractor the written notice required by Paragraph 4.06.E.

E. Contractor shall not be required to resume Work in connection with such condition or in any affected area until after Owner has obtained any required permits related thereto and delivered written notice to Contractor: (i) specifying that such condition and any affected area is or has been rendered safe for the resumption of Work; or (ii) specifying any special conditions under which such Work may be resumed safely. If Owner and Contractor cannot agree as to entitlement to or on the amount or extent, if any, of any adjustment in Contract Price or Contract Times, or both, as a result of such Work stoppage or such special conditions under which Work is agreed to be resumed by Contractor, either party may make a Claim therefor as provided in Paragraph 10.05.

F. If after receipt of such written notice Contractor does not agree to resume such Work based on a reasonable belief it is unsafe, or does not agree to resume such Work under such special conditions, then Owner may order the portion of the Work that is in the area affected by such condition to be deleted from the Work. If Owner and Contractor cannot agree as to entitlement to or on the amount or extent, if any, of an adjustment in Contract Price or Contract Times as a result of deleting such portion of the Work, then either party may make a Claim therefor as provided in Paragraph 10.05. Owner may have such deleted portion of the Work performed by Owner's own forces or others in accordance with Article 7.

G. To the fullest extent permitted by Laws and Regulations, Owner shall indemnify and hold harmless Contractor, Subcontractors, and Engineer, and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to a Hazardous Environmental Condition, provided that such Hazardous Environmental Condition: (i) was not shown or indicated in the Drawings or Specifications or identified in the Contract Documents to be included within the scope of the Work, and (ii) was not created by Contractor or by anyone for whom Contractor is responsible. Nothing in this Paragraph 4.06.G shall obligate Owner to indemnify any individual or entity from and against the consequences of that individual's or entity's own negligence.

H. To the fullest extent permitted by Laws and Regulations, Contractor shall indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to a Hazardous Environmental Condition created by Contractor or by anyone for whom Contractor is responsible. Nothing in this Paragraph 4.06.H shall obligate Contractor to indemnify any individual or entity from and against the consequences of that individual's or entity's own negligence.

I. The provisions of Paragraphs 4.02, 4.03, and 4.04 do not apply to a Hazardous Environmental Condition uncovered or revealed at the Site.

ARTICLE 5 – BONDS AND INSURANCE

5.01 *Performance, Payment, and Other Bonds*

A. Contractor shall furnish performance and payment bonds, each in an amount at least equal to the Contract Price as security for the faithful performance and payment of all of Contractor's obligations under the Contract Documents. These bonds shall remain in effect until one year after the date when final payment becomes due or until completion of the correction period specified in Paragraph 13.07, whichever is later, except as provided otherwise by Laws or Regulations or by the Contract Documents. Contractor shall also furnish such other bonds as are required by the Contract Documents.

B. All bonds shall be in the form prescribed by the Contract Documents except as provided otherwise by Laws or Regulations, and shall be executed by such sureties as are named in the list of "Companies Holding Certificates of Authority as Acceptable Sureties on Federal Bonds and as Acceptable Reinsuring Companies" as published in Circular 570 (amended) by the Financial Management Service, Surety Bond Branch, U.S. Department of the Treasury. All bonds signed by an agent or attorney-in-fact must be accompanied by a certified copy of that individual's authority to bind the surety. The evidence of authority shall show that it is effective on the date the agent or attorney-in-fact signed each bond.

C. If the surety on any bond furnished by Contractor is declared bankrupt or becomes insolvent or its right to do business is terminated in any state where any part of the Project is located or it ceases to meet the requirements of Paragraph 5.01.B, Contractor shall promptly notify Owner and Engineer and shall, within 20 days after the event giving rise to such notification, provide another bond and surety, both of which shall comply with the requirements of Paragraphs 5.01.B and 5.02.

5.02 *Licensed Sureties and Insurers*

A. All bonds and insurance required by the Contract Documents to be purchased and maintained by Owner or Contractor shall be obtained from surety or insurance companies that are duly licensed or authorized in the jurisdiction in which the Project is located to issue bonds or insurance policies for the limits and coverages so required. Such surety and insurance companies shall also meet such additional requirements and qualifications as may be provided in the Supplementary Conditions.

5.03 *Certificates of Insurance*

A. Contractor shall deliver to Owner, with copies to each additional insured and loss payee identified in the Supplementary Conditions, certificates of insurance (and other evidence of insurance requested by Owner or any other additional insured) which Contractor is required to purchase and maintain.

B. Owner shall deliver to Contractor, with copies to each additional insured and loss payee identified in the Supplementary Conditions, certificates of insurance (and other evidence of insurance requested by Contractor or any other additional insured) which Owner is required to purchase and maintain.

C. Failure of Owner to demand such certificates or other evidence of Contractor's full compliance with these insurance requirements or failure of Owner to identify a deficiency in compliance from the evidence provided shall not be construed as a waiver of Contractor's obligation to maintain such insurance.

D. Owner does not represent that insurance coverage and limits established in this Contract necessarily will be adequate to protect Contractor.

E. The insurance and insurance limits required herein shall not be deemed as a limitation on Contractor's liability under the indemnities granted to Owner in the Contract Documents.

5.04 *Contractor's Insurance*

A. Contractor shall purchase and maintain such insurance as is appropriate for the Work being performed and as will provide protection from claims set forth below which may arise out of or result from Contractor's performance of the Work and Contractor's other obligations under the Contract Documents, whether it is to be performed by Contractor, any Subcontractor or Supplier, or by anyone directly or indirectly employed by any of them to perform any of the Work, or by anyone for whose acts any of them may be liable:

1. claims under workers' compensation, disability benefits, and other similar employee benefit acts;

2. claims for damages because of bodily injury, occupational sickness or disease, or death of Contractor's employees;

3. claims for damages because of bodily injury, sickness or disease, or death of any person other than Contractor's employees;

4. claims for damages insured by reasonably available personal injury liability coverage which are sustained:

   a. by any person as a result of an offense directly or indirectly related to the employment of such person by Contractor, or

   b. by any other person for any other reason;

5. claims for damages, other than to the Work itself, because of injury to or destruction of tangible property wherever located, including loss of use resulting therefrom; and

6. claims for damages because of bodily injury or death of any person or property damage arising out of the ownership, maintenance or use of any motor vehicle.

B. The policies of insurance required by this Paragraph 5.04 shall:

1. with respect to insurance required by Paragraphs 5.04.A.3 through 5.04.A.6 inclusive, be written on an occurrence basis, include as additional insureds (subject to any customary exclusion regarding professional liability) Owner and Engineer, and any other individuals or entities identified in the Supplementary Conditions, all of whom shall be listed as additional insureds, and include coverage for the respective officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of all such additional insureds, and the insurance afforded to these additional insureds shall provide primary coverage for all claims covered thereby;

2. include at least the specific coverages and be written for not less than the limits of liability provided in the Supplementary Conditions or required by Laws or Regulations, whichever is greater;

3. include contractual liability insurance covering Contractor's indemnity obligations under Paragraphs 6.11 and 6.20;

4. contain a provision or endorsement that the coverage afforded will not be canceled, materially changed or renewal refused until at least 30 days prior written notice has been given to Owner and Contractor and to each other additional insured identified in the Supplementary Conditions to whom a certificate of insurance has been issued (and the certificates of insurance furnished by the Contractor pursuant to Paragraph 5.03 will so provide);

5. remain in effect at least until final payment and at all times thereafter when Contractor may be correcting, removing, or replacing defective Work in accordance with Paragraph 13.07; and

6. include completed operations coverage:

    a. Such insurance shall remain in effect for two years after final payment.

    b. Contractor shall furnish Owner and each other additional insured identified in the Supplementary Conditions, to whom a certificate of insurance has been issued, evidence satisfactory to Owner and any such additional insured of continuation of such insurance at final payment and one year thereafter.

5.05 *Owner's Liability Insurance*

A. In addition to the insurance required to be provided by Contractor under Paragraph 5.04, Owner, at Owner's option, may purchase and maintain at Owner's expense Owner's own liability insurance as will protect Owner against claims which may arise from operations under the Contract Documents.

5.06 *Property Insurance*

A. Unless otherwise provided in the Supplementary Conditions, Owner shall purchase and maintain property insurance upon the Work at the Site in the amount of the full replacement cost thereof (subject to such deductible amounts as may be provided in the Supplementary Conditions or required by Laws and Regulations). This insurance shall:

1. include the interests of Owner, Contractor, Subcontractors, and Engineer, and any other individuals or entities identified in the Supplementary Conditions, and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them, each of whom is deemed to have an insurable interest and shall be listed as a loss payee;

2. be written on a Builder's Risk "all-risk" policy form that shall at least include insurance for physical loss or damage to the Work, temporary buildings, falsework, and materials and equipment in transit, and shall insure against at least the following perils or causes of loss: fire, lightning, extended coverage, theft, vandalism and malicious mischief, earthquake, collapse, debris removal, demolition occasioned by enforcement of Laws and Regulations, water damage (other than that caused by flood), and such other perils or causes of loss as may be specifically required by the Supplementary Conditions.

3. include expenses incurred in the repair or replacement of any insured property (including but not limited to fees and charges of engineers and architects);

4. cover materials and equipment stored at the Site or at another location that was agreed to in writing by Owner prior to being incorporated in the Work, provided that such materials and equipment have been included in an Application for Payment recommended by Engineer;

5. allow for partial utilization of the Work by Owner;

6. include testing and startup; and

7. be maintained in effect until final payment is made unless otherwise agreed to in writing by Owner, Contractor, and Engineer with 30 days written notice to each other loss payee to whom a certificate of insurance has been issued.

B. Owner shall purchase and maintain such equipment breakdown insurance or additional property insurance as may be required by the Supplementary Conditions or Laws and Regulations which will include the interests of Owner, Contractor, Subcontractors, and Engineer, and any other individuals or entities identified in the Supplementary Conditions, and the officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them, each of whom is deemed to have an insurable interest and shall be listed as a loss payee.

C. All the policies of insurance (and the certificates or other evidence thereof) required to be purchased and maintained in accordance with this Paragraph 5.06 will contain a provision or endorsement that the coverage afforded will not be canceled or materially changed or renewal refused until at least 30 days prior written notice has been given to Owner and Contractor and to each other loss payee to whom a certificate of insurance has been issued and will contain waiver provisions in accordance with Paragraph 5.07.

D. Owner shall not be responsible for purchasing and maintaining any property insurance specified in this Paragraph 5.06 to protect the interests of Contractor, Subcontractors, or others in the Work to the extent of any deductible amounts that are identified in the Supplementary Conditions. The risk of loss within such identified deductible amount will be borne by Contractor, Subcontractors, or others suffering any such loss, and if any of them wishes property

insurance coverage within the limits of such amounts, each may purchase and maintain it at the purchaser's own expense.

E. If Contractor requests in writing that other special insurance be included in the property insurance policies provided under this Paragraph 5.06, Owner shall, if possible, include such insurance, and the cost thereof will be charged to Contractor by appropriate Change Order. Prior to commencement of the Work at the Site, Owner shall in writing advise Contractor whether or not such other insurance has been procured by Owner.

5.07 *Waiver of Rights*

A. Owner and Contractor intend that all policies purchased in accordance with Paragraph 5.06 will protect Owner, Contractor, Subcontractors, and Engineer, and all other individuals or entities identified in the Supplementary Conditions as loss payees (and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them) in such policies and will provide primary coverage for all losses and damages caused by the perils or causes of loss covered thereby. All such policies shall contain provisions to the effect that in the event of payment of any loss or damage the insurers will have no rights of recovery against any of the insureds or loss payees thereunder. Owner and Contractor waive all rights against each other and their respective officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them for all losses and damages caused by, arising out of or resulting from any of the perils or causes of loss covered by such policies and any other property insurance applicable to the Work; and, in addition, waive all such rights against Subcontractors and Engineer, and all other individuals or entities identified in the Supplementary Conditions as loss payees (and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them) under such policies for losses and damages so caused. None of the above waivers shall extend to the rights that any party making such waiver may have to the proceeds of insurance held by Owner as trustee or otherwise payable under any policy so issued.

B. Owner waives all rights against Contractor, Subcontractors, and Engineer, and the officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them for:

1. loss due to business interruption, loss of use, or other consequential loss extending beyond direct physical loss or damage to Owner's property or the Work caused by, arising out of, or resulting from fire or other perils whether or not insured by Owner; and

2. loss or damage to the completed Project or part thereof caused by, arising out of, or resulting from fire or other insured peril or cause of loss covered by any property insurance maintained on the completed Project or part thereof by Owner during partial utilization pursuant to Paragraph 14.05, after Substantial Completion pursuant to Paragraph 14.04, or after final payment pursuant to Paragraph 14.07.

C. Any insurance policy maintained by Owner covering any loss, damage or consequential loss referred to in Paragraph 5.07.B shall contain provisions to the effect that in the event of payment of any such loss, damage, or consequential loss, the insurers will have no rights of recovery

against Contractor, Subcontractors, or Engineer, and the officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them.

5.08 *Receipt and Application of Insurance Proceeds*

A. Any insured loss under the policies of insurance required by Paragraph 5.06 will be adjusted with Owner and made payable to Owner as fiduciary for the loss payees, as their interests may appear, subject to the requirements of any applicable mortgage clause and of Paragraph 5.08.B. Owner shall deposit in a separate account any money so received and shall distribute it in accordance with such agreement as the parties in interest may reach. If no other special agreement is reached, the damaged Work shall be repaired or replaced, the moneys so received applied on account thereof, and the Work and the cost thereof covered by an appropriate Change Order.

B. Owner as fiduciary shall have power to adjust and settle any loss with the insurers unless one of the parties in interest shall object in writing within 15 days after the occurrence of loss to Owner's exercise of this power. If such objection be made, Owner as fiduciary shall make settlement with the insurers in accordance with such agreement as the parties in interest may reach. If no such agreement among the parties in interest is reached, Owner as fiduciary shall adjust and settle the loss with the insurers and, if required in writing by any party in interest, Owner as fiduciary shall give bond for the proper performance of such duties.

5.09 *Acceptance of Bonds and Insurance; Option to Replace*

A. If either Owner or Contractor has any objection to the coverage afforded by or other provisions of the bonds or insurance required to be purchased and maintained by the other party in accordance with Article 5 on the basis of non-conformance with the Contract Documents, the objecting party shall so notify the other party in writing within 10 days after receipt of the certificates (or other evidence requested) required by Paragraph 2.01.B. Owner and Contractor shall each provide to the other such additional information in respect of insurance provided as the other may reasonably request. If either party does not purchase or maintain all of the bonds and insurance required of such party by the Contract Documents, such party shall notify the other party in writing of such failure to purchase prior to the start of the Work, or of such failure to maintain prior to any change in the required coverage. Without prejudice to any other right or remedy, the other party may elect to obtain equivalent bonds or insurance to protect such other party's interests at the expense of the party who was required to provide such coverage, and a Change Order shall be issued to adjust the Contract Price accordingly.

5.10 *Partial Utilization, Acknowledgment of Property Insurer*

A. If Owner finds it necessary to occupy or use a portion or portions of the Work prior to Substantial Completion of all the Work as provided in Paragraph 14.05, no such use or occupancy shall commence before the insurers providing the property insurance pursuant to Paragraph 5.06 have acknowledged notice thereof and in writing effected any changes in coverage necessitated thereby. The insurers providing the property insurance shall consent by endorsement on the policy or policies, but the property insurance shall not be canceled or permitted to lapse on account of any such partial use or occupancy.

ARTICLE 6 – CONTRACTOR'S RESPONSIBILITIES

6.01 *Supervision and Superintendence*

A. Contractor shall supervise, inspect, and direct the Work competently and efficiently, devoting such attention thereto and applying such skills and expertise as may be necessary to perform the Work in accordance with the Contract Documents. Contractor shall be solely responsible for the means, methods, techniques, sequences, and procedures of construction. Contractor shall not be responsible for the negligence of Owner or Engineer in the design or specification of a specific means, method, technique, sequence, or procedure of construction which is shown or indicated in and expressly required by the Contract Documents.

B. At all times during the progress of the Work, Contractor shall assign a competent resident superintendent who shall not be replaced without written notice to Owner and Engineer except under extraordinary circumstances.

6.02 *Labor; Working Hours*

A. Contractor shall provide competent, suitably qualified personnel to survey and lay out the Work and perform construction as required by the Contract Documents. Contractor shall at all times maintain good discipline and order at the Site.

B. Except as otherwise required for the safety or protection of persons or the Work or property at the Site or adjacent thereto, and except as otherwise stated in the Contract Documents, all Work at the Site shall be performed during regular working hours. Contractor will not permit the performance of Work on a Saturday, Sunday, or any legal holiday without Owner's written consent (which will not be unreasonably withheld) given after prior written notice to Engineer.

6.03 *Services, Materials, and Equipment*

A. Unless otherwise specified in the Contract Documents, Contractor shall provide and assume full responsibility for all services, materials, equipment, labor, transportation, construction equipment and machinery, tools, appliances, fuel, power, light, heat, telephone, water, sanitary facilities, temporary facilities, and all other facilities and incidentals necessary for the performance, testing, start-up, and completion of the Work.

B. All materials and equipment incorporated into the Work shall be as specified or, if not specified, shall be of good quality and new, except as otherwise provided in the Contract Documents. All special warranties and guarantees required by the Specifications shall expressly run to the benefit of Owner. If required by Engineer, Contractor shall furnish satisfactory evidence (including reports of required tests) as to the source, kind, and quality of materials and equipment.

C. All materials and equipment shall be stored, applied, installed, connected, erected, protected, used, cleaned, and conditioned in accordance with instructions of the applicable Supplier, except as otherwise may be provided in the Contract Documents.

6.04 *Progress Schedule*

A. Contractor shall adhere to the Progress Schedule established in accordance with Paragraph 2.07 as it may be adjusted from time to time as provided below.

1. Contractor shall submit to Engineer for acceptance (to the extent indicated in Paragraph 2.07) proposed adjustments in the Progress Schedule that will not result in changing the Contract Times. Such adjustments will comply with any provisions of the General Requirements applicable thereto.

2. Proposed adjustments in the Progress Schedule that will change the Contract Times shall be submitted in accordance with the requirements of Article 12. Adjustments in Contract Times may only be made by a Change Order.

6.05 *Substitutes and "Or-Equals"*

A. Whenever an item of material or equipment is specified or described in the Contract Documents by using the name of a proprietary item or the name of a particular Supplier, the specification or description is intended to establish the type, function, appearance, and quality required. Unless the specification or description contains or is followed by words reading that no like, equivalent, or "or-equal" item or no substitution is permitted, other items of material or equipment or material or equipment of other Suppliers may be submitted to Engineer for review under the circumstances described below.

1. *"Or-Equal" Items:* If in Engineer's sole discretion an item of material or equipment proposed by Contractor is functionally equal to that named and sufficiently similar so that no change in related Work will be required, it may be considered by Engineer as an "or-equal" item, in which case review and approval of the proposed item may, in Engineer's sole discretion, be accomplished without compliance with some or all of the requirements for approval of proposed substitute items. For the purposes of this Paragraph 6.05.A.1, a proposed item of material or equipment will be considered functionally equal to an item so named if:

a. in the exercise of reasonable judgment Engineer determines that:

1) it is at least equal in materials of construction, quality, durability, appearance, strength, and design characteristics;

2) it will reliably perform at least equally well the function and achieve the results imposed by the design concept of the completed Project as a functioning whole; and

3) it has a proven record of performance and availability of responsive service.

b. Contractor certifies that, if approved and incorporated into the Work:

1) there will be no increase in cost to the Owner or increase in Contract Times; and

2) it will conform substantially to the detailed requirements of the item named in the Contract Documents.

2. *Substitute Items:*

   a. If in Engineer's sole discretion an item of material or equipment proposed by Contractor does not qualify as an "or-equal" item under Paragraph 6.05.A.1, it will be considered a proposed substitute item.

   b. Contractor shall submit sufficient information as provided below to allow Engineer to determine if the item of material or equipment proposed is essentially equivalent to that named and an acceptable substitute therefor. Requests for review of proposed substitute items of material or equipment will not be accepted by Engineer from anyone other than Contractor.

   c. The requirements for review by Engineer will be as set forth in Paragraph 6.05.A.2.d, as supplemented by the General Requirements, and as Engineer may decide is appropriate under the circumstances.

   d. Contractor shall make written application to Engineer for review of a proposed substitute item of material or equipment that Contractor seeks to furnish or use. The application:

      1) shall certify that the proposed substitute item will:

         a) perform adequately the functions and achieve the results called for by the general design,

         b) be similar in substance to that specified, and

         c) be suited to the same use as that specified;

      2) will state:

         a) the extent, if any, to which the use of the proposed substitute item will prejudice Contractor's achievement of Substantial Completion on time,

         b) whether use of the proposed substitute item in the Work will require a change in any of the Contract Documents (or in the provisions of any other direct contract with Owner for other work on the Project) to adapt the design to the proposed substitute item, and

         c) whether incorporation or use of the proposed substitute item in connection with the Work is subject to payment of any license fee or royalty;

      3) will identify:

         a) all variations of the proposed substitute item from that specified, and

         b) available engineering, sales, maintenance, repair, and replacement services; and

4) shall contain an itemized estimate of all costs or credits that will result directly or indirectly from use of such substitute item, including costs of redesign and claims of other contractors affected by any resulting change.

B. *Substitute Construction Methods or Procedures:* If a specific means, method, technique, sequence, or procedure of construction is expressly required by the Contract Documents, Contractor may furnish or utilize a substitute means, method, technique, sequence, or procedure of construction approved by Engineer. Contractor shall submit sufficient information to allow Engineer, in Engineer's sole discretion, to determine that the substitute proposed is equivalent to that expressly called for by the Contract Documents. The requirements for review by Engineer will be similar to those provided in Paragraph 6.05.A.2.

C. *Engineer's Evaluation:* Engineer will be allowed a reasonable time within which to evaluate each proposal or submittal made pursuant to Paragraphs 6.05.A and 6.05.B. Engineer may require Contractor to furnish additional data about the proposed substitute item. Engineer will be the sole judge of acceptability. No "or equal" or substitute will be ordered, installed or utilized until Engineer's review is complete, which will be evidenced by a Change Order in the case of a substitute and an approved Shop Drawing for an "or equal." Engineer will advise Contractor in writing of any negative determination.

D. *Special Guarantee:* Owner may require Contractor to furnish at Contractor's expense a special performance guarantee or other surety with respect to any substitute.

E. *Engineer's Cost Reimbursement*: Engineer will record Engineer's costs in evaluating a substitute proposed or submitted by Contractor pursuant to Paragraphs 6.05.A.2 and 6.05.B. Whether or not Engineer approves a substitute so proposed or submitted by Contractor, Contractor shall reimburse Owner for the reasonable charges of Engineer for evaluating each such proposed substitute. Contractor shall also reimburse Owner for the reasonable charges of Engineer for making changes in the Contract Documents (or in the provisions of any other direct contract with Owner) resulting from the acceptance of each proposed substitute.

F. *Contractor's Expense*: Contractor shall provide all data in support of any proposed substitute or "or-equal" at Contractor's expense.

6.06 *Concerning Subcontractors, Suppliers, and Others*

A. Contractor shall not employ any Subcontractor, Supplier, or other individual or entity (including those acceptable to Owner as indicated in Paragraph 6.06.B), whether initially or as a replacement, against whom Owner may have reasonable objection. Contractor shall not be required to employ any Subcontractor, Supplier, or other individual or entity to furnish or perform any of the Work against whom Contractor has reasonable objection.

B. If the Supplementary Conditions require the identity of certain Subcontractors, Suppliers, or other individuals or entities to be submitted to Owner in advance for acceptance by Owner by a specified date prior to the Effective Date of the Agreement, and if Contractor has submitted a list thereof in accordance with the Supplementary Conditions, Owner's acceptance (either in writing or by failing to make written objection thereto by the date indicated for acceptance or objection in the Bidding Documents or the Contract Documents) of any such Subcontractor, Supplier, or

other individual or entity so identified may be revoked on the basis of reasonable objection after due investigation. Contractor shall submit an acceptable replacement for the rejected Subcontractor, Supplier, or other individual or entity, and the Contract Price will be adjusted by the difference in the cost occasioned by such replacement, and an appropriate Change Order will be issued. No acceptance by Owner of any such Subcontractor, Supplier, or other individual or entity, whether initially or as a replacement, shall constitute a waiver of any right of Owner or Engineer to reject defective Work.

C. Contractor shall be fully responsible to Owner and Engineer for all acts and omissions of the Subcontractors, Suppliers, and other individuals or entities performing or furnishing any of the Work just as Contractor is responsible for Contractor's own acts and omissions. Nothing in the Contract Documents:

1. shall create for the benefit of any such Subcontractor, Supplier, or other individual or entity any contractual relationship between Owner or Engineer and any such Subcontractor, Supplier or other individual or entity; nor

2. shall create any obligation on the part of Owner or Engineer to pay or to see to the payment of any moneys due any such Subcontractor, Supplier, or other individual or entity except as may otherwise be required by Laws and Regulations.

D. Contractor shall be solely responsible for scheduling and coordinating the Work of Subcontractors, Suppliers, and other individuals or entities performing or furnishing any of the Work under a direct or indirect contract with Contractor.

E. Contractor shall require all Subcontractors, Suppliers, and such other individuals or entities performing or furnishing any of the Work to communicate with Engineer through Contractor.

F. The divisions and sections of the Specifications and the identifications of any Drawings shall not control Contractor in dividing the Work among Subcontractors or Suppliers or delineating the Work to be performed by any specific trade.

G. All Work performed for Contractor by a Subcontractor or Supplier will be pursuant to an appropriate agreement between Contractor and the Subcontractor or Supplier which specifically binds the Subcontractor or Supplier to the applicable terms and conditions of the Contract Documents for the benefit of Owner and Engineer. Whenever any such agreement is with a Subcontractor or Supplier who is listed as a loss payee on the property insurance provided in Paragraph 5.06, the agreement between the Contractor and the Subcontractor or Supplier will contain provisions whereby the Subcontractor or Supplier waives all rights against Owner, Contractor, Engineer, and all other individuals or entities identified in the Supplementary Conditions to be listed as insureds or loss payees (and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them) for all losses and damages caused by, arising out of, relating to, or resulting from any of the perils or causes of loss covered by such policies and any other property insurance applicable to the Work. If the insurers on any such policies require separate waiver forms to be signed by any Subcontractor or Supplier, Contractor will obtain the same.

6.07 *Patent Fees and Royalties*

A. Contractor shall pay all license fees and royalties and assume all costs incident to the use in the performance of the Work or the incorporation in the Work of any invention, design, process, product, or device which is the subject of patent rights or copyrights held by others. If a particular invention, design, process, product, or device is specified in the Contract Documents for use in the performance of the Work and if, to the actual knowledge of Owner or Engineer, its use is subject to patent rights or copyrights calling for the payment of any license fee or royalty to others, the existence of such rights shall be disclosed by Owner in the Contract Documents.

B. To the fullest extent permitted by Laws and Regulations, Owner shall indemnify and hold harmless Contractor, and its officers, directors, members, partners, employees, agents, consultants, and subcontractors from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals, and all court or arbitration or other dispute resolution costs) arising out of or relating to any infringement of patent rights or copyrights incident to the use in the performance of the Work or resulting from the incorporation in the Work of any invention, design, process, product, or device specified in the Contract Documents, but not identified as being subject to payment of any license fee or royalty to others required by patent rights or copyrights.

C. To the fullest extent permitted by Laws and Regulations, Contractor shall indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to any infringement of patent rights or copyrights incident to the use in the performance of the Work or resulting from the incorporation in the Work of any invention, design, process, product, or device not specified in the Contract Documents.

6.08 *Permits*

A. Unless otherwise provided in the Supplementary Conditions, Contractor shall obtain and pay for all construction permits and licenses. Owner shall assist Contractor, when necessary, in obtaining such permits and licenses. Contractor shall pay all governmental charges and inspection fees necessary for the prosecution of the Work which are applicable at the time of opening of Bids, or, if there are no Bids, on the Effective Date of the Agreement. Owner shall pay all charges of utility owners for connections for providing permanent service to the Work.

6.09 *Laws and Regulations*

A. Contractor shall give all notices required by and shall comply with all Laws and Regulations applicable to the performance of the Work. Except where otherwise expressly required by applicable Laws and Regulations, neither Owner nor Engineer shall be responsible for monitoring Contractor's compliance with any Laws or Regulations.

B. If Contractor performs any Work knowing or having reason to know that it is contrary to Laws or Regulations, Contractor shall bear all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all

court or arbitration or other dispute resolution costs) arising out of or relating to such Work. However, it shall not be Contractor's responsibility to make certain that the Specifications and Drawings are in accordance with Laws and Regulations, but this shall not relieve Contractor of Contractor's obligations under Paragraph 3.03.

C. Changes in Laws or Regulations not known at the time of opening of Bids (or, on the Effective Date of the Agreement if there were no Bids) having an effect on the cost or time of performance of the Work shall be the subject of an adjustment in Contract Price or Contract Times. If Owner and Contractor are unable to agree on entitlement to or on the amount or extent, if any, of any such adjustment, a Claim may be made therefor as provided in Paragraph 10.05.

6.10 *Taxes*

A. Contractor shall pay all sales, consumer, use, and other similar taxes required to be paid by Contractor in accordance with the Laws and Regulations of the place of the Project which are applicable during the performance of the Work.

6.11 *Use of Site and Other Areas*

A. *Limitation on Use of Site and Other Areas:*

1. Contractor shall confine construction equipment, the storage of materials and equipment, and the operations of workers to the Site and other areas permitted by Laws and Regulations, and shall not unreasonably encumber the Site and other areas with construction equipment or other materials or equipment. Contractor shall assume full responsibility for any damage to any such land or area, or to the owner or occupant thereof, or of any adjacent land or areas resulting from the performance of the Work.

2. Should any claim be made by any such owner or occupant because of the performance of the Work, Contractor shall promptly settle with such other party by negotiation or otherwise resolve the claim by arbitration or other dispute resolution proceeding or at law.

3. To the fullest extent permitted by Laws and Regulations, Contractor shall indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to any claim or action, legal or equitable, brought by any such owner or occupant against Owner, Engineer, or any other party indemnified hereunder to the extent caused by or based upon Contractor's performance of the Work.

B. *Removal of Debris During Performance of the Work:* During the progress of the Work Contractor shall keep the Site and other areas free from accumulations of waste materials, rubbish, and other debris. Removal and disposal of such waste materials, rubbish, and other debris shall conform to applicable Laws and Regulations.

C. *Cleaning:* Prior to Substantial Completion of the Work Contractor shall clean the Site and the Work and make it ready for utilization by Owner. At the completion of the Work Contractor

shall remove from the Site all tools, appliances, construction equipment and machinery, and surplus materials and shall restore to original condition all property not designated for alteration by the Contract Documents.

D. *Loading Structures:* Contractor shall not load nor permit any part of any structure to be loaded in any manner that will endanger the structure, nor shall Contractor subject any part of the Work or adjacent property to stresses or pressures that will endanger it.

6.12 *Record Documents*

A. Contractor shall maintain in a safe place at the Site one record copy of all Drawings, Specifications, Addenda, Change Orders, Work Change Directives, Field Orders, and written interpretations and clarifications in good order and annotated to show changes made during construction. These record documents together with all approved Samples and a counterpart of all approved Shop Drawings will be available to Engineer for reference. Upon completion of the Work, these record documents, Samples, and Shop Drawings will be delivered to Engineer for Owner.

6.13 *Safety and Protection*

A. Contractor shall be solely responsible for initiating, maintaining and supervising all safety precautions and programs in connection with the Work. Such responsibility does not relieve Subcontractors of their responsibility for the safety of persons or property in the performance of their work, nor for compliance with applicable safety Laws and Regulations. Contractor shall take all necessary precautions for the safety of, and shall provide the necessary protection to prevent damage, injury or loss to:

1. all persons on the Site or who may be affected by the Work;

2. all the Work and materials and equipment to be incorporated therein, whether in storage on or off the Site; and

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

B. Contractor shall comply with all applicable Laws and Regulations relating to the safety of persons or property, or to the protection of persons or property from damage, injury, or loss; and shall erect and maintain all necessary safeguards for such safety and protection. Contractor shall notify owners of adjacent property and of Underground Facilities and other utility owners when prosecution of the Work may affect them, and shall cooperate with them in the protection, removal, relocation, and replacement of their property.

C. Contractor shall comply with the applicable requirements of Owner's safety programs, if any. The Supplementary Conditions identify any Owner's safety programs that are applicable to the Work.

D. Contractor shall inform Owner and Engineer of the specific requirements of Contractor's safety program with which Owner's and Engineer's employees and representatives must comply while at the Site.

E. All damage, injury, or loss to any property referred to in Paragraph 6.13.A.2 or 6.13.A.3 caused, directly or indirectly, in whole or in part, by Contractor, any Subcontractor, Supplier, or any other individual or entity directly or indirectly employed by any of them to perform any of the Work, or anyone for whose acts any of them may be liable, shall be remedied by Contractor (except damage or loss attributable to the fault of Drawings or Specifications or to the acts or omissions of Owner or Engineer or anyone employed by any of them, or anyone for whose acts any of them may be liable, and not attributable, directly or indirectly, in whole or in part, to the fault or negligence of Contractor or any Subcontractor, Supplier, or other individual or entity directly or indirectly employed by any of them).

F. Contractor's duties and responsibilities for safety and for protection of the Work shall continue until such time as all the Work is completed and Engineer has issued a notice to Owner and Contractor in accordance with Paragraph 14.07.B that the Work is acceptable (except as otherwise expressly provided in connection with Substantial Completion).

6.14 *Safety Representative*

A. Contractor shall designate a qualified and experienced safety representative at the Site whose duties and responsibilities shall be the prevention of accidents and the maintaining and supervising of safety precautions and programs.

6.15 *Hazard Communication Programs*

A. Contractor shall be responsible for coordinating any exchange of material safety data sheets or other hazard communication information required to be made available to or exchanged between or among employers at the Site in accordance with Laws or Regulations.

6.16 *Emergencies*

A. In emergencies affecting the safety or protection of persons or the Work or property at the Site or adjacent thereto, Contractor is obligated to act to prevent threatened damage, injury, or loss. Contractor shall give Engineer prompt written notice if Contractor believes that any significant changes in the Work or variations from the Contract Documents have been caused thereby or are required as a result thereof. If Engineer determines that a change in the Contract Documents is required because of the action taken by Contractor in response to such an emergency, a Work Change Directive or Change Order will be issued.

6.17 *Shop Drawings and Samples*

A. Contractor shall submit Shop Drawings and Samples to Engineer for review and approval in accordance with the accepted Schedule of Submittals (as required by Paragraph 2.07). Each submittal will be identified as Engineer may require.

1. *Shop Drawings:*

    a. Submit number of copies specified in the General Requirements.

    b. Data shown on the Shop Drawings will be complete with respect to quantities, dimensions, specified performance and design criteria, materials, and similar data to show Engineer the services, materials, and equipment Contractor proposes to provide and to enable Engineer to review the information for the limited purposes required by Paragraph 6.17.D.

2. *Samples:*

    a. Submit number of Samples specified in the Specifications.

    b. Clearly identify each Sample as to material, Supplier, pertinent data such as catalog numbers, the use for which intended and other data as Engineer may require to enable Engineer to review the submittal for the limited purposes required by Paragraph 6.17.D.

B. Where a Shop Drawing or Sample is required by the Contract Documents or the Schedule of Submittals, any related Work performed prior to Engineer's review and approval of the pertinent submittal will be at the sole expense and responsibility of Contractor.

C. *Submittal Procedures:*

1. Before submitting each Shop Drawing or Sample, Contractor shall have:

    a. reviewed and coordinated each Shop Drawing or Sample with other Shop Drawings and Samples and with the requirements of the Work and the Contract Documents;

    b. determined and verified all field measurements, quantities, dimensions, specified performance and design criteria, installation requirements, materials, catalog numbers, and similar information with respect thereto;

    c. determined and verified the suitability of all materials offered with respect to the indicated application, fabrication, shipping, handling, storage, assembly, and installation pertaining to the performance of the Work; and

    d. determined and verified all information relative to Contractor's responsibilities for means, methods, techniques, sequences, and procedures of construction, and safety precautions and programs incident thereto.

2. Each submittal shall bear a stamp or specific written certification that Contractor has satisfied Contractor's obligations under the Contract Documents with respect to Contractor's review and approval of that submittal.

3. With each submittal, Contractor shall give Engineer specific written notice of any variations that the Shop Drawing or Sample may have from the requirements of the Contract Documents. This notice shall be both a written communication separate from the Shop

Drawings or Sample submittal; and, in addition, by a specific notation made on each Shop Drawing or Sample submitted to Engineer for review and approval of each such variation.

D. *Engineer's Review:*

1. Engineer will provide timely review of Shop Drawings and Samples in accordance with the Schedule of Submittals acceptable to Engineer. Engineer's review and approval will be only to determine if the items covered by the submittals will, after installation or incorporation in the Work, conform to the information given in the Contract Documents and be compatible with the design concept of the completed Project as a functioning whole as indicated by the Contract Documents.

2. Engineer's review and approval will not extend to means, methods, techniques, sequences, or procedures of construction (except where a particular means, method, technique, sequence, or procedure of construction is specifically and expressly called for by the Contract Documents) or to safety precautions or programs incident thereto. The review and approval of a separate item as such will not indicate approval of the assembly in which the item functions.

3. Engineer's review and approval shall not relieve Contractor from responsibility for any variation from the requirements of the Contract Documents unless Contractor has complied with the requirements of Paragraph 6.17.C.3 and Engineer has given written approval of each such variation by specific written notation thereof incorporated in or accompanying the Shop Drawing or Sample. Engineer's review and approval shall not relieve Contractor from responsibility for complying with the requirements of Paragraph 6.17.C.1.

E. *Resubmittal Procedures:*

1. Contractor shall make corrections required by Engineer and shall return the required number of corrected copies of Shop Drawings and submit, as required, new Samples for review and approval. Contractor shall direct specific attention in writing to revisions other than the corrections called for by Engineer on previous submittals.

6.18 *Continuing the Work*

A. Contractor shall carry on the Work and adhere to the Progress Schedule during all disputes or disagreements with Owner. No Work shall be delayed or postponed pending resolution of any disputes or disagreements, except as permitted by Paragraph 15.04 or as Owner and Contractor may otherwise agree in writing.

6.19 *Contractor's General Warranty and Guarantee*

A. Contractor warrants and guarantees to Owner that all Work will be in accordance with the Contract Documents and will not be defective. Engineer and its officers, directors, members, partners, employees, agents, consultants, and subcontractors shall be entitled to rely on representation of Contractor's warranty and guarantee.

B. Contractor's warranty and guarantee hereunder excludes defects or damage caused by:

1. abuse, modification, or improper maintenance or operation by persons other than Contractor, Subcontractors, Suppliers, or any other individual or entity for whom Contractor is responsible; or

2. normal wear and tear under normal usage.

C. Contractor's obligation to perform and complete the Work in accordance with the Contract Documents shall be absolute. None of the following will constitute an acceptance of Work that is not in accordance with the Contract Documents or a release of Contractor's obligation to perform the Work in accordance with the Contract Documents:

1. observations by Engineer;

2. recommendation by Engineer or payment by Owner of any progress or final payment;

3. the issuance of a certificate of Substantial Completion by Engineer or any payment related thereto by Owner;

4. use or occupancy of the Work or any part thereof by Owner;

5. any review and approval of a Shop Drawing or Sample submittal or the issuance of a notice of acceptability by Engineer;

6. any inspection, test, or approval by others; or

7. any correction of defective Work by Owner.

6.20 *Indemnification*

A. To the fullest extent permitted by Laws and Regulations, Contractor shall indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to the performance of the Work, provided that any such claim, cost, loss, or damage is attributable to bodily injury, sickness, disease, or death, or to injury to or destruction of tangible property (other than the Work itself), including the loss of use resulting therefrom but only to the extent caused by any negligent act or omission of Contractor, any Subcontractor, any Supplier, or any individual or entity directly or indirectly employed by any of them to perform any of the Work or anyone for whose acts any of them may be liable .

B. In any and all claims against Owner or Engineer or any of their officers, directors, members, partners, employees, agents, consultants, or subcontractors by any employee (or the survivor or personal representative of such employee) of Contractor, any Subcontractor, any Supplier, or any individual or entity directly or indirectly employed by any of them to perform any of the Work, or anyone for whose acts any of them may be liable, the indemnification obligation under Paragraph 6.20.A shall not be limited in any way by any limitation on the amount or type of damages, compensation, or benefits payable by or for Contractor or any such Subcontractor,

Supplier, or other individual or entity under workers' compensation acts, disability benefit acts, or other employee benefit acts.

C. The indemnification obligations of Contractor under Paragraph 6.20.A shall not extend to the liability of Engineer and Engineer's officers, directors, members, partners, employees, agents, consultants and subcontractors arising out of:

1. the preparation or approval of, or the failure to prepare or approve maps, Drawings, opinions, reports, surveys, Change Orders, designs, or Specifications; or

2. giving directions or instructions, or failing to give them, if that is the primary cause of the injury or damage.

6.21 *Delegation of Professional Design Services*

A. Contractor will not be required to provide professional design services unless such services are specifically required by the Contract Documents for a portion of the Work or unless such services are required to carry out Contractor's responsibilities for construction means, methods, techniques, sequences and procedures. Contractor shall not be required to provide professional services in violation of applicable law.

B. If professional design services or certifications by a design professional related to systems, materials or equipment are specifically required of Contractor by the Contract Documents, Owner and Engineer will specify all performance and design criteria that such services must satisfy. Contractor shall cause such services or certifications to be provided by a properly licensed 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 Engineer.

C. Owner and Engineer shall be entitled to rely upon the adequacy, accuracy and completeness of the services, certifications or approvals performed by such design professionals, provided Owner and Engineer have specified to Contractor all performance and design criteria that such services must satisfy.

D. Pursuant to this Paragraph 6.21, Engineer's review and approval of design calculations and design drawings will be only for the limited purpose of checking for conformance with performance and design criteria given and the design concept expressed in the Contract Documents. Engineer's review and approval of Shop Drawings and other submittals (except design calculations and design drawings) will be only for the purpose stated in Paragraph 6.17.D.1.

E. Contractor shall not be responsible for the adequacy of the performance or design criteria required by the Contract Documents.

ARTICLE 7 – OTHER WORK AT THE SITE

7.01 *Related Work at Site*

A. Owner may perform other work related to the Project at the Site with Owner's employees, or through other direct contracts therefor, or have other work performed by utility owners. If such other work is not noted in the Contract Documents, then:

1. written notice thereof will be given to Contractor prior to starting any such other work; and

2. if Owner and Contractor are unable to agree on entitlement to or on the amount or extent, if any, of any adjustment in the Contract Price or Contract Times that should be allowed as a result of such other work, a Claim may be made therefor as provided in Paragraph 10.05.

B. Contractor shall afford each other contractor who is a party to such a direct contract, each utility owner, and Owner, if Owner is performing other work with Owner's employees, proper and safe access to the Site, provide a reasonable opportunity for the introduction and storage of materials and equipment and the execution of such other work, and properly coordinate the Work with theirs. Contractor shall do all cutting, fitting, and patching of the Work that may be required to properly connect or otherwise make its several parts come together and properly integrate with such other work. Contractor shall not endanger any work of others by cutting, excavating, or otherwise altering such work; provided, however, that Contractor may cut or alter others' work with the written consent of Engineer and the others whose work will be affected. The duties and responsibilities of Contractor under this Paragraph are for the benefit of such utility owners and other contractors to the extent that there are comparable provisions for the benefit of Contractor in said direct contracts between Owner and such utility owners and other contractors.

C. If the proper execution or results of any part of Contractor's Work depends upon work performed by others under this Article 7, Contractor shall inspect such other work and promptly report to Engineer in writing any delays, defects, or deficiencies in such other work that render it unavailable or unsuitable for the proper execution and results of Contractor's Work. Contractor's failure to so report will constitute an acceptance of such other work as fit and proper for integration with Contractor's Work except for latent defects and deficiencies in such other work.

7.02 *Coordination*

A. If Owner intends to contract with others for the performance of other work on the Project at the Site, the following will be set forth in Supplementary Conditions:

1. the individual or entity who will have authority and responsibility for coordination of the activities among the various contractors will be identified;

2. the specific matters to be covered by such authority and responsibility will be itemized; and

3. the extent of such authority and responsibilities will be provided.

B. Unless otherwise provided in the Supplementary Conditions, Owner shall have sole authority and responsibility for such coordination.

7.03 *Legal Relationships*

A. Paragraphs 7.01.A and 7.02 are not applicable for utilities not under the control of Owner.

B. Each other direct contract of Owner under Paragraph 7.01.A shall provide that the other contractor is liable to Owner and Contractor for the reasonable direct delay and disruption costs incurred by Contractor as a result of the other contractor's wrongful actions or inactions.

C. Contractor shall be liable to Owner and any other contractor under direct contract to Owner for the reasonable direct delay and disruption costs incurred by such other contractor as a result of Contractor's wrongful action or inactions.

ARTICLE 8 – OWNER'S RESPONSIBILITIES

8.01 *Communications to Contractor*

A. Except as otherwise provided in these General Conditions, Owner shall issue all communications to Contractor through Engineer.

8.02 *Replacement of Engineer*

A. In case of termination of the employment of Engineer, Owner shall appoint an engineer to whom Contractor makes no reasonable objection, whose status under the Contract Documents shall be that of the former Engineer.

8.03 *Furnish Data*

A. Owner shall promptly furnish the data required of Owner under the Contract Documents.

8.04 *Pay When Due*

A. Owner shall make payments to Contractor when they are due as provided in Paragraphs 14.02.C and 14.07.C.

8.05 *Lands and Easements; Reports and Tests*

A. Owner's duties with respect to providing lands and easements and providing engineering surveys to establish reference points are set forth in Paragraphs 4.01 and 4.05. Paragraph 4.02 refers to Owner's identifying and making available to Contractor copies of reports of explorations and tests of subsurface conditions and drawings of physical conditions relating to existing surface or subsurface structures at the Site.

8.06 *Insurance*

A. Owner's responsibilities, if any, with respect to purchasing and maintaining liability and property insurance are set forth in Article 5.

8.07 *Change Orders*

A. Owner is obligated to execute Change Orders as indicated in Paragraph 10.03.

8.08 *Inspections, Tests, and Approvals*

A. Owner's responsibility with respect to certain inspections, tests, and approvals is set forth in Paragraph 13.03.B.

8.09 *Limitations on Owner's Responsibilities*

A. The Owner shall not supervise, direct, or have control or authority over, nor be responsible for, Contractor's means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto, or for any failure of Contractor to comply with Laws and Regulations applicable to the performance of the Work. Owner will not be responsible for Contractor's failure to perform the Work in accordance with the Contract Documents.

8.10 *Undisclosed Hazardous Environmental Condition*

A. Owner's responsibility in respect to an undisclosed Hazardous Environmental Condition is set forth in Paragraph 4.06.

8.11 *Evidence of Financial Arrangements*

A. Upon request of Contractor, Owner shall furnish Contractor reasonable evidence that financial arrangements have been made to satisfy Owner's obligations under the Contract Documents.

8.12 *Compliance with Safety Program*

A. While at the Site, Owner's employees and representatives shall comply with the specific applicable requirements of Contractor's safety programs of which Owner has been informed pursuant to Paragraph 6.13.D.

ARTICLE 9 – ENGINEER'S STATUS DURING CONSTRUCTION

9.01 *Owner's Representative*

A. Engineer will be Owner's representative during the construction period. The duties and responsibilities and the limitations of authority of Engineer as Owner's representative during construction are set forth in the Contract Documents.

9.02 *Visits to Site*

A. Engineer will make visits to the Site at intervals appropriate to the various stages of construction as Engineer deems necessary in order to observe as an experienced and qualified design professional the progress that has been made and the quality of the various aspects of Contractor's executed Work. Based on information obtained during such visits and observations, Engineer, for the benefit of Owner, will determine, in general, if the Work is proceeding in accordance with the Contract Documents. Engineer will not be required to make exhaustive or continuous inspections on the Site to check the quality or quantity of the Work. Engineer's efforts will be directed toward providing for Owner a greater degree of confidence that the completed Work will conform generally to the Contract Documents. On the basis of such visits

and observations, Engineer will keep Owner informed of the progress of the Work and will endeavor to guard Owner against defective Work.

B. Engineer's visits and observations are subject to all the limitations on Engineer's authority and responsibility set forth in Paragraph 9.09. Particularly, but without limitation, during or as a result of Engineer's visits or observations of Contractor's Work, Engineer will not supervise, direct, control, or have authority over or be responsible for Contractor's means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto, or for any failure of Contractor to comply with Laws and Regulations applicable to the performance of the Work.

9.03 *Project Representative*

A. If Owner and Engineer agree, Engineer will furnish a Resident Project Representative to assist Engineer in providing more extensive observation of the Work. The authority and responsibilities of any such Resident Project Representative and assistants will be as provided in the Supplementary Conditions, and limitations on the responsibilities thereof will be as provided in Paragraph 9.09. If Owner designates another representative or agent to represent Owner at the Site who is not Engineer's consultant, agent or employee, the responsibilities and authority and limitations thereon of such other individual or entity will be as provided in the Supplementary Conditions.

9.04 *Authorized Variations in Work*

A. Engineer may authorize minor variations in the Work from the requirements of the Contract Documents which do not involve an adjustment in the Contract Price or the Contract Times and are compatible with the design concept of the completed Project as a functioning whole as indicated by the Contract Documents. These may be accomplished by a Field Order and will be binding on Owner and also on Contractor, who shall perform the Work involved promptly. If Owner or Contractor believes that a Field Order justifies an adjustment in the Contract Price or Contract Times, or both, and the parties are unable to agree on entitlement to or on the amount or extent, if any, of any such adjustment, a Claim may be made therefor as provided in Paragraph 10.05.

9.05 *Rejecting Defective Work*

A. Engineer will have authority to reject Work which Engineer believes to be defective, or that Engineer believes will not produce a completed Project that conforms to the Contract Documents or that will prejudice the integrity of the design concept of the completed Project as a functioning whole as indicated by the Contract Documents. Engineer will also have authority to require special inspection or testing of the Work as provided in Paragraph 13.04, whether or not the Work is fabricated, installed, or completed.

9.06 *Shop Drawings, Change Orders and Payments*

A. In connection with Engineer's authority, and limitations thereof, as to Shop Drawings and Samples, see Paragraph 6.17.

B. In connection with Engineer's authority, and limitations thereof, as to design calculations and design drawings submitted in response to a delegation of professional design services, if any, see Paragraph 6.21.

C. In connection with Engineer's authority as to Change Orders, see Articles 10, 11, and 12.

D. In connection with Engineer's authority as to Applications for Payment, see Article 14.

9.07 *Determinations for Unit Price Work*

A. Engineer will determine the actual quantities and classifications of Unit Price Work performed by Contractor. Engineer will review with Contractor the Engineer's preliminary determinations on such matters before rendering a written decision thereon (by recommendation of an Application for Payment or otherwise). Engineer's written decision thereon will be final and binding (except as modified by Engineer to reflect changed factual conditions or more accurate data) upon Owner and Contractor, subject to the provisions of Paragraph 10.05.

9.08 *Decisions on Requirements of Contract Documents and Acceptability of Work*

A. Engineer will be the initial interpreter of the requirements of the Contract Documents and judge of the acceptability of the Work thereunder. All matters in question and other matters between Owner and Contractor arising prior to the date final payment is due relating to the acceptability of the Work, and the interpretation of the requirements of the Contract Documents pertaining to the performance of the Work, will be referred initially to Engineer in writing within 30 days of the event giving rise to the question.

B. Engineer will, with reasonable promptness, render a written decision on the issue referred. If Owner or Contractor believes that any such decision entitles them to an adjustment in the Contract Price or Contract Times or both, a Claim may be made under Paragraph 10.05. The date of Engineer's decision shall be the date of the event giving rise to the issues referenced for the purposes of Paragraph 10.05.B.

C. Engineer's written decision on the issue referred will be final and binding on Owner and Contractor, subject to the provisions of Paragraph 10.05.

D. When functioning as interpreter and judge under this Paragraph 9.08, Engineer will not show partiality to Owner or Contractor and will not be liable in connection with any interpretation or decision rendered in good faith in such capacity.

9.09 *Limitations on Engineer's Authority and Responsibilities*

A. Neither Engineer's authority or responsibility under this Article 9 or under any other provision of the Contract Documents nor any decision made by Engineer in good faith either to exercise or not exercise such authority or responsibility or the undertaking, exercise, or performance of any authority or responsibility by Engineer shall create, impose, or give rise to any duty in contract, tort, or otherwise owed by Engineer to Contractor, any Subcontractor, any Supplier, any other individual or entity, or to any surety for or employee or agent of any of them.

B. Engineer will not supervise, direct, control, or have authority over or be responsible for Contractor's means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto, or for any failure of Contractor to comply with Laws and Regulations applicable to the performance of the Work. Engineer will not be responsible for Contractor's failure to perform the Work in accordance with the Contract Documents.

C. Engineer will not be responsible for the acts or omissions of Contractor or of any Subcontractor, any Supplier, or of any other individual or entity performing any of the Work.

D. Engineer's review of the final Application for Payment and accompanying documentation and all maintenance and operating instructions, schedules, guarantees, bonds, certificates of inspection, tests and approvals, and other documentation required to be delivered by Paragraph 14.07.A will only be to determine generally that their content complies with the requirements of, and in the case of certificates of inspections, tests, and approvals that the results certified indicate compliance with, the Contract Documents.

E. The limitations upon authority and responsibility set forth in this Paragraph 9.09 shall also apply to the Resident Project Representative, if any, and assistants, if any.

9.10 *Compliance with Safety Program*

A. While at the Site, Engineer's employees and representatives shall comply with the specific applicable requirements of Contractor's safety programs of which Engineer has been informed pursuant to Paragraph 6.13.D.

ARTICLE 10 – CHANGES IN THE WORK; CLAIMS

10.01 *Authorized Changes in the Work*

A. Without invalidating the Contract and without notice to any surety, Owner may, at any time or from time to time, order additions, deletions, or revisions in the Work by a Change Order, or a Work Change Directive. Upon receipt of any such document, Contractor shall promptly proceed with the Work involved which will be performed under the applicable conditions of the Contract Documents (except as otherwise specifically provided).

B. If Owner and Contractor are unable to agree on entitlement to, or on the amount or extent, if any, of an adjustment in the Contract Price or Contract Times, or both, that should be allowed as a result of a Work Change Directive, a Claim may be made therefor as provided in Paragraph 10.05.

10.02 *Unauthorized Changes in the Work*

A. Contractor shall not be entitled to an increase in the Contract Price or an extension of the Contract Times with respect to any work performed that is not required by the Contract Documents as amended, modified, or supplemented as provided in Paragraph 3.04, except in the case of an emergency as provided in Paragraph 6.16 or in the case of uncovering Work as provided in Paragraph 13.04.D.

10.03 *Execution of Change Orders*

A. Owner and Contractor shall execute appropriate Change Orders recommended by Engineer covering:

1. changes in the Work which are: (i) ordered by Owner pursuant to Paragraph 10.01.A, (ii) required because of acceptance of defective Work under Paragraph 13.08.A or Owner's correction of defective Work under Paragraph 13.09, or (iii) agreed to by the parties;

2. changes in the Contract Price or Contract Times which are agreed to by the parties, including any undisputed sum or amount of time for Work actually performed in accordance with a Work Change Directive; and

3. changes in the Contract Price or Contract Times which embody the substance of any written decision rendered by Engineer pursuant to Paragraph 10.05; provided that, in lieu of executing any such Change Order, an appeal may be taken from any such decision in accordance with the provisions of the Contract Documents and applicable Laws and Regulations, but during any such appeal, Contractor shall carry on the Work and adhere to the Progress Schedule as provided in Paragraph 6.18.A.

10.04 *Notification to Surety*

A. If the provisions of any bond require notice to be given to a surety of any change affecting the general scope of the Work or the provisions of the Contract Documents (including, but not limited to, Contract Price or Contract Times), the giving of any such notice will be Contractor's responsibility. The amount of each applicable bond will be adjusted to reflect the effect of any such change.

10.05 *Claims*

A. *Engineer's Decision Required*: All Claims, except those waived pursuant to Paragraph 14.09, shall be referred to the Engineer for decision. A decision by Engineer shall be required as a condition precedent to any exercise by Owner or Contractor of any rights or remedies either may otherwise have under the Contract Documents or by Laws and Regulations in respect of such Claims.

B. *Notice:* Written notice stating the general nature of each Claim shall be delivered by the claimant to Engineer and the other party to the Contract promptly (but in no event later than 30 days) after the start of the event giving rise thereto. The responsibility to substantiate a Claim shall rest with the party making the Claim. Notice of the amount or extent of the Claim, with supporting data shall be delivered to the Engineer and the other party to the Contract within 60 days after the start of such event (unless Engineer allows additional time for claimant to submit additional or more accurate data in support of such Claim). A Claim for an adjustment in Contract Price shall be prepared in accordance with the provisions of Paragraph 12.01.B. A Claim for an adjustment in Contract Times shall be prepared in accordance with the provisions of Paragraph 12.02.B. Each Claim shall be accompanied by claimant's written statement that the adjustment claimed is the entire adjustment to which the claimant believes it is entitled as a result of said event. The

opposing party shall submit any response to Engineer and the claimant within 30 days after receipt of the claimant's last submittal (unless Engineer allows additional time).

C. *Engineer's Action*: Engineer will review each Claim and, within 30 days after receipt of the last submittal of the claimant or the last submittal of the opposing party, if any, take one of the following actions in writing:

1. deny the Claim in whole or in part;

2. approve the Claim; or

3. notify the parties that the Engineer is unable to resolve the Claim if, in the Engineer's sole discretion, it would be inappropriate for the Engineer to do so. For purposes of further resolution of the Claim, such notice shall be deemed a denial.

D. In the event that Engineer does not take action on a Claim within said 30 days, the Claim shall be deemed denied.

E. Engineer's written action under Paragraph 10.05.C or denial pursuant to Paragraphs 10.05.C.3 or 10.05.D will be final and binding upon Owner and Contractor, unless Owner or Contractor invoke the dispute resolution procedure set forth in Article 16 within 30 days of such action or denial.

F. No Claim for an adjustment in Contract Price or Contract Times will be valid if not submitted in accordance with this Paragraph 10.05.

ARTICLE 11 – COST OF THE WORK; ALLOWANCES; UNIT PRICE WORK

11.01 *Cost of the Work*

A. *Costs Included:* The term Cost of the Work means the sum of all costs, except those excluded in Paragraph 11.01.B, necessarily incurred and paid by Contractor in the proper performance of the Work. When the value of any Work covered by a Change Order or when a Claim for an adjustment in Contract Price is determined on the basis of Cost of the Work, the costs to be reimbursed to Contractor will be only those additional or incremental costs required because of the change in the Work or because of the event giving rise to the Claim. Except as otherwise may be agreed to in writing by Owner, such costs shall be in amounts no higher than those prevailing in the locality of the Project, shall not include any of the costs itemized in Paragraph 11.01.B, and shall include only the following items:

1. Payroll costs for employees in the direct employ of Contractor in the performance of the Work under schedules of job classifications agreed upon by Owner and Contractor. Such employees shall include, without limitation, superintendents, foremen, and other personnel employed full time on the Work. Payroll costs for employees not employed full time on the Work shall be apportioned on the basis of their time spent on the Work. Payroll costs shall include, but not be limited to, salaries and wages plus the cost of fringe benefits, which shall include social security contributions, unemployment, excise, and payroll taxes, workers' compensation, health and retirement benefits, bonuses, sick leave, vacation and holiday pay applicable thereto. The expenses of performing Work outside of regular working hours, on

Saturday, Sunday, or legal holidays, shall be included in the above to the extent authorized by Owner.

2. Cost of all materials and equipment furnished and incorporated in the Work, including costs of transportation and storage thereof, and Suppliers' field services required in connection therewith. All cash discounts shall accrue to Contractor unless Owner deposits funds with Contractor with which to make payments, in which case the cash discounts shall accrue to Owner. All trade discounts, rebates and refunds and returns from sale of surplus materials and equipment shall accrue to Owner, and Contractor shall make provisions so that they may be obtained.

3. Payments made by Contractor to Subcontractors for Work performed by Subcontractors. If required by Owner, Contractor shall obtain competitive bids from subcontractors acceptable to Owner and Contractor and shall deliver such bids to Owner, who will then determine, with the advice of Engineer, which bids, if any, will be acceptable. If any subcontract provides that the Subcontractor is to be paid on the basis of Cost of the Work plus a fee, the Subcontractor's Cost of the Work and fee shall be determined in the same manner as Contractor's Cost of the Work and fee as provided in this Paragraph 11.01.

4. Costs of special consultants (including but not limited to engineers, architects, testing laboratories, surveyors, attorneys, and accountants) employed for services specifically related to the Work.

5. Supplemental costs including the following:

   a. The proportion of necessary transportation, travel, and subsistence expenses of Contractor's employees incurred in discharge of duties connected with the Work.

   b. Cost, including transportation and maintenance, of all materials, supplies, equipment, machinery, appliances, office, and temporary facilities at the Site, and hand tools not owned by the workers, which are consumed in the performance of the Work, and cost, less market value, of such items used but not consumed which remain the property of Contractor.

   c. Rentals of all construction equipment and machinery, and the parts thereof whether rented from Contractor or others in accordance with rental agreements approved by Owner with the advice of Engineer, and the costs of transportation, loading, unloading, assembly, dismantling, and removal thereof. All such costs shall be in accordance with the terms of said rental agreements. The rental of any such equipment, machinery, or parts shall cease when the use thereof is no longer necessary for the Work.

   d. Sales, consumer, use, and other similar taxes related to the Work, and for which Contractor is liable, as imposed by Laws and Regulations.

   e. Deposits lost for causes other than negligence of Contractor, any Subcontractor, or anyone directly or indirectly employed by any of them or for whose acts any of them may be liable, and royalty payments and fees for permits and licenses.

f. Losses and damages (and related expenses) caused by damage to the Work, not compensated by insurance or otherwise, sustained by Contractor in connection with the performance of the Work (except losses and damages within the deductible amounts of property insurance established in accordance with Paragraph 5.06.D), provided such losses and damages have resulted from causes other than the negligence of Contractor, any Subcontractor, or anyone directly or indirectly employed by any of them or for whose acts any of them may be liable. Such losses shall include settlements made with the written consent and approval of Owner. No such losses, damages, and expenses shall be included in the Cost of the Work for the purpose of determining Contractor's fee.

g. The cost of utilities, fuel, and sanitary facilities at the Site.

h. Minor expenses such as telegrams, long distance telephone calls, telephone service at the Site, express and courier services, and similar petty cash items in connection with the Work.

i. The costs of premiums for all bonds and insurance Contractor is required by the Contract Documents to purchase and maintain.

B. *Costs Excluded:* The term Cost of the Work shall not include any of the following items:

1. Payroll costs and other compensation of Contractor's officers, executives, principals (of partnerships and sole proprietorships), general managers, safety managers, engineers, architects, estimators, attorneys, auditors, accountants, purchasing and contracting agents, expediters, timekeepers, clerks, and other personnel employed by Contractor, whether at the Site or in Contractor's principal or branch office for general administration of the Work and not specifically included in the agreed upon schedule of job classifications referred to in Paragraph 11.01.A.1 or specifically covered by Paragraph 11.01.A.4, all of which are to be considered administrative costs covered by the Contractor's fee.

2. Expenses of Contractor's principal and branch offices other than Contractor's office at the Site.

3. Any part of Contractor's capital expenses, including interest on Contractor's capital employed for the Work and charges against Contractor for delinquent payments.

4. Costs due to the negligence of Contractor, any Subcontractor, or anyone directly or indirectly employed by any of them or for whose acts any of them may be liable, including but not limited to, the correction of defective Work, disposal of materials or equipment wrongly supplied, and making good any damage to property.

5. Other overhead or general expense costs of any kind and the costs of any item not specifically and expressly included in Paragraphs 11.01.A.

C. *Contractor's Fee:* When all the Work is performed on the basis of cost-plus, Contractor's fee shall be determined as set forth in the Agreement. When the value of any Work covered by a Change Order or when a Claim for an adjustment in Contract Price is determined on the basis of Cost of the Work, Contractor's fee shall be determined as set forth in Paragraph 12.01.C.

D. *Documentation:* Whenever the Cost of the Work for any purpose is to be determined pursuant to Paragraphs 11.01.A and 11.01.B, Contractor will establish and maintain records thereof in accordance with generally accepted accounting practices and submit in a form acceptable to Engineer an itemized cost breakdown together with supporting data.

11.02 *Allowances*

A. It is understood that Contractor has included in the Contract Price all allowances so named in the Contract Documents and shall cause the Work so covered to be performed for such sums and by such persons or entities as may be acceptable to Owner and Engineer.

B. *Cash Allowances:*

1. Contractor agrees that:

a. the cash allowances include the cost to Contractor (less any applicable trade discounts) of materials and equipment required by the allowances to be delivered at the Site, and all applicable taxes; and

b. Contractor's costs for unloading and handling on the Site, labor, installation, overhead, profit, and other expenses contemplated for the cash allowances have been included in the Contract Price and not in the allowances, and no demand for additional payment on account of any of the foregoing will be valid.

C. *Contingency Allowance:*

1. Contractor agrees that a contingency allowance, if any, is for the sole use of Owner to cover unanticipated costs.

D. Prior to final payment, an appropriate Change Order will be issued as recommended by Engineer to reflect actual amounts due Contractor on account of Work covered by allowances, and the Contract Price shall be correspondingly adjusted.

11.03 *Unit Price Work*

A. Where the Contract Documents provide that all or part of the Work is to be Unit Price Work, initially the Contract Price will be deemed to include for all Unit Price Work an amount equal to the sum of the unit price for each separately identified item of Unit Price Work times the estimated quantity of each item as indicated in the Agreement.

B. The estimated quantities of items of Unit Price Work are not guaranteed and are solely for the purpose of comparison of Bids and determining an initial Contract Price. Determinations of the actual quantities and classifications of Unit Price Work performed by Contractor will be made by Engineer subject to the provisions of Paragraph 9.07.

C. Each unit price will be deemed to include an amount considered by Contractor to be adequate to cover Contractor's overhead and profit for each separately identified item.

D. Owner or Contractor may make a Claim for an adjustment in the Contract Price in accordance with Paragraph 10.05 if:

1. the quantity of any item of Unit Price Work performed by Contractor differs materially and significantly from the estimated quantity of such item indicated in the Agreement; and

2. there is no corresponding adjustment with respect to any other item of Work; and

3. Contractor believes that Contractor is entitled to an increase in Contract Price as a result of having incurred additional expense or Owner believes that Owner is entitled to a decrease in Contract Price and the parties are unable to agree as to the amount of any such increase or decrease.

ARTICLE 12 – CHANGE OF CONTRACT PRICE; CHANGE OF CONTRACT TIMES

12.01 *Change of Contract Price*

A. The Contract Price may only be changed by a Change Order. Any Claim for an adjustment in the Contract Price shall be based on written notice submitted by the party making the Claim to the Engineer and the other party to the Contract in accordance with the provisions of Paragraph 10.05.

B. The value of any Work covered by a Change Order or of any Claim for an adjustment in the Contract Price will be determined as follows:

1. where the Work involved is covered by unit prices contained in the Contract Documents, by application of such unit prices to the quantities of the items involved (subject to the provisions of Paragraph 11.03); or

2. where the Work involved is not covered by unit prices contained in the Contract Documents, by a mutually agreed lump sum (which may include an allowance for overhead and profit not necessarily in accordance with Paragraph 12.01.C.2); or

3. where the Work involved is not covered by unit prices contained in the Contract Documents and agreement to a lump sum is not reached under Paragraph 12.01.B.2, on the basis of the Cost of the Work (determined as provided in Paragraph 11.01) plus a Contractor's fee for overhead and profit (determined as provided in Paragraph 12.01.C).

C. *Contractor's Fee:* The Contractor's fee for overhead and profit shall be determined as follows:

1. a mutually acceptable fixed fee; or

2. if a fixed fee is not agreed upon, then a fee based on the following percentages of the various portions of the Cost of the Work:

a. for costs incurred under Paragraphs 11.01.A.1 and 11.01.A.2, the Contractor's fee shall be 15 percent;

b. for costs incurred under Paragraph 11.01.A.3, the Contractor's fee shall be five percent;

c. where one or more tiers of subcontracts are on the basis of Cost of the Work plus a fee and no fixed fee is agreed upon, the intent of Paragraphs 12.01.C.2.a and 12.01.C.2.b is that the Subcontractor who actually performs the Work, at whatever tier, will be paid a fee of 15 percent of the costs incurred by such Subcontractor under Paragraphs 11.01.A.1 and 11.01.A.2 and that any higher tier Subcontractor and Contractor will each be paid a fee of five percent of the amount paid to the next lower tier Subcontractor;

d. no fee shall be payable on the basis of costs itemized under Paragraphs 11.01.A.4, 11.01.A.5, and 11.01.B;

e. the amount of credit to be allowed by Contractor to Owner for any change which results in a net decrease in cost will be the amount of the actual net decrease in cost plus a deduction in Contractor's fee by an amount equal to five percent of such net decrease; and

f. when both additions and credits are involved in any one change, the adjustment in Contractor's fee shall be computed on the basis of the net change in accordance with Paragraphs 12.01.C.2.a through 12.01.C.2.e, inclusive.

12.02 *Change of Contract Times*

A. The Contract Times may only be changed by a Change Order. Any Claim for an adjustment in the Contract Times shall be based on written notice submitted by the party making the Claim to the Engineer and the other party to the Contract in accordance with the provisions of Paragraph 10.05.

B. Any adjustment of the Contract Times covered by a Change Order or any Claim for an adjustment in the Contract Times will be determined in accordance with the provisions of this Article 12.

12.03 *Delays*

A. Where Contractor is prevented from completing any part of the Work within the Contract Times due to delay beyond the control of Contractor, the Contract Times will be extended in an amount equal to the time lost due to such delay if a Claim is made therefor as provided in Paragraph 12.02.A. Delays beyond the control of Contractor shall include, but not be limited to, acts or neglect by Owner, acts or neglect of utility owners or other contractors performing other work as contemplated by Article 7, fires, floods, epidemics, abnormal weather conditions, or acts of God.

B. If Owner, Engineer, or other contractors or utility owners performing other work for Owner as contemplated by Article 7, or anyone for whom Owner is responsible, delays, disrupts, or interferes with the performance or progress of the Work, then Contractor shall be entitled to an equitable adjustment in the Contract Price or the Contract Times, or both. Contractor's entitlement to an adjustment of the Contract Times is conditioned on such adjustment being essential to Contractor's ability to complete the Work within the Contract Times.

C. If Contractor is delayed in the performance or progress of the Work by fire, flood, epidemic, abnormal weather conditions, acts of God, acts or failures to act of utility owners not under the

control of Owner, or other causes not the fault of and beyond control of Owner and Contractor, then Contractor shall be entitled to an equitable adjustment in Contract Times, if such adjustment is essential to Contractor's ability to complete the Work within the Contract Times. Such an adjustment shall be Contractor's sole and exclusive remedy for the delays described in this Paragraph 12.03.C.

D. Owner, Engineer, and their officers, directors, members, partners, employees, agents, consultants, or subcontractors shall not be liable to Contractor for any claims, costs, losses, or damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) sustained by Contractor on or in connection with any other project or anticipated project.

E. Contractor shall not be entitled to an adjustment in Contract Price or Contract Times for delays within the control of Contractor. Delays attributable to and within the control of a Subcontractor or Supplier shall be deemed to be delays within the control of Contractor.

ARTICLE 13 – TESTS AND INSPECTIONS; CORRECTION, REMOVAL OR ACCEPTANCE OF DEFECTIVE WORK

13.01 *Notice of Defects*

A. Prompt notice of all defective Work of which Owner or Engineer has actual knowledge will be given to Contractor. Defective Work may be rejected, corrected, or accepted as provided in this Article 13.

13.02 *Access to Work*

A. Owner, Engineer, their consultants and other representatives and personnel of Owner, independent testing laboratories, and governmental agencies with jurisdictional interests will have access to the Site and the Work at reasonable times for their observation, inspection, and testing. Contractor shall provide them proper and safe conditions for such access and advise them of Contractor's safety procedures and programs so that they may comply therewith as applicable.

13.03 *Tests and Inspections*

A. Contractor shall give Engineer timely notice of readiness of the Work for all required inspections, tests, or approvals and shall cooperate with inspection and testing personnel to facilitate required inspections or tests.

B. Owner shall employ and pay for the services of an independent testing laboratory to perform all inspections, tests, or approvals required by the Contract Documents except:

1. for inspections, tests, or approvals covered by Paragraphs 13.03.C and 13.03.D below;

2. that costs incurred in connection with tests or inspections conducted pursuant to Paragraph 13.04.B shall be paid as provided in Paragraph 13.04.C; and

3. as otherwise specifically provided in the Contract Documents.

C. If Laws or Regulations of any public body having jurisdiction require any Work (or part thereof) specifically to be inspected, tested, or approved by an employee or other representative of such public body, Contractor shall assume full responsibility for arranging and obtaining such inspections, tests, or approvals, pay all costs in connection therewith, and furnish Engineer the required certificates of inspection or approval.

D. Contractor shall be responsible for arranging and obtaining and shall pay all costs in connection with any inspections, tests, or approvals required for Owner's and Engineer's acceptance of materials or equipment to be incorporated in the Work; or acceptance of materials, mix designs, or equipment submitted for approval prior to Contractor's purchase thereof for incorporation in the Work. Such inspections, tests, or approvals shall be performed by organizations acceptable to Owner and Engineer.

E. If any Work (or the work of others) that is to be inspected, tested, or approved is covered by Contractor without written concurrence of Engineer, Contractor shall, if requested by Engineer, uncover such Work for observation.

F. Uncovering Work as provided in Paragraph 13.03.E shall be at Contractor's expense unless Contractor has given Engineer timely notice of Contractor's intention to cover the same and Engineer has not acted with reasonable promptness in response to such notice.

13.04 *Uncovering Work*

A. If any Work is covered contrary to the written request of Engineer, it must, if requested by Engineer, be uncovered for Engineer's observation and replaced at Contractor's expense.

B. If Engineer considers it necessary or advisable that covered Work be observed by Engineer or inspected or tested by others, Contractor, at Engineer's request, shall uncover, expose, or otherwise make available for observation, inspection, or testing as Engineer may require, that portion of the Work in question, furnishing all necessary labor, material, and equipment.

C. If it is found that the uncovered Work is defective, Contractor shall pay all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to such uncovering, exposure, observation, inspection, and testing, and of satisfactory replacement or reconstruction (including but not limited to all costs of repair or replacement of work of others); and Owner shall be entitled to an appropriate decrease in the Contract Price. If the parties are unable to agree as to the amount thereof, Owner may make a Claim therefor as provided in Paragraph 10.05.

D. If the uncovered Work is not found to be defective, Contractor shall be allowed an increase in the Contract Price or an extension of the Contract Times, or both, directly attributable to such uncovering, exposure, observation, inspection, testing, replacement, and reconstruction. If the parties are unable to agree as to the amount or extent thereof, Contractor may make a Claim therefor as provided in Paragraph 10.05.

13.05 *Owner May Stop the Work*

A. If the Work is defective, or Contractor fails to supply sufficient skilled workers or suitable materials or equipment, or fails to perform the Work in such a way that the completed Work will conform to the Contract Documents, Owner may order Contractor to stop the Work, or any portion thereof, until the cause for such order has been eliminated; however, this right of Owner to stop the Work shall not give rise to any duty on the part of Owner to exercise this right for the benefit of Contractor, any Subcontractor, any Supplier, any other individual or entity, or any surety for, or employee or agent of any of them.

13.06 *Correction or Removal of Defective Work*

A. Promptly after receipt of written notice, Contractor shall correct all defective Work, whether or not fabricated, installed, or completed, or, if the Work has been rejected by Engineer, remove it from the Project and replace it with Work that is not defective. Contractor shall pay all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to such correction or removal (including but not limited to all costs of repair or replacement of work of others).

B. When correcting defective Work under the terms of this Paragraph 13.06 or Paragraph 13.07, Contractor shall take no action that would void or otherwise impair Owner's special warranty and guarantee, if any, on said Work.

13.07 *Correction Period*

A. If within one year after the date of Substantial Completion (or such longer period of time as may be prescribed by the terms of any applicable special guarantee required by the Contract Documents) or by any specific provision of the Contract Documents, any Work is found to be defective, or if the repair of any damages to the land or areas made available for Contractor's use by Owner or permitted by Laws and Regulations as contemplated in Paragraph 6.11.A is found to be defective, Contractor shall promptly, without cost to Owner and in accordance with Owner's written instructions:

1. repair such defective land or areas; or

2. correct such defective Work; or

3. if the defective Work has been rejected by Owner, remove it from the Project and replace it with Work that is not defective, and

4. satisfactorily correct or repair or remove and replace any damage to other Work, to the work of others or other land or areas resulting therefrom.

B. If Contractor does not promptly comply with the terms of Owner's written instructions, or in an emergency where delay would cause serious risk of loss or damage, Owner may have the defective Work corrected or repaired or may have the rejected Work removed and replaced. All claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute

resolution costs) arising out of or relating to such correction or repair or such removal and replacement (including but not limited to all costs of repair or replacement of work of others) will be paid by Contractor.

C. In special circumstances where a particular item of equipment is placed in continuous service before Substantial Completion of all the Work, the correction period for that item may start to run from an earlier date if so provided in the Specifications.

D. Where defective Work (and damage to other Work resulting therefrom) has been corrected or removed and replaced under this Paragraph 13.07, the correction period hereunder with respect to such Work will be extended for an additional period of one year after such correction or removal and replacement has been satisfactorily completed.

E. Contractor's obligations under this Paragraph 13.07 are in addition to any other obligation or warranty. The provisions of this Paragraph 13.07 shall not be construed as a substitute for, or a waiver of, the provisions of any applicable statute of limitation or repose.

13.08 *Acceptance of Defective Work*

A. If, instead of requiring correction or removal and replacement of defective Work, Owner (and, prior to Engineer's recommendation of final payment, Engineer) prefers to accept it, Owner may do so. Contractor shall pay all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) attributable to Owner's evaluation of and determination to accept such defective Work (such costs to be approved by Engineer as to reasonableness) and for the diminished value of the Work to the extent not otherwise paid by Contractor pursuant to this sentence. If any such acceptance occurs prior to Engineer's recommendation of final payment, a Change Order will be issued incorporating the necessary revisions in the Contract Documents with respect to the Work, and Owner shall be entitled to an appropriate decrease in the Contract Price, reflecting the diminished value of Work so accepted. If the parties are unable to agree as to the amount thereof, Owner may make a Claim therefor as provided in Paragraph 10.05. If the acceptance occurs after such recommendation, an appropriate amount will be paid by Contractor to Owner.

13.09 *Owner May Correct Defective Work*

A. If Contractor fails within a reasonable time after written notice from Engineer to correct defective Work, or to remove and replace rejected Work as required by Engineer in accordance with Paragraph 13.06.A, or if Contractor fails to perform the Work in accordance with the Contract Documents, or if Contractor fails to comply with any other provision of the Contract Documents, Owner may, after seven days written notice to Contractor, correct, or remedy any such deficiency.

B. In exercising the rights and remedies under this Paragraph 13.09, Owner shall proceed expeditiously. In connection with such corrective or remedial action, Owner may exclude Contractor from all or part of the Site, take possession of all or part of the Work and suspend Contractor's services related thereto, take possession of Contractor's tools, appliances, construction equipment and machinery at the Site, and incorporate in the Work all materials and

equipment stored at the Site or for which Owner has paid Contractor but which are stored elsewhere. Contractor shall allow Owner, Owner's representatives, agents and employees, Owner's other contractors, and Engineer and Engineer's consultants access to the Site to enable Owner to exercise the rights and remedies under this Paragraph.

C. All claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) incurred or sustained by Owner in exercising the rights and remedies under this Paragraph 13.09 will be charged against Contractor, and a Change Order will be issued incorporating the necessary revisions in the Contract Documents with respect to the Work; and Owner shall be entitled to an appropriate decrease in the Contract Price. If the parties are unable to agree as to the amount of the adjustment, Owner may make a Claim therefor as provided in Paragraph 10.05. Such claims, costs, losses and damages will include but not be limited to all costs of repair, or replacement of work of others destroyed or damaged by correction, removal, or replacement of Contractor's defective Work.

D. Contractor shall not be allowed an extension of the Contract Times because of any delay in the performance of the Work attributable to the exercise by Owner of Owner's rights and remedies under this Paragraph 13.09.

ARTICLE 14 – PAYMENTS TO CONTRACTOR AND COMPLETION

14.01 *Schedule of Values*

A. The Schedule of Values established as provided in Paragraph 2.07.A will serve as the basis for progress payments and will be incorporated into a form of Application for Payment acceptable to Engineer. Progress payments on account of Unit Price Work will be based on the number of units completed.

14.02 *Progress Payments*

A. *Applications for Payments:*

1. At least 20 days before the date established in the Agreement for each progress payment (but not more often than once a month), Contractor shall submit to Engineer for review an Application for Payment filled out and signed by Contractor covering the Work completed as of the date of the Application and accompanied by such supporting documentation as is required by the Contract Documents. If payment is requested on the basis of materials and equipment not incorporated in the Work but delivered and suitably stored at the Site or at another location agreed to in writing, the Application for Payment shall also be accompanied by a bill of sale, invoice, or other documentation warranting that Owner has received the materials and equipment free and clear of all Liens and evidence that the materials and equipment are covered by appropriate property insurance or other arrangements to protect Owner's interest therein, all of which must be satisfactory to Owner.

2. Beginning with the second Application for Payment, each Application shall include an affidavit of Contractor stating that all previous progress payments received on account of the

Work have been applied on account to discharge Contractor's legitimate obligations associated with prior Applications for Payment.

3. The amount of retainage with respect to progress payments will be as stipulated in the Agreement.

B. *Review of Applications:*

1. Engineer will, within 10 days after receipt of each Application for Payment, either indicate in writing a recommendation of payment and present the Application to Owner or return the Application to Contractor indicating in writing Engineer's reasons for refusing to recommend payment. In the latter case, Contractor may make the necessary corrections and resubmit the Application.

2. Engineer's recommendation of any payment requested in an Application for Payment will constitute a representation by Engineer to Owner, based on Engineer's observations of the executed Work as an experienced and qualified design professional, and on Engineer's review of the Application for Payment and the accompanying data and schedules, that to the best of Engineer's knowledge, information and belief:

   a. the Work has progressed to the point indicated;

   b. the quality of the Work is generally in accordance with the Contract Documents (subject to an evaluation of the Work as a functioning whole prior to or upon Substantial Completion, the results of any subsequent tests called for in the Contract Documents, a final determination of quantities and classifications for Unit Price Work under Paragraph 9.07, and any other qualifications stated in the recommendation); and

   c. the conditions precedent to Contractor's being entitled to such payment appear to have been fulfilled in so far as it is Engineer's responsibility to observe the Work.

3. By recommending any such payment Engineer will not thereby be deemed to have represented that:

   a. inspections made to check the quality or the quantity of the Work as it has been performed have been exhaustive, extended to every aspect of the Work in progress, or involved detailed inspections of the Work beyond the responsibilities specifically assigned to Engineer in the Contract Documents; or

   b. there may not be other matters or issues between the parties that might entitle Contractor to be paid additionally by Owner or entitle Owner to withhold payment to Contractor.

4. Neither Engineer's review of Contractor's Work for the purposes of recommending payments nor Engineer's recommendation of any payment, including final payment, will impose responsibility on Engineer:

   a. to supervise, direct, or control the Work, or

b. for the means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto, or

c. for Contractor's failure to comply with Laws and Regulations applicable to Contractor's performance of the Work, or

d. to make any examination to ascertain how or for what purposes Contractor has used the moneys paid on account of the Contract Price, or

e. to determine that title to any of the Work, materials, or equipment has passed to Owner free and clear of any Liens.

5. Engineer may refuse to recommend the whole or any part of any payment if, in Engineer's opinion, it would be incorrect to make the representations to Owner stated in Paragraph 14.02.B.2. Engineer may also refuse to recommend any such payment or, because of subsequently discovered evidence or the results of subsequent inspections or tests, revise or revoke any such payment recommendation previously made, to such extent as may be necessary in Engineer's opinion to protect Owner from loss because:

   a. the Work is defective, or completed Work has been damaged, requiring correction or replacement;

   b. the Contract Price has been reduced by Change Orders;

   c. Owner has been required to correct defective Work or complete Work in accordance with Paragraph 13.09; or

   d. Engineer has actual knowledge of the occurrence of any of the events enumerated in Paragraph 15.02.A.

C. *Payment Becomes Due:*

1. Ten days after presentation of the Application for Payment to Owner with Engineer's recommendation, the amount recommended will (subject to the provisions of Paragraph 14.02.D) become due, and when due will be paid by Owner to Contractor.

D. *Reduction in Payment:*

1. Owner may refuse to make payment of the full amount recommended by Engineer because:

   a. claims have been made against Owner on account of Contractor's performance or furnishing of the Work;

   b. Liens have been filed in connection with the Work, except where Contractor has delivered a specific bond satisfactory to Owner to secure the satisfaction and discharge of such Liens;

   c. there are other items entitling Owner to a set-off against the amount recommended; or

d. Owner has actual knowledge of the occurrence of any of the events enumerated in Paragraphs 14.02.B.5.a through 14.02.B.5.c or Paragraph 15.02.A.

2. If Owner refuses to make payment of the full amount recommended by Engineer, Owner will give Contractor immediate written notice (with a copy to Engineer) stating the reasons for such action and promptly pay Contractor any amount remaining after deduction of the amount so withheld. Owner shall promptly pay Contractor the amount so withheld, or any adjustment thereto agreed to by Owner and Contractor, when Contractor remedies the reasons for such action.

3. Upon a subsequent determination that Owner's refusal of payment was not justified, the amount wrongfully withheld shall be treated as an amount due as determined by Paragraph 14.02.C.1 and subject to interest as provided in the Agreement.

14.03 *Contractor's Warranty of Title*

A. Contractor warrants and guarantees that title to all Work, materials, and equipment covered by any Application for Payment, whether incorporated in the Project or not, will pass to Owner no later than the time of payment free and clear of all Liens.

14.04 *Substantial Completion*

A. When Contractor considers the entire Work ready for its intended use Contractor shall notify Owner and Engineer in writing that the entire Work is substantially complete (except for items specifically listed by Contractor as incomplete) and request that Engineer issue a certificate of Substantial Completion.

B. Promptly after Contractor's notification, Owner, Contractor, and Engineer shall make an inspection of the Work to determine the status of completion. If Engineer does not consider the Work substantially complete, Engineer will notify Contractor in writing giving the reasons therefor.

C. If Engineer considers the Work substantially complete, Engineer will deliver to Owner a tentative certificate of Substantial Completion which shall fix the date of Substantial Completion. There shall be attached to the certificate a tentative list of items to be completed or corrected before final payment. Owner shall have seven days after receipt of the tentative certificate during which to make written objection to Engineer as to any provisions of the certificate or attached list. If, after considering such objections, Engineer concludes that the Work is not substantially complete, Engineer will, within 14 days after submission of the tentative certificate to Owner, notify Contractor in writing, stating the reasons therefor. If, after consideration of Owner's objections, Engineer considers the Work substantially complete, Engineer will, within said 14 days, execute and deliver to Owner and Contractor a definitive certificate of Substantial Completion (with a revised tentative list of items to be completed or corrected) reflecting such changes from the tentative certificate as Engineer believes justified after consideration of any objections from Owner.

D. At the time of delivery of the tentative certificate of Substantial Completion, Engineer will deliver to Owner and Contractor a written recommendation as to division of responsibilities

pending final payment between Owner and Contractor with respect to security, operation, safety, and protection of the Work, maintenance, heat, utilities, insurance, and warranties and guarantees. Unless Owner and Contractor agree otherwise in writing and so inform Engineer in writing prior to Engineer's issuing the definitive certificate of Substantial Completion, Engineer's aforesaid recommendation will be binding on Owner and Contractor until final payment.

E. Owner shall have the right to exclude Contractor from the Site after the date of Substantial Completion subject to allowing Contractor reasonable access to remove its property and complete or correct items on the tentative list.

14.05 *Partial Utilization*

A. Prior to Substantial Completion of all the Work, Owner may use or occupy any substantially completed part of the Work which has specifically been identified in the Contract Documents, or which Owner, Engineer, and Contractor agree constitutes a separately functioning and usable part of the Work that can be used by Owner for its intended purpose without significant interference with Contractor's performance of the remainder of the Work, subject to the following conditions:

1. Owner at any time may request Contractor in writing to permit Owner to use or occupy any such part of the Work which Owner believes to be ready for its intended use and substantially complete. If and when Contractor agrees that such part of the Work is substantially complete, Contractor, Owner, and Engineer will follow the procedures of Paragraph 14.04.A through D for that part of the Work.

2. Contractor at any time may notify Owner and Engineer in writing that Contractor considers any such part of the Work ready for its intended use and substantially complete and request Engineer to issue a certificate of Substantial Completion for that part of the Work.

3. Within a reasonable time after either such request, Owner, Contractor, and Engineer shall make an inspection of that part of the Work to determine its status of completion. If Engineer does not consider that part of the Work to be substantially complete, Engineer will notify Owner and Contractor in writing giving the reasons therefor. If Engineer considers that part of the Work to be substantially complete, the provisions of Paragraph 14.04 will apply with respect to certification of Substantial Completion of that part of the Work and the division of responsibility in respect thereof and access thereto.

4. No use or occupancy or separate operation of part of the Work may occur prior to compliance with the requirements of Paragraph 5.10 regarding property insurance.

14.06 *Final Inspection*

A. Upon written notice from Contractor that the entire Work or an agreed portion thereof is complete, Engineer will promptly make a final inspection with Owner and Contractor and will notify Contractor in writing of all particulars in which this inspection reveals that the Work is incomplete or defective. Contractor shall immediately take such measures as are necessary to complete such Work or remedy such deficiencies.

14.07 *Final Payment*

A. *Application for Payment:*

1. After Contractor has, in the opinion of Engineer, satisfactorily completed all corrections identified during the final inspection and has delivered, in accordance with the Contract Documents, all maintenance and operating instructions, schedules, guarantees, bonds, certificates or other evidence of insurance, certificates of inspection, marked-up record documents (as provided in Paragraph 6.12), and other documents, Contractor may make application for final payment following the procedure for progress payments.

2. The final Application for Payment shall be accompanied (except as previously delivered) by:

   a. all documentation called for in the Contract Documents, including but not limited to the evidence of insurance required by Paragraph 5.04.B.6;

   b. consent of the surety, if any, to final payment;

   c. a list of all Claims against Owner that Contractor believes are unsettled; and

   d. complete and legally effective releases or waivers (satisfactory to Owner) of all Lien rights arising out of or Liens filed in connection with the Work.

3. In lieu of the releases or waivers of Liens specified in Paragraph 14.07.A.2 and as approved by Owner, Contractor may furnish receipts or releases in full and an affidavit of Contractor that: (i) the releases and receipts include all labor, services, material, and equipment for which a Lien could be filed; and (ii) all payrolls, material and equipment bills, and other indebtedness connected with the Work for which Owner might in any way be responsible, or which might in any way result in liens or other burdens on Owner's property, have been paid or otherwise satisfied. If any Subcontractor or Supplier fails to furnish such a release or receipt in full, Contractor may furnish a bond or other collateral satisfactory to Owner to indemnify Owner against any Lien.

B. *Engineer's Review of Application and Acceptance:*

1. If, on the basis of Engineer's observation of the Work during construction and final inspection, and Engineer's review of the final Application for Payment and accompanying documentation as required by the Contract Documents, Engineer is satisfied that the Work has been completed and Contractor's other obligations under the Contract Documents have been fulfilled, Engineer will, within ten days after receipt of the final Application for Payment, indicate in writing Engineer's recommendation of payment and present the Application for Payment to Owner for payment. At the same time Engineer will also give written notice to Owner and Contractor that the Work is acceptable subject to the provisions of Paragraph 14.09. Otherwise, Engineer will return the Application for Payment to Contractor, indicating in writing the reasons for refusing to recommend final payment, in which case Contractor shall make the necessary corrections and resubmit the Application for Payment.

C. *Payment Becomes Due:*

1. Thirty days after the presentation to Owner of the Application for Payment and accompanying documentation, the amount recommended by Engineer, less any sum Owner is entitled to set off against Engineer's recommendation, including but not limited to liquidated damages, will become due and will be paid by Owner to Contractor.

14.08 *Final Completion Delayed*

A. If, through no fault of Contractor, final completion of the Work is significantly delayed, and if Engineer so confirms, Owner shall, upon receipt of Contractor's final Application for Payment (for Work fully completed and accepted) and recommendation of Engineer, and without terminating the Contract, make payment of the balance due for that portion of the Work fully completed and accepted. If the remaining balance to be held by Owner for Work not fully completed or corrected is less than the retainage stipulated in the Agreement, and if bonds have been furnished as required in Paragraph 5.01, the written consent of the surety to the payment of the balance due for that portion of the Work fully completed and accepted shall be submitted by Contractor to Engineer with the Application for such payment. Such payment shall be made under the terms and conditions governing final payment, except that it shall not constitute a waiver of Claims.

14.09 *Waiver of Claims*

A. The making and acceptance of final payment will constitute:

1. a waiver of all Claims by Owner against Contractor, except Claims arising from unsettled Liens, from defective Work appearing after final inspection pursuant to Paragraph 14.06, from failure to comply with the Contract Documents or the terms of any special guarantees specified therein, or from Contractor's continuing obligations under the Contract Documents; and

2. a waiver of all Claims by Contractor against Owner other than those previously made in accordance with the requirements herein and expressly acknowledged by Owner in writing as still unsettled.

ARTICLE 15 – SUSPENSION OF WORK AND TERMINATION

15.01 *Owner May Suspend Work*

A. At any time and without cause, Owner may suspend the Work or any portion thereof for a period of not more than 90 consecutive days by notice in writing to Contractor and Engineer which will fix the date on which Work will be resumed. Contractor shall resume the Work on the date so fixed. Contractor shall be granted an adjustment in the Contract Price or an extension of the Contract Times, or both, directly attributable to any such suspension if Contractor makes a Claim therefor as provided in Paragraph 10.05.

15.02 *Owner May Terminate for Cause*

A. The occurrence of any one or more of the following events will justify termination for cause:

1. Contractor's persistent failure to perform the Work in accordance with the Contract Documents (including, but not limited to, failure to supply sufficient skilled workers or suitable materials or equipment or failure to adhere to the Progress Schedule established under Paragraph 2.07 as adjusted from time to time pursuant to Paragraph 6.04);

2. Contractor's disregard of Laws or Regulations of any public body having jurisdiction;

3. Contractor's repeated disregard of the authority of Engineer; or

4. Contractor's violation in any substantial way of any provisions of the Contract Documents.

B. If one or more of the events identified in Paragraph 15.02.A occur, Owner may, after giving Contractor (and surety) seven days written notice of its intent to terminate the services of Contractor:

1. exclude Contractor from the Site, and take possession of the Work and of all Contractor's tools, appliances, construction equipment, and machinery at the Site, and use the same to the full extent they could be used by Contractor (without liability to Contractor for trespass or conversion);

2. incorporate in the Work all materials and equipment stored at the Site or for which Owner has paid Contractor but which are stored elsewhere; and

3. complete the Work as Owner may deem expedient.

C. If Owner proceeds as provided in Paragraph 15.02.B, Contractor shall not be entitled to receive any further payment until the Work is completed. If the unpaid balance of the Contract Price exceeds all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) sustained by Owner arising out of or relating to completing the Work, such excess will be paid to Contractor. If such claims, costs, losses, and damages exceed such unpaid balance, Contractor shall pay the difference to Owner. Such claims, costs, losses, and damages incurred by Owner will be reviewed by Engineer as to their reasonableness and, when so approved by Engineer, incorporated in a Change Order. When exercising any rights or remedies under this Paragraph, Owner shall not be required to obtain the lowest price for the Work performed.

D. Notwithstanding Paragraphs 15.02.B and 15.02.C, Contractor's services will not be terminated if Contractor begins within seven days of receipt of notice of intent to terminate to correct its failure to perform and proceeds diligently to cure such failure within no more than 30 days of receipt of said notice.

E. Where Contractor's services have been so terminated by Owner, the termination will not affect any rights or remedies of Owner against Contractor then existing or which may thereafter accrue. Any retention or payment of moneys due Contractor by Owner will not release Contractor from liability.

F. If and to the extent that Contractor has provided a performance bond under the provisions of Paragraph 5.01.A, the termination procedures of that bond shall supersede the provisions of Paragraphs 15.02.B and 15.02.C.

15.03 *Owner May Terminate For Convenience*

A. Upon seven days written notice to Contractor and Engineer, Owner may, without cause and without prejudice to any other right or remedy of Owner, terminate the Contract. In such case, Contractor shall be paid for (without duplication of any items):

1. completed and acceptable Work executed in accordance with the Contract Documents prior to the effective date of termination, including fair and reasonable sums for overhead and profit on such Work;

2. expenses sustained prior to the effective date of termination in performing services and furnishing labor, materials, or equipment as required by the Contract Documents in connection with uncompleted Work, plus fair and reasonable sums for overhead and profit on such expenses;

3. all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) incurred in settlement of terminated contracts with Subcontractors, Suppliers, and others; and

4. reasonable expenses directly attributable to termination.

B. Contractor shall not be paid on account of loss of anticipated profits or revenue or other economic loss arising out of or resulting from such termination.

15.04 *Contractor May Stop Work or Terminate*

A. If, through no act or fault of Contractor, (i) the Work is suspended for more than 90 consecutive days by Owner or under an order of court or other public authority, or (ii) Engineer fails to act on any Application for Payment within 30 days after it is submitted, or (iii) Owner fails for 30 days to pay Contractor any sum finally determined to be due, then Contractor may, upon seven days written notice to Owner and Engineer, and provided Owner or Engineer do not remedy such suspension or failure within that time, terminate the Contract and recover from Owner payment on the same terms as provided in Paragraph 15.03.

B. In lieu of terminating the Contract and without prejudice to any other right or remedy, if Engineer has failed to act on an Application for Payment within 30 days after it is submitted, or Owner has failed for 30 days to pay Contractor any sum finally determined to be due, Contractor may, seven days after written notice to Owner and Engineer, stop the Work until payment is made of all such amounts due Contractor, including interest thereon. The provisions of this Paragraph 15.04 are not intended to preclude Contractor from making a Claim under Paragraph 10.05 for an adjustment in Contract Price or Contract Times or otherwise for expenses or damage directly attributable to Contractor's stopping the Work as permitted by this Paragraph.

ARTICLE 16 – DISPUTE RESOLUTION

16.01 *Methods and Procedures*

A. Either Owner or Contractor may request mediation of any Claim submitted to Engineer for a decision under Paragraph 10.05 before such decision becomes final and binding. The mediation will be governed by the Construction Industry Mediation Rules of the American Arbitration Association in effect as of the Effective Date of the Agreement. The request for mediation shall be submitted in writing to the American Arbitration Association and the other party to the Contract. Timely submission of the request shall stay the effect of Paragraph 10.05.E.

B. Owner and Contractor shall participate in the mediation process in good faith. The process shall be concluded within 60 days of filing of the request. The date of termination of the mediation shall be determined by application of the mediation rules referenced above.

C. If the Claim is not resolved by mediation, Engineer's action under Paragraph 10.05.C or a denial pursuant to Paragraphs 10.05.C.3 or 10.05.D shall become final and binding 30 days after termination of the mediation unless, within that time period, Owner or Contractor:

1. elects in writing to invoke any dispute resolution process provided for in the Supplementary Conditions; or

2. agrees with the other party to submit the Claim to another dispute resolution process; or

3. gives written notice to the other party of the intent to submit the Claim to a court of competent jurisdiction.

ARTICLE 17 – MISCELLANEOUS

17.01 *Giving Notice*

A. Whenever any provision of the Contract Documents requires the giving of written notice, it will be deemed to have been validly given if:

1. 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

2. delivered at or sent by registered or certified mail, postage prepaid, to the last business address known to the giver of the notice.

17.02 *Computation of Times*

A. When any period of time is referred to in the Contract Documents by days, it will be computed to exclude the first and include the last day of such period. If the last day of any such period falls on a Saturday or Sunday or on a day made a legal holiday by the law of the applicable jurisdiction, such day will be omitted from the computation.

17.03 *Cumulative Remedies*

A. The duties and obligations imposed by these General Conditions and the rights and remedies available hereunder to the parties hereto are in addition to, and are not to be construed in any way as a limitation of, any rights and remedies available to any or all of them which are otherwise imposed or available by Laws or Regulations, by special warranty or guarantee, or by other provisions of the Contract Documents. The provisions of this Paragraph will be as effective as if repeated specifically in the Contract Documents in connection with each particular duty, obligation, right, and remedy to which they apply.

17.04 *Survival of Obligations*

A. All representations, indemnifications, warranties, and guarantees made in, required by, or given in accordance with the Contract Documents, as well as all continuing obligations indicated in the Contract Documents, will survive final payment, completion, and acceptance of the Work or termination or completion of the Contract or termination of the services of Contractor.

17.05 *Controlling Law*

A. This Contract is to be governed by the law of the state in which the Project is located.

17.06 *Headings*

A. Article and paragraph headings are inserted for convenience only and do not constitute parts of these General Conditions.

SECTION 00800

SUPPLEMENTAL GENERAL CONDITIONS

Exhibit No.	List of Exhibits
1	Prevailing Wage Rates
2	List of Debarred Contractors and Subcontractors
3	Davis Bacon Act – Labor Standards Provisions for Federally Assisted Construction Contracts (EPA Form 5720-4) and USEPA Attachment 6 – Requirements for Subrecipients that are Government Entities
4	Contract Modification Proposal and Acceptance Form
5	NJAC 7:22-9 and NJAC 7:22-10.11, 12
6	SED Participation Building Phase Quarterly Report (Form OEO-002)
7	SED Participation Monthly Progress Report (Form OEO-003)
8	PVSC SED Utilization Plan
9	NJAC 7:14-2
10	NJSA 2A:44-143, 144
11	Implementation of American Iron and Steel Provisions of P.L. 113-76, Consolidated Appropriations Act, 2014
12	List of Drawings

SECTION 00800

SUPPLEMENTAL GENERAL CONDITIONS

These Supplemental General Conditions amend or supplement the Standard General Conditions of the Construction Contract (No. C700, 2007 Edition) given as Specification Section 00700 and other provisions of the Contract Documents as indicated below. All provisions that are not so amended or supplemented remain in full force and effect.

ARTICLE 1 – DEFINITIONS AND TERMINOLOGY

Add the following Section at the beginning of this Article:

1.00 Terms

A. The terms used in these Supplemental General Conditions which are defined in the Standard General Conditions of the Construction Contract (No. C700, 2007 Edition) given as Specification Section 00700 have the meanings assigned to them in the General Conditions.

1.01 Defined Terms

Definition 18. Omit the word "two".

Delete Definition 42. in its entirety and replace with the following:

"Specifications – All the terms and stipulations contained in the General Requirements and in the Detailed Specifications. The requirements of the General Requirements shall be considered part of each Item of the Detailed Specifications."

Definition 43. Omit "Work at the Site" and substitute "Project".

In the second line of Definition 44. Substantial Completion, delete:

"of ENGINEER", and add "of ENGINEER, and approved by OWNER"

Insert the following at the end of Definition 44. Substantial Completion.

"The date of Substantial Completion shall be certified by the ENGINEER."

Add the following new definition:

"52. *Conditions of the Contract* - The combined General Conditions and Supplemental General Conditions."

ARTICLE 2 – PRELIMINARY MATTERS

Add the following Section to the beginning of this Article:

"2.00 *Execution of Agreement*

A. At least six counterparts of the Agreement will be executed and delivered by the CONTRACTOR to the OWNER within ten (10) working days of the Notice of Award and receipt of Contract Documents by the CONTRACTOR for execution; and thereafter OWNER will execute and deliver one counterpart to CONTRACTOR."

2.01 *Delivery of Bonds and Evidence of Insurance*

Delete Part B. Evidence of Insurance in its entirety and substitute the following:

"B. *Evidence of Insurance*: Before any Work at the site is started, Contractor shall deliver to Owner, with copies to Engineer and each additional insured identified in Article 5 of the Supplemental General Conditions, certificates of insurance (and other evidence requested by Owner) which Contractor is required to purchase and maintain in accordance with the requirements of Article 5."

2.03 *Commencement of Contract Times; Notice to Proceed*

Delete in its entirety and substitute the following:

"A. Except as otherwise provided in (ii) hereinafter, the Contract Time will commence to run on the day indicated in the Notice to Proceed; but in no event will the Contract Time commence to run later than the ninetieth day after the day of Bid opening or the thirtieth day after the Effective Date of the Agreement. By mutual consent of the parties to the Contract, these time limits may be changed.

B. Notwithstanding the provisions of subsection (i) above, if award of the Bid is challenged, and the Owner determines that a hearing is required on the challenge, or a Court or governmental entity having jurisdiction issues a stay of the award or performance of the Contract, the Contract Time and Effective Date of the Agreement shall be stayed for the time necessary for Owner to conduct a hearing and make a determination on the challenge and/or the time that the Contract award or performance are stayed by a Court or governmental entity having jurisdiction, not to exceed an additional 180 days."

2.06 *Pre-construction Conference; Designation of Authorized Representatives*

Delete in its entirety and substitute the following:

"A. Within ten (10) days after the Contract Times start to run, but before any Work at the site is started, a pre-construction conference shall be attended by, but without limitations to, the following: Contractor's Representatives, Owner's Representatives, NJDEP, Utility Companies and all other Regulatory Agencies as required. The conference will establish a working understanding among the parties as to the Work and to discuss the schedules referred to in paragraph 2.05A, procedures for handling Shop Drawings and other submittals, processing Applications for Payment and maintaining required records."

ARTICLE 3- CONTRACT DOCUMENTS: INTENT, AMENDING AND REUSE

3.01 *Intent*

Add the following subparts to Part A:

"1. Each and every provision of law and clause required by law to be inserted in these Contract Documents shall be deemed to be inserted herein, and they shall be read and enforced as though it were included herein, and if through mistake or otherwise, any such provision is not inserted, or if not correctly inserted, then upon the application of either party, the Contract Documents shall forthwith be physically amended to make such insertion.

2. The Contract Documents indicate the extent and general arrangement of the work. It is the intent of the Contract Documents to obtain an operable Project. Equipment, components, systems, etc., therein shall be made operable by the CONTRACTOR.

3. The Contract Drawings may be supplemented from time to time with additional drawings by the ENGINEER as may be required to illustrate the work or, as the work progresses, with additional Drawings, by the CONTRACTOR, subject to the approval of the ENGINEER. Supplementary Drawings, when issued by the ENGINEER or by the CONTRACTOR, after approval by the ENGINEER, shall be furnished in sufficient quantity to all those who, in the opinion of the ENGINEER, are affected by such Drawings."

3.03 Reporting and Resolving Discrepancies.

A. 3. "or should have known."

ARTICLE 4 – AVAILABILITY OF LANDS; SUBSURFACE AND PHYSICAL CONDITIONS; HAZARDOUS ENVIRONMENTAL CONDITIONS; REFERENCE POINTS

4.02 *Subsurface and Physical Conditions*

Part B: In the sixth line delete "The Supplementary Conditions", and substitute "Contract Documents"

Add the following Paragraph to Section 4.02:

C. It shall be understood and agreed that the CONTRACTOR will not use any of the information made available to him, or obtained in any examination made by him, in any manner as a basis or ground of claim or demand of any nature against the OWNER or the ENGINEER, arising from or by reason of any variance which may exist between the information offered and the actual materials or structures encountered during the construction.

4.04 *Underground Facilities*

Delete Part B. in its entirety and substitute the following:

B. All information given on the Drawings, or in the Contract Documents, relative to subsurface and latent physical conditions or otherwise affecting the

performance of the Work is from the present sources available to the OWNER and the ENGINEER. It is understood and agreed that the OWNER and the ENGINEER do not warrant or guarantee that the materials, conditions, and pipes, or other structures encountered during the construction will be the same as those indicated on the Drawings or in the Contract Documents. Each Bidder must inform himself fully of the conditions relating to the construction and labor under which the work will be performed; and in particular as to subsurface and groundwater conditions; failure to do so will not relieve a successful bidder of his obligation to furnish all material and labor necessary to carry out the provisions of the Contract Documents and to complete the contemplated work for the considerations and he makes his bid with a full knowledge of conditions, and the kind, quality, and quantity of work required.

It is also understood and agreed that the Bidder or the CONTRACTOR will not use any of the information made available to him, or obtained in any examination made by him, in any manner as a basis or ground of claim or demand of any nature against the OWNER or the ENGINEER, arising from or by reason of any variance which may exist between the information offered and the actual materials or structures encountered during construction.

4.05 *Reference Points*

Part A: Add the following after "provide" in the first line:

", if available,"

Add the following paragraphs:

"B. ENGINEER may check the lines, elevations, reference marks, batter boards, etc., set by CONTRACTOR, and CONTRACTOR shall correct any errors disclosed by such check. Such a check shall not be considered as approval of CONTRACTOR's work and shall not relieve CONTRACTOR of the responsibility for accurate construction of the entire Work. CONTRACTOR shall furnish personnel to assist ENGINEER in checking lines and grades."

"C. No separate payment will be made to the CONTRACTOR for the cost of establishing lines and grades or for the cost of assisting the ENGINEER in checking of such work or for the delay in checking such work, but the cost thereof shall be included in the prices bid for the various items."

4.06 Hazardous Environmental Condition at Site.

G. Omit in its entirety and substitute the following: "Owner, in its sole discretion, shall have the right to dispose of the contamination, either on its own or through an independent Contractor, or negotiate a Change Order with the Contractor.

ARTICLE 5 – BONDS AND INSURANCE

5.01 *Performance, Payment and Other Bonds*

Part A: Add the following after "payment bonds" in the first line:

"within ten (10) working days of Notice of Award".

Delete the second sentence and replace with the following:

"The Performance Bond shall remain in effect until completion and acceptance by the OWNER as specified in paragraph 14.07".

Add the following Paragraphs to Section 5.01:

"D. As surety that the CONTRACTOR will faithfully maintain the Work during the twelve (12) month Correction Period, the CONTRACTOR agrees to furnish to the OWNER before final payment shall be made under the terms of this Contract, a suitable Maintenance Bond in the amount of one hundred percent (100%) of the Contract price less the amount of the Environmental Maintenance Bond, with a surety company (licensed by the Commissioner of Banking and Insurance of New Jersey), as surety, running from the date of substantial completion to date twelve (12) months after the date of substantial completion and acceptance as herein before described.

The CONTRACTOR shall note that the form of Maintenance Bond shall be approved by the OWNER prior to the execution therof by the CONTRACTOR and acceptance thereof by the OWNER. Should the CONTRACTOR fail to commence within one week of notice from the OWNER to make the repairs or replacements required under the terms of the Correction Period set forth above, the OWNER may have said replacements made or repairs done and the expense thereof shall paid by the CONTRACTOR or by the CONTRACTOR's Surety."

"E. The Environmental Maintenance Bond, furnished by the Contractor shall be supplied in the amount of $25,000 or 50% of the bid price for the Environmental Protection bid items, whichever is greater, and shall remain in full force and effect for one (1) year beyond the end of the Correction Period".

5.03 *Certificates of Insurance*

Add the following paragraph to 5.03:

"F. Wherever in this Article the terms "The Insured" and OWNER occurs with respect to coverage in a policy, it shall mean the OWNER and its agent and agencies, all municipalities where work is being performed under the contract, the ENGINEER, and any other parties specifically designated below, who shall be named as insured in each policy issued. The insurance policies required herein shall not contain any Third Party Beneficiary Exclusion. The State of New Jersey and its venues, employees and officers shall be named insured on each certificate of Insurance."

5.04 *CONTRACTOR's Insurance*

Add the following to the end of the paragraph of Part A:

"The limits of liability for the insurance required by Paragraph 5.04 of the General Conditions shall provide coverage for not less than the following amounts or greater where required by law:"

Add the following to Part A, Subparts 1 and 2:

"Workers' Compensation

(1)	Worker's Compensation	Statutory
(2)	Employer's Liability	$2,000,000"

Add the following to Part A, Subparts 3, 4 and 5:

"Comprehensive General Liability including Premise/Operations; Explosion, Collapse and Underground Property Damage; Products/Completed Operations, Broad Form Contractual, Independent CONTRACTORs; Broad Form Property Damage; and Personal Injury liabilities:

(1)	Bodily Injury:	$2,000,000 Each Occurrence $2,000,000 Annual Aggregate
(2)	Property Damage:*	$1,000,000 Each Occurrence $2,000,000 Annual Aggregate

*Property Damage shall include Explosion, Collapse and Underground Coverages. Property Damage shall include property in the care, custody and control of the insured.

(3)	Personal Injury, with employment exclusion deleted.	$2,000,000 Annual Aggregate"

Add the following to Part A, Subparts 6:

"Comprehensive Automobile Liability including all owned (private and others), hired and non-owned vehicles:

(1)	Bodily Injury	$1,000,000 Each Person $2,000,000 Each Accident
(2)	Property Damage	$1,000,000 Each Occurrence"

Add the following Paragraph to Part B:

"7. CONTRACTOR may purchase and maintain excess liability insurance in the umbrella form in order to satisfy the limits of liability required for the insurance to be purchased and maintained in accordance with paragraph 5.04. Evidence of such excess liability shall be delivered to OWNER in accordance with paragraph 5.03 in the form of a certificate indicating the policy numbers and limits of liability of all underlying insurance. The umbrella liability insurance shall have a combined single limit of not less than $5,000,000."

5.05 *OWNER's Liability Insurance*

Delete Part A of Section 5.05 in its entirety and insert the following in its place:

A. CONTRACTOR shall purchase and maintain a separate OWNER's Protective Liability Policy, issued to OWNER at the expense of CONTRACTOR, including OWNER and ENGINEER as named insured. This insurance shall provide coverage for not less than the following amounts:

1.	Bodily Injury	$2,000,000 Each Occurrence
2.	Property Damage	$1,000,000 Each Occurrence $2,000,000 Annual Aggregate

5.06 *Property Insurance*

Delete the first sentence of Part A and replace with the following:

> "CONTRACTOR shall purchase and maintain property insurance upon the Work at the site, written on the completed value form, in an amount equal to the total bid price for the completed construction."

Add a sentence immediately after the paragraph of Part A, Subpart 2 as follows:

> "The policy shall contain endorsements covering damage from flood and earthquake. The value of the coverage for damage from flood shall have a minimum limit of 40% if the **Total Bid Price**, but in no case less than $3,250,000."

Delete Part B in its entirety.

5.10 *Partial Utilization, Acknowledgement of Property Insurer*

Add a new paragraph as follows:

> "B. OWNER will continually occupy all facilities involved in this project and will require temporary access to the Work prior to substantial completion. Endorsements to the property insurance policies provided by the CONTRACTOR that protect the interests of all parties shall be provided."

ARTICLE 6 – CONTRACTOR'S RESPONSIBILITIES

6.01 *Supervision and Superintendant*

Add the following:

> "C. CONTRACTOR will be held responsible for the conduct of all personnel on site employed by or through Contract. CONTRACTOR shall employ only competent persons to perform the work of this contract. Whenever OWNER shall notify CONTRACTOR, in writing, that any person on the work, including superintendents and other Supervisors, appears to be incompetent, disorderly, or who disregards the authority of the ENGINEER and/or OWNER, or is otherwise unsatisfactory, such person shall be removed from the Project within the time frame specified by the OWNER, and shall not again be employed on it except with the consent of OWNER."

6.03 *Services, Materials, and Equipment*

Add the following:

> "D. Contractor 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."

6.05 *Substitutes and "Or-Equals"*

Delete the following statement from the second sentence of Part A:

"Unless the specification or description contains or is followed by words reading that no like, equivalent, or "or equal" item or no substitution is permitted,"

6.06 *Concerning Subcontractors, Suppliers and Others*

Change this Section Title to read 'Concerning Assignment, Subcontractors, Suppliers and Others:"
Add the following to Part A:

"CONTRACTOR shall not assign, transfer, convey or otherwise dispose of the Contract, or of his legal right, title, or interest in or to the same or to any part thereof, without the prior written consent of the OWNER. CONTRACTOR shall not assign by power of attorney or otherwise any monies due him and payable under this Contract without the prior written consent of the OWNER. Such consent, if given, will in no way relieve the CONTRACTOR from any of the obligations of this Contract. OWNER shall not be bound to abide by or observe the requirements of any such assignment. Acceptance of any Subcontractor, other person or organization by OWNER shall not constitute a waiver of any right of OWNER to reject defective work.

The CONTRACTOR agrees that it is as fully responsible to OWNER for the acts and omissions of its Subcontractors and of persons either directly or indirectly employed by them, as it is for the acts and omissions of persons directly employed by it.

CONTRACTOR shall comply with the New Jersey Regulations governing minority and female CONTRACTOR and subcontractor participation on Construction Contracts as required by NJSA 52:32-17. The regulations, which are more specifically set forth in NJAC 17:14-1.1 et seq., are incorporated herein by reference and made a part hereof."

Add the following changes to Part B:

First line, delete: "If the Supplementary Conditions", and substitute "Contract Documents". The fourth line, delete: "Supplementary Conditions", and substitute "Contract Documents".

6.07 *Patent Fees and Royalties*

Delete Part A in its entirety and substitute the following:

"A. CONTRACTOR shall pay all license fees and royalties and assume all costs incident to the use in the performance of the work of any invention, design, process, products or device which is the subject of patent rights or copyrights

held by others. CONTRACTOR shall indemnify and hold harmless OWNER AND ENGINEER and anyone directly or indirectly employed by either of them from and against all claims, damages, losses and expenses, including attorney's fees, arising out of any infringement of patent rights or copyrights incident to the use in the performance of the work or furnished by him in fulfillment of the requirements of this Contract. In the event of any claim or action by law on account of such patents or fees, it is agreed that the OWNER may retain out of the monies which are or which may become due to the CONTRACTOR under this Contract, a sum of money sufficient to protect itself against loss, and to retain the same until said claims are paid or satisfactorily adjusted."

6.08 *Permits*

Add the following new paragraphs:

B. Federal, State, County and municipal permits required as a result of the construction activity within the delineated project site shall be obtained by the Owner and associated fees shall be paid by the Owner. In addition, permits required for construction activities on railroad properties shall be obtained by the Owner.

C. The Contractor shall be responsible for obtaining any permits to use explosives for rock excavation and for such other permits which by law are required to be obtained by the Contractor and the Owner will reimburse the Contractor for the direct cost of obtaining such permits. The Contractor shall, at its own expense, post all necessary sureties required by the agencies issuing the permits to be obtained by the Contractor.

D. Conditions pertaining to construction activity made a part of any permit shall be imposed upon the Contractor at no additional charge. Additional costs associated with a permit resulting from the construction activity which is beyond that stipulated in the Contract shall be the responsibility of the Contractor.

E. The methods of construction to be utilized by the Contractor must satisfy the requirements of the agencies having jurisdiction. Generally, the "methods of construction" are defined as the means to be employed by the Contractor to obtain the end results required by the design.

F. Whenever requested, the Contractor shall assist the Owner in the acquisition of permits.

G. The Contractor shall obtain the consent of and shall bear the charges of all utilities and agencies involved for connections with the work.

H. The Contractor shall notify, cooperate with and arrange for inspections from all agencies having jurisdiction over the work.

6.09 *Laws and Regulations*

Delete Part B in its entirety and substitute the following:

"B. If CONTRACTOR observes that the Specifications or Drawings are at variance with any Laws or Regulations, he shall give ENGINEER prompt written notice thereof. If CONTRACTOR performs any work knowing it to be contrary to such Laws or Regulations, and without such notice to ENGINEER, he shall bear all costs arising therefrom. The CONTRACTOR shall, at all times, observe and comply with and shall cause all his agents and employees and all his Subcontractors to observe and comply with all such existing Laws or Regulations, and shall protect and indemnify the OWNER and the ENGINEER and the municipalities in which work is being performed, and their officers and agents against any claim or liability arising from or based on the violation of any such Law or Regulation, whether by himself or his employees or any of his Subcontractors."

Add the following paragraph:

"D. The CONTRACTOR shall keep itself fully informed of all existing and future state and Federal Laws and Regulations and Municipal Ordinances and Regulations, in any manner affecting the work and the persons engaged or employed in the work, or the materials used in the work, or in any affecting the performance of the work, either with respect to hours of labor or otherwise, and of all such laws, ordinances, regulations, orders and decrees, and shall protect and indemnify OWNER and their officers and agents against any claims or liability arising from or based on the violation of any such law, ordinance, regulation, order or decree, whether by itself, or by its agents or employees."

6.10 *Taxes*

Add the following to Part A:

"The materials and supplies to be used in the work of this contract are exempt from sales tax of the State of New Jersey. CONTRACTOR shall obtain the proper certificates, maintain the necessary records and otherwise comply with the requirements of state law."

6.13 *Safety and Protection*

Add the following Paragraph:

"G. The CONTRACTOR throughout the work of this contract shall comply with the OWNER Safety Rules, as well as the Federal Occupational Safety and Health Act and the applicable New Jersey Department of Labor Administrative Codes. The CONTRACTOR shall obtain a copy of the OWNER Safety Rules (http://www.nj.gov/pvsc/home/forms/pdf/ConstructionSafetyHealthManualforContractors08272012.pdf), these rules, including the wearing of protective head gear, shall be strongly enforced by the CONTRACTOR in respect to his own employees, Subcontractors employees, and other personnel engaged in business with the CONTRACTOR on OWNER's property.

CONTRACTOR's (and Subcontractors) personnel when on OWNER property shall prominently display Company name or logo on their safety helmet (hard hat).

The CONTRACTOR is advised of the 15-MPH speed limit on all plant roads, and will be held responsible for his employees (and Subcontractors) compliance with this and all rules for traffic safety in the plant.

All CONTRACTORs personnel shall wear OSHA approved hard hats and shall display a clearly visible company logo on the hat.

The CONTRACTORs attention is directed toward several New Jersey Labor Department Administrative Codes that influence the conduct of his work in specific areas:

1. NJAC 12:100-9 – Work in Confined Space

2. NJAC 12:100-11 – Control of Hazardous Energy
(Electrical energy lockout and other energy sources such as steam, air, liquids)

3. NJAC 7:31-1-6 – Toxic Catastrophe Prevention Act.

Before any work commences on OWNER property, the CONTRACTOR's Superintendent shall contact the OWNER Facility Supervisor at the site. The OWNER Supervisor will inform the CONTRACTOR of the OWNER emergency plant evacuation plan and where he is to assemble his personnel.

The CONTRACTOR shall instruct and show his personnel where to assemble, at the sound of the OWNER emergency evacuation siren. The facility Supervisor will notify the CONTRACTOR's personnel of the emergency evacuation route they are to follow. At the assembly point, the CONTRACTOR's person in charge shall account for all his personnel, supply transportation, and see that they utilize the prescribed evacuation route.

Every third Wednesday of each month at 11:00 a.m. the evacuation siren is put through a test cycle, it is not required to assemble for the test cycle.

Where portions of the work of the contract fall under the authority of these Administrative Codes for Public Employees, the CONTRACTOR shall at all times maintain safety standards for his employees equivalent to that imposed by the Codes. This includes, for example, monitoring of air in confined spaces with appropriate instrumentation for noxious or toxic gases, and lockout of hazardous energy such as electrical, steam, air, or liquids under pressure.

The CONTRACTOR shall be responsible for providing first aid, and emergency medical assistance for any of his employees injured on the work site. The CONTRACTOR shall be responsible for arranging emergency assistance with local hospitals, and/or EMT services. The CONTRACTOR's arrangements shall be submitted in writing, with required telephone numbers to OWNER's Security Department. OWNER Security will summon the CONTRACTOR's emergency personnel, if the CONTRACTOR calls OWNER Security from any in plant telephone.

CONTRACTOR's personnel will not be treated in the OWNER Dispensary for minor injuries, cuts or services."

6.15 *Hazardous Communication Program*

Add the following paragraph:

"B. All hazardous material whether sold, delivered, and/or used to perform a service on the OWNER site, shall be properly labeled in accordance with the New Jersey Worker and Community Right to Know (P.L. 1983, C315, NJSA 34:56A-1 et seq.). The bidder shall provide prior to arrival on site the Material Safety Data Sheets to the OWNER for all the products that he intends to utilize under this contract."

6.19 *CONTRACTOR's General Warranty and Guarantee*

After the first sentence of Part A add the following:

"All materials or equipment delivered to the site shall be accompanied by certificates, signed by an authorized officer of the supplier, and notarized guaranteeing that the materials or equipment conform to specification requirements. Such certificates shall be immediately turned over to the OWNER. Materials or equipment delivered to the site without such certificates will be subject to rejection."

Omit the entire second sentence of Part A.

6.20 *Indemnification*

Delete Part A in its entirety and substitute the following:

"A. To the fullest extent permitted by Laws and Regulations, and except for the willful misconduct of OWNER, CONTRACTOR shall indemnify and hold harmless OWNER, ENGINEER, ENGINEER's Consultants and the officers, directors, employees, agents and other consultants of each and any of them from and against all claims, costs, losses and damages (including but not limited to all fees and charges of ENGINEERS, architects, attorneys and other professionals and all court or arbitration of other dispute resolution costs including appeals) caused by, arising out of or resulting from the performance of the Work, provided that any such claim, cost, loss or damage is caused in whole or in part by any negligent act or omission of the CONTRACTOR, any Subcontractor, any Supplier, any person or organization directly or indirectly employed by any of them to perform or furnish any of the Work or anyone for whose acts any of them may be liable, regardless of whether or not caused in part by any negligence or omission of a person or entity indemnified hereunder or whether liability is imposed upon such indemnified party by Laws and Regulations regardless of the negligence of any such person or entity."

Add the following new Paragraphs as follows:

"D. Wherever in this Agreement a provision imposes upon the CONTRACTOR an obligation of indemnification, that obligation shall be as set forth in the preceding paragraphs of this provision. CONTRACTOR acknowledges that it is the intent of the parties that any indemnification obligation imposed upon CONTRACTOR pursuant to any provision of this Agreement shall be the broadest called for under this Agreement.

E. Nothing in the Contract Documents shall create or give to third parties any claim or right of action against the CONTRACTOR, the OWNER or the ENGINEER beyond such as may legally exist irrespective of the Contract."

ARTICLE 7 – OTHER WORK AT THE SITE

7.02 *Coordination* — Delete this Section in its entirety.

ARTICLE 8 – OWNER'S RESPONSIBILITIES

8.02 *Replacement of ENGINEER* — Delete this Section in its entirety.

8.06 *Insurance* — Delete this Section in its entirety.

8.11 *Evidence of Financial Arrangements* — Delete this Section in its entirety.

ARTICLE 9 – ENGINEER'S STATUS DURING CONSTRUCTION

9.01 *OWNER's Representative*

Delete Part A in its entirety and substitute the following:

"A. ENGINEER will be the OWNER's representative during the construction period, and his instructions shall be carried into effect promptly and efficiently."

9.03 *Project Representative*

Part A: In the first sentence delete "If OWNER and ENGINEER agree" and substitute "At OWNER's option".

Add the following paragraphs:

"B. The Resident Project Representative will serve as the ENGINEER's liaison with the CONTRACTOR, working principally through the CONTRACTOR's superintendent to assist him in understanding the intent of the Contract Documents.

C. The Resident Project Representative shall conduct on-site observations of the work in progress to confirm that the work is proceeding in accordance with the Contract Documents. He will verify that tests, equipment and systems start-ups and operating and maintenance instructions are conducted as required by the Contract Documents. He will have the authority to disapprove or reject defective work in accordance with Article 13."

9.09 *Limitations on ENGINEER's Authority and Responsibilities*

Add the following to Part E:

"Except upon written instructions of the ENGINEER, the Resident Project Representative:

1. Shall not authorize any deviation from the Contract Documents or approve any substitute materials or equipment.

2. Shall not exceed limitations of ENGINEER's authority as set forth in the Contract Documents.

3. Shall not undertake any of the responsibilities of CONTRACTOR, Subcontractors or CONTRACTOR's superintendent, or expedite the work.

4. Shall not advise on/or issue directions to any aspect of the means, methods, techniques, sequences or procedures of construction unless such is specifically called for in the Contract.

5. Shall not advise on or issue directions as to safety precautions and programs in connection with the work."

ARTICLE 10 – CHANGES IN THE WORK; CLAIMS

10.01 *Authorized Changes in the Work*

Add the following to the end of Part B:

"CONTRACTOR certifies that this claim is made in good faith, that the supporting data are accurate and complete to the best of CONTRACTOR's knowledge and belief, and that the amount or time requested accurately reflects the contract adjustment for which CONTRACTOR believes OWNER is liable."

ARTICLE 11 – COST OF THE WORK; CASH ALLOWANCES; UNIT PRICE WORK

11.01 *Cost of the Work*

Delete the fourth sentence in the paragraph of Part A, Subpart 1 in its entirety and replace with the following:

Such employees shall include all labor categories listed in the New Jersey Department of Labor Prevailing Wage Rate Determination.

Delete the second sentence in the paragraph of Part A, Subpart 3 "If required ... be acceptable."

Delete Part A, Subpart 5a in its entirety.

Add the following before the last sentence of the paragraph of Part A, Subpart 5c:

"These rates shall include all fuel, lubricants, insurance, etc. Equipment rental charges shall not exceed the prorated monthly rental rates listed in the current edition of the " 'Compilation' of Rental Rates for Construction Equipment" as published by the Associated Equipment Distributors. Charges per hour shall be determined by dividing the monthly rates by 176."

Delete Part A, Subpart 5.f. in its entirety.

Delete Part A, Subpart 5.g. in its entirety.

Delete Part A, Subpart 5.h. in its entirety.

Delete Part A, Subpart 5.I. in its entirety

11.02 *Allowances*

Add the following paragraph:

"E. It should be noted that the following Allowance Items are partially or wholly not fundable under the New Jersey Environmental Infrastructure Trust Loan:

1. Item 3 - Allowance for Audio Visual Design & Implementation
2. Item 5 - Allowance for Painting, Wall Finishes & Flooring on 2nd Floor
3. Item 6 - Allowance for Additional Authorized Work

11.03 *Unit Price Work*

In Part D, Subpart 1, delete "materially and significantly", and insert "by more than plus or minus twenty percent (20%)".

ARTICLE 12 – CHANGE OF CONTRACT PRICE; CHANGE OF CONTRACT TIMES

12.01 *Change in Contract Price*

Delete part B, Subpart 2 in its entirety and replace with the following:

"2. Where the Work involved is not covered by unit prices contained in the Contract Documents, by a mutually agreed upon lump sum which includes an allowance for overhead and profit in accordance with paragraph 12.01.C.2"

Delete Part C, Subpart 1 in its entirety.

Add the following to Part C, Subpart 2.a.:

"CONTRACTOR's fee shall not be applied to payroll taxes, social security contributions, or unemployment taxes. CONTRACTOR's fee of fifteen percent shall not be applied to moveable equipment (i.e., cranes, furniture etc.) purchased and supplied to the OWNER under a change in the contract price or a construction allowance. CONTRACTOR will be allowed a five percent fee in this case."

ARTICLE 13 – TESTS AND INSPECTIONS; CORRECTION, REMOVAL OR ACCEPTANCE OF DEFECTIVE WORK

13.03 *Tests and Inspections*

Delete Part B in its entirety and substitute the following:

"B. OWNER shall employ and pay for all inspections and testing services specifically noted as such in the Contract. All others required shall be the responsibility of the CONTRACTOR."

Delete Parts C and D in their entirety and substitute the following:

"C. If the Contract Documents, laws, ordinances, rules, regulations or orders of any public authority having jurisdiction require any work to be specifically inspected, tested or approved by any public entity, CONTRACTOR shall assume full responsibility therefore, pay all costs in connection therewith and furnish ENGINEER the required certificates of inspection, testing or approval.

D. The OWNER reserves the right to independently perform at its own expense, laboratory tests on random samples of material or performance tests on equipment delivered to the site. These tests, if made, will be conducted in accordance with appropriate referenced standards or Specifications requirements. The entire shipment represented by a given sample, samples or piece of equipment may be rejected on the basis of the failure of samples or pieces of equipment to meet specified test requirements. All rejected materials or equipment shall be removed from the site, whether stored or installed in the work, and the required replacement shall be made, all at no additional cost to the OWNER."

13.05 *OWNER May Stop the Work*

Insert the following in the third line between "Documents," and "OWNER":

"or if the work interferes with the operation of the existing facility

Add the following at the end of the paragraph of Part A.

"If the OWNER stops work under Paragraph 13.05, Contractor shall be entitled to no extension of Contract Time or increase in Contract Price."

13.06 *Corrections or Removal of Defective Work*

Add the following Paragraph:

"C. At any time during the progress of the work and up to the date of final acceptance, the ENGINEER shall have the right to reject any work which does not conform to the requirements of the Contract Documents, even though-such work has been previously inspected and paid for. Any omissions or failure on the part of the ENGINEER to disapprove or reject any work or materials at the time of inspection shall not be construed as an acceptance of any defective work or materials."

ARTICLE 14 - PAYMENTS TO CONTRACTOR AND COMPLETION

14.01 *Schedule of Values*

Add the following at the end of the paragraph of Part A:

"The CONTRACTOR shall submit for the ENGINEER's approval, a complete breakdown of all Lump Sum Items in the Proposal. This breakdown, modified as directed by the ENGINEER, will be used as a basis for preparing estimates and establishing progress payments.

14.02 *Progress Payments*

A. Applications for Payments

Delete Subpart 3 in its entirety and substitute the following:

"3. Any Contract, the total price of which exceeds $100,000.00, entered into by the OWNER involving the construction, reconstruction, alteration, repair or maintenance of any building, structure, facility or other improvement to real property, shall provide for partial payments to e made at least once each month as the work progresses, unless the contractor shall agree to deposit bonds with the contracting unit pursuant to P.L. 1979, c.152 (C.40A:11-16.1)

Application for Progress Payment request shall include the total amount of the work completed to the month prior to date of application for Progress Payment and the amount earned by the CONTRACTOR for the payment period. The payment period may conclude on the last day of the preceding month, or other mutually agreed upon day of the month accompanied by such data and supporting evidence as OWNER or ENGINEER may require.

Forms to be used shall be prepared by the CONTRACTOR and submitted to the ENGINEER for approval.

The OWNER shall withhold two (2) percent of the amount due on each application for Progress Payment pursuant to NJSA 40A: 11-16.3, unless the CONTRACTOR makes the deposits referred to in NJSA 40A:11-16.1. Such withholding shall be in addition to any retainage otherwise authorized by law or the Contract Documents.

The OWNER shall make payments to the CONTRACTOR once each month as the work progresses. Payment may be withheld at any time if the work is not proceeding in accordance with the Contract Documents.

The OWNER will not pay for equipment stored on or off-site and payments will be made on completed work only; unless by special approval. Upon application to the OWNER, the OWNER may, at its own discretion, approve payments for stored equipment provided the equipment has been inspected and approved by the ENGINEER at its stored location.

Where instruction manuals and parts list are specified in the Contract Documents. Payment will not be made until approved Instruction Manuals and Parts Lists have been received and approved by OWNER.

The CONTRACTOR shall furnish evidence that payment received on the basis of materials and equipment not incorporated and suitably stored, has in fact been paid to the respective supplier(s) within thirty days of payment by OWNER. Failure to provide such evidence of payment may result in the withdrawal of previous approval(s) and removal of the cost of related materials and equipment from the next submitted application for Progress Payment.

Upon Substantial Completion the retainage withheld by the OWNER pursuant to NJSA 40A:11-16.3 shall be paid to the CONTRACTOR as provided by law. The OWNER may reinstate the retainage if it is determined that the CONTRACTOR is not making satisfactory progress or there is other specific cause for such retainage.

The NJAC 7:14-2.8 requirements will be followed."

B. *Review of Applications:*

Add the following to Subpart 1:

"Should CONTRACTOR neglect to pay any undisputed claims, made in writing to OWNER within thirty days after completion of the Work, but continuing unsatisfied for a period of ninety days, OWNER may pay such claim and deduct the amount thereof from the balance due CONTRATOR. OWNER may also, with the written consent of CONTRACTOR, use any monies retained, due, or to become due under this Contract for the purpose of paying for both labor and materials for the Work, for which claims have not been filed.

Security is provided both by the Payment Bond and the power of OWNER to retain any monies for claims, but payment by one shall in no way impair or discharge the liability of the other.

Any and all liens for work and materials may be paid off by OWNER within a reasonable time after filing for record in accordance with State and local laws, a notice of such liens except where claim on which the lien is filed is being litigated by CONTRACTOR, and in such case OWNER may pay the amount of any final judgement or decree or any such claim within reasonable time after such final judgement or decree shall be rendered.

All monies paid by the OWNER in settlement of liens as aforesaid, with the costs and expenses incurred by OWNER in connection therewith, shall be charged to CONTRACTOR, shall bear interest at the rate of three percentage points above the rediscount rate then charged by the Federal Reserve Bank, and shall be deducted from the next payment due CONTRACTOR under the terms of this Contract."

14.03 *CONTRACTOR's Warranty of Title*

Add the following Paragraph to Section 14.03:

"B. The Application for payment shall be accompanied by such data, satisfactory to OWNER, as will establish OWNER'S title to the material and equipment and protect his interest therein, including applicable insurance. Each subsequent Application for Payment shall include an Affidavit of CONTRACTOR stating that all previous progress payments received on account of the work have been applied to discharge in full all of CONTRACTOR's obligations reflected in prior Applications for Payment.

No materials or supplies for the Work shall be purchased by CONTRACTOR or Subcontractor subject to any chattel mortgage or under conditional sales contract or other agreement by which an interest is retained by the seller. CONTRACTOR warrants that he/she has good title to all materials and supplies used by him/her in the Work, free from all liens, claims or encumbrances.

CONTRACTOR shall indemnify and save OWNER harmless from all claims growing out of the lawful demands of Subcontractors, laborers, workmen, mechanics, materialmen, and furnishers or machinery and parts thereof, equipment, power tools, and all supplies, including commissary, incurred in the furtherance of the performance of this Contract. CONTRACTOR shall at

OWNER's request, furnish satisfactory evidence that all obligations of the nature hereinabove designated have been paid, discharged, or waived. If CONTRACTOR fails to do so, then OWNER may, after having served written notice on the said CONTRACTOR either pay unpaid bills, of which OWNER has written notice, direct, or withhold from the CONTRACTOR's unpaid compensation a sum of money deemed reasonably sufficient to pay any and all such lawful claims until satisfactory evidence is furnished that all liabilities have been fully discharged whereupon payment to CONTRACTOR shall be resumed, in accordance with the terms of this Contract, but in no event shall the provisions of this sentence be construed to impose any obligations upon OWNER to either CONTRACTOR or his/her Surety.

In paying any unpaid bills of the CONTRACTOR, OWNER shall be deemed the agent of CONTRACTOR and any payment so made by the OWNER, shall be considered as payment made under the Contract by OWNER to CONTRACTOR and OWNER shall not be liable to CONTRACTOR for any such payment made in good faith."

14.04 *Substantial Completion*

Delete Parts A, B, and C in its entirety and substitute the following:

"A. CONTRACTOR may, in writing to OWNER and ENGINEER, certify that the entire Project is substantially complete and request that ENGINEER issue a certificate of Substantial Completion. Within a reasonable time thereafter, OWNER, CONTRACTOR and ENGINEER shall make an inspection of the Project to determine the status of completion. If ENGINEER and OWNER do not consider the Project substantially complete, ENGINEER will notify CONTRACTOR in writing giving his reasons therefor. If ENGINEER and OWNER consider the Project substantially complete, ENGINEER will prepare and deliver to OWNER a tentative certificate of Substantial Completion and the responsibilities between OWNER and CONTRACTOR for maintenance, heat and utilities. There shall be attached to the certificate a tentative list of items to be completed or corrected before Substantial Completion, and the certificate shall fix the time within which such items shall be completed or corrected, said time to be within Contract Time."

14.05 *Partial Utilization*

Delete Part A, and its subparts, in its entirety and substitute the following:

"A. Prior to Substantial Completion of the Project, OWNER may advise CONTRACTOR in writing to permit him to use a specified part of the Project which OWNER believes may be used without significant interference with construction of the other parts of the Project. Upon receipt of such notice, CONTRACTOR will certify to OWNER and ENGINEER that said part of the Project is substantially complete and request the ENGINEER to issue a certificate of Substantial Completion for that part of the Project. Within a reasonable time thereafter, OWNER, CONTRACTOR and ENGINEER shall make an inspection of that part of the Project to determine its status of completion. If ENGINEER and OWNER do not consider that it is substantially complete, ENGINEER will notify CONTRACTOR in writing giving his reasons therefor. If ENGINEER and OWNER consider that part of the Project to be substantially complete, ENGINEER will execute and deliver to OWNER and

CONTRACTOR a certificate to that effect, fixing the date of Substantial Completion as to that part of the Project, attaching thereto a tentative list of items to be completed or corrected before Substantial Completion of the entire Project and fixing the responsibility between OWNER and CONTRACTOR for maintenance and utilities as to that part of the Project. OWNER shall have the right to exclude CONTRACTOR from any part of the Project which ENGINEER has so certified to be substantially complete, but OWNER shall allow CONTRACTOR reasonable access to complete items on the tentative list."

14.06 *Final Inspection*

In the first sentence remove "Owner and Contractor" and replace with "the Owner, Contractor, NJDEP, Utility Companies and all other Regulatory Agencies as required,"

14.07 *Final Payment*

Delete Part B, subpart 1 in its entirety and replace with the following:

"B. If, on the basis of ENGINEER's observation of the Work during construction and final inspection, and ENGINEER's review of the final Application for Payment and accompanying documentation - all as required by the Contract Documents, ENGINEER is satisfied that the Work has been completed and CONTRACTOR's other obligations under the Contract Documents have been fulfilled, ENGINEER will indicate in writing a recommendation of payment and present the Application to OWNER for payment. Thereupon ENGINEER will give written notice to OWNER and CONTRACTOR that the Work is acceptable subject to the provisions of paragraph 14.09. Otherwise, ENGINEER will return the Application to CONTRACTOR, indicating in writing the reasons for refusing to recommend final payment, in which case CONTRACTOR shall make the necessary corrections and resubmit the Application. If the Application and accompanying documentation are appropriate as to form and substance, OWNER shall, within sixty-five days after receipt thereof pay CONTRACTOR the amount recommended by ENGINEER.

No final or semi-final payment shall be made until the CONTRACTOR has executed and delivered a release to OWNER and every member, agent or employee thereof, from all claims and liability to the CONTRACTOR for everything and anything done or furnished, or any act or neglect of OWNER or of any person relating to or affecting the work.

Before final or semi-final payment, the CONTRACTOR shall deliver to OWNER an affidavit of payment of all claims of suppliers and Subcontractors. In the event that any supplier or Subcontractor has not been paid and the claim is disputed by the CONTRACTOR, the CONTRACTOR shall submit all of the facts in its affidavit and OWNER shall be authorized, in the exercise of its discretion, to withhold from the payment the sum of money sufficient to guarantee payment of the claims. Nothing contained herein, however, shall incur any responsibility by OWNER to any materialman or Subcontractor, nor shall anything contained herein give rise to a cause of action by any Subcontractor or supplier against OWNER.

Before final acceptance and final or semi-final payment by OWNER, the CONTRACTOR shall deliver to OWNER a complete release of all liens arising

out of the Contract. CONTRACTOR agrees that at no time shall any municipal liens, mechanic's liens, notices of intention, or secured instrument be filed against the work and should OWNER be compelled to remove or discharge a municipal lien, mechanic's lien, notice of intention or secured instrument, the CONTRACTOR shall reimburse OWNER for all costs.

Before final or semi-final payment, the CONTRACTOR shall deliver to OWNER a consent of the Surety to the final payment."

Upon acceptance of the work performed pursuant to the contract for which the CONTRACTOR has agreed to the withholding of payments pursuant to NJSA 40A:11-16.3 a., all amounts being withheld by the contracting unit shall be released and paid in full to the CONTRACTOR within 45 days of the final acceptance date agreed upon by the CONTRACTOR and the OWNER, without further withholding of any amounts for any purpose whatsoever, provided that the contract has been completed as indicated.

Delete Part C in its entirety.

ARTICLE 15 - SUSPENSION OF WORK AND TERMINATION

15.02 *OWNER may Terminate for Cause*

Add the following subparts to Part A:

"5. If the CONTRACTOR should be adjudged a bankrupt, or if it should make a general assignment for the benefit of its creditors, or if a receiver should be appointed on account of its insolvency.

6. If the CONTRACTOR should fail to make prompt payment to Subcontractors for material, labor or equipment rental.

7. If CONTRACTOR abandons the Work, or sublets this Contract or any part thereof, without the previous written consent of OWNER, or if the Contract or any claim thereunder shall be assigned by CONTRACTOR otherwise than as herein specified;"

Add the following to the end of Part F:

"The termination of the employment of the CONTRACTOR under the provisions of this paragraph shall not relieve the surety of its responsibility".

Add the following Section to the end of Article 15:

"15.05 *Three (3) Days Notice*:

A. If the CONTRACTOR or his Subcontractors should neglect to prosecute the work properly or fail to perform any provisions of the Contract Documents, the OWNER, after three (3) days written notice to the CONTRACTOR may without prejudice to any other remedy he may have, make good such deficiencies and may deduct the cost thereof from the payment then or thereafter due the CONTRACTOR."

ARTICLE 16 – DISPUTE RESOLUTION

16.01 – *Methods and Procedures*

Delete in its entirety and replace with the following:

"A. All Services under this Contract shall be performed to the satisfaction of the OWNER, which shall in all cases determine the amount and acceptability of the Services which is to be paid for hereunder, and decide all questions which may arise as to the fulfillment of this Agreement on the part of the CONTRACTOR, and its determination and decision thereon shall be final and conclusive, and such determination and decision, in case any question shall arise, shall be a condition precedent to the right of the CONTRACTOR to receive any money hereunder."

ARTICLE 17 – MISCELLANEOUS

17.01 *Giving Notice*

Add the following subpart to Part A:

"3. No oral statement of any person whosoever shall in any manner or degree modify or otherwise affect the terms of this Contract. Any notice to the CONTRACTOR, from OWNER and ENGINEER, relative to any part of this Contract shall be in writing."

Add the following Section to the end of Article 17:

17.07 *CONTRACTOR's Legal Address*

A. Both the address given in the Bid Form upon which this Agreement is founded, and CONTRACTOR's office at or near the site of the Work are hereby designated as places to either of which notices, letters, and other communications to CONTRACTOR shall be certified, mailed, or delivered. The delivering at the above named place, or depositing in a postpaid wrapper directed to the first-named place, in any post office box regularly maintained by the post office department, of any notice, letter or other communication to CONTRACTOR shall be deemed sufficient service thereof upon CONTRACTOR; and the date of said service shall be the date of such delivery or mailing. The first-named address may be changed at any time by an instrument in writing, executed and acknowledged by CONTRACTOR, and delivered to OWNER and ENGINEER. Nothing herein contained shall be deemed to preclude or render inoperative the service, of any notice, letter, or other communication upon CONTRACTOR personally.

Add the following additional Article:

ARTICLE 18 - LIQUIDATED DAMAGES

18.01 If the CONTRACTOR shall fail to complete the work within the Contract Time, or extension of time granted by the OWNER in accordance with Article 12, then the CONTRACTOR will pay to the OWNER the amount for damages as specified in the Agreement for each calendar day that the Contract work remains incomplete.

18.02 For the purposes of calculating the number of calendar days for damaged assessment, such calculation shall include the day on which date of completion occurs, but shall not include the day of scheduled completion.

18.03 *Penalties and Fines*

In the event OWNER is penalized by any governmental entity, including but not limited to the NJDEP, due to any act or omission by the CONTRACTOR, the CONTRACTOR shall be solely responsible for the payment of same. CONTRACTOR shall reimburse OWNER for payment of any such fine and penalty within ten (10) days of receiving notice of payment of such fine or penalty from OWNER. Any monies paid by the CONTRACTOR pursuant to this provision shall not relieve the CONTRACTOR of liability to OWNER for damages sustained by OWNER by virtue of any other provision of this Agreement.

Add the following additional Article:

ARTICLE 19 - FEDERAL AND STATE GOVERNMENT PROVISIONS

19.01 *Affirmative Action Requirements*

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

A) 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, up-grading, 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.

B) 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.

C) The CONTRACTOR or subcontractor, where applicable, will send to each labor union or representative of workers with which it has a collective bargaining agreement or other contract or understanding, 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.

D) 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.

E) 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 Division may, in its discretion, exempt a contractor or subcontractor from compliance with the good faith procedures prescribed by the following provisions, a, b and c, as long as the Division is satisfied that the CONTRACTOR or subcontractor is employing workers provided by a union which provides evidence, in accordance with standards prescribed by the Division, 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 subcontractor 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 subcontractor 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 or is so notified by the Division 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 Division, 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) 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 Division. 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.

   (ii) 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 paragraph (i) above, whenever vacancies occur. At the request of the Division, the CONTRACTOR or subcontractor shall provide evidence of its good faith efforts to employ women and minorities from the list to fill vacancies.

   (iii) 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 Division.

7) 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 Division and submitted promptly to the Division 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 apprenticeship 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 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.

d) After notification of award, but prior to signing a construction contract, the CONTRACTOR shall submit to the public agency compliance officer and the Division an initial project workforce report (Form AA 201) provided to the public agency by the Division 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 Division and to the public agency compliance officer.

e) 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.

f) The CONTRACTOR and its subcontractors shall furnish such reports or other documents to the Division of Public Contracts Equal Employment Opportunity Compliance as may be requested by the Division from time to time in order to carry out the purposes of these regulations, and public agencies shall furnish such information as may be requested by the Division of Public Contracts Equal Employment Opportunity Compliance for conducting a compliance investigation pursuant to Subchapter 10 of the Administrative Code (NJAC 17:27).

19.02 *Anti-Discrimination (NJSA 10:2-1)*

Every contract for or on behalf of the State or any county or municipality or other political subdivision of the State, or any agency of or authority created by any of the foregoing, for the construction, alteration or repair of any public building or public work or for the acquisition of materials, equipment, supplies or services shall contain provisions by which the CONTRACTOR agrees that:

a. In the hiring of persons for the performance of work under this contract 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, sex, effectional or sexual orientation, 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, sex, effectional or sexual orientation;

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 intimidate 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.

19.03 *Foreign Corporations (NJSA 14A: 13-3)*

1. No foreign corporation shall have the right to transact business in this State until it shall have procured a certificate of authority so to do from the Secretary of State. A foreign corporation may be authorized to do in this State any business which may be done lawfully in this State by a domestic corporation, to the extent that it is authorized to do such business if the jurisdiction of its incorporation, but no other business.

2. Without excluding other activities which may not constitute transacting business in this State, a foreign corporation shall not be considered to be transacting business in this State, for the purposes of this act, by reason of carrying on in this State any one or more of the following activities;

   a. maintaining, defining or otherwise participating in any action or proceeding, whether judicial, administrative, arbitrative or otherwise, or effecting the settlement thereof or the settlement of claims or disputes;

   b. holding meetings of its directors or shareholders;

   c. maintaining bank accounts or borrowing money, with or without security, even if such borrowings are repeated and continuous transactions and even if such security has a situs in this State;

d. maintaining offices or agencies for the transfer, exchange and registration of its securities, or appointing and maintaining trustees or depositories with relation to its securities.

3. The specification in subsection 14A: 13-3(2) does not establish a standard for activities which may subject a foreign corporation to service of process or taxation in this State.

19.04 *Statement of Ownership (NJSA 52:25-24.2)*

No corporation or partnership 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 or said partnership, there is submitted a statement setting forth the names and addresses of all stockholders in the corporation or partnership who own 10% or more of its stock, of any class or of all individual partners in the partnership who own a 10 % or greater interest therein, as the case may be. If one or more such stockholder or partner is itself a corporation or partnership, the stockholders holding 10% or more of that corporation's stock, or the individual partners owning 10% or greater interest in that partnership, as the case may be, shall also be listed. The disclosure shall be continued until all names and addresses of every non-corporate stockholder, and individual partner, exceeding the 10% ownership criteria established in this act, has been listed (see Section 00305).

19.05 *Use of Domestic Materials (NJSA 52:33-1 52:33-3)*

Notwithstanding any inconsistent provision of any law, and unless the head of the department, or other public officer charged with the duty by law, shall determine it to be inconsistent with the public interest, or the cost to be unreasonable, only domestic materials shall be acquired or used for any public work.

This section shall not apply with respect to domestic materials to be used for any public work, if domestic materials of the class or kind to be used are not mined, produced or manufactured, as the case may be, in the United States in commercial quantities and of a satisfactory quality.

Every contract for the construction, alteration, or repair of any public work in this state shall contain a provision that in the performance of the work the CONTRACTOR and all Subcontractors shall use only domestic material sin the performance of the work; but if the head of the department or other public officer authorized by law to make the contract shall find that in respect to some particular domestic materials it is impracticable to make such requirement or that it would unreasonably increase the cost, an exception shall be noted in the specifications as to that particular material, and a public record made of the findings which justified the exception.

19.06 *Prevailing Wage Rates (NJSA 34.11-56.25)*

The Contractor shall pay not less than the prevailing wage rate to workers employed in the performance of any contract for the project, in accordance with the rate determined by the Commissioner of New Jersey Department of Labor pursuant to N.J.S. A. 34:11-56.25 et seq. OR the United States Secretary of Labor pursuant to 29 CFR Part 5, whichever is greater. The Contractor shall refer to section 19.10 for the requirements of the Davis-Bacon Act.

In accordance with the New Jersey Prevailing Wage Act no worker shall be paid less than such prevailing rates (included in Contract Documents). In the event it is found that any CONTRACTOR covered by said contract paid a rate of wages less than the prevailing wage required to be paid, OWNER may terminate the CONTRACTOR's right to proceed with the contract, or such part of work as to which there has been a failure to pay required wages, and to prosecute the work to completion or otherwise. The CONTRACTOR and his sureties shall be liable to the OWNER for any excess cost occasioned thereby. Nothing in this act shall prohibit the payment of more than the prevailing rate to any worker employed on a public work.

The CONTRACTOR and Subcontractor shall post the prevailing wage rates for each craft and classification involved, as determined by the Commissioner of Labor, including the effective date of any changes thereof, in prominent and easily accessible places at the site of the work, or at such place or places as are used by them to pay workmen their wages.

The New Jersey Prevailing Wage Act, NJSA 34:11-56.25 et seq. requires that all public works employers shall submit a certified payroll record to the public body or lessor which contracted for the public work project each payroll period within ten (10) days of the payment of wages. The public body shall receive, file and make available for inspection during normal business hours the certified payroll records.

Attention is directed to the Prevailing Wage Rate List and to the applicable provision of "The New Jersey Prevailing Wage Act" N.J.S.A. 34:11-56.25 et. Seq., governs the prevailing wage rates of wagers for workmen who are employed on this Project. The provisions of said Wage Act and Amendment thereto, shall be considered as part of this Contract and made part hereof.

The Bidder by submitting the Proposal represents to the OWNER that bidder is aware of the provision of said Wage Act with relation to prevailing rates of wages for workmen to be employed on this Project.

The Bidder further represents that in the event of any re-determination of such prevailing rates at any time before the execution and delivery of the Contract between the Bidder and the OWNER for the work of construction of the Project, or at any time thereafter, the new rates, if any, will become the applicable minimum rates for work performed thereafter under said Contract. No increase in the contract price will be claimed by the Bidder and no such increase in the contract price will be claimed by the Bidder and no such increase will be granted by the OWNER as a result of such determination.

Prospective bidders are advised to contact the New Jersey Department of Labor and Industry with respect to questions relating to the Wage Rate Determination.

19.07 *State Treasurer's List of Debarred, Suspended and Disqualified Bidders (NJSA 34: 11)*

No recipient shall enter into a contract for work on environmental infrastructure facilities with any person debarred, suspended or disqualified from Department contracting pursuant N.J.A.C. 7:1D-2.

Recipients shall insert in every contract for work on a project a clause stating that the contractor may be debarred, suspended or disqualified from contracting on any project financially assisted by the State or the Department if the contractor commits any of the acts listed in N.J.A.C. 7:1D-2.2.

The recipient, prior to acceptance of Trust loan moneys, shall certify that no contractor or subcontractor is included on the State Treasurer's list of the debarred, suspended or disqualified bidders as a result of action by a State Agency in addition to that of the Department of Environmental Protection. If Trust loan moneys are used for disbursement to a debarred firm, the Trust reserves the right to immediately terminate (N.J.A.C. 7:22-4.44) the Trust loan and /or take such other action pursuant to N.J.A.C. 7:1D-2 as is appropriate.

Whenever a bidder is debarred, suspended or disqualified from Department contracting pursuant to N.J.A.C. 7:1D-2, the recipient may take into account the loss of Trust loan moneys under these regulations which result from awarding a contract to such bidder, in determining whether such bidder is the lowest responsive and responsible bidder pursuant to law, and the recipient may advise prospective bidders that these procedures shall be followed.

Any person included on the State Treasurer's list as a result of action by a State agency, who is or may become a bidder on any contract which is or shall be funded by a Trust loan under this subchapter, may present information to the Trust why this section should not apply to such person. If the Trust determines that it is essential to the public interest and files a finding thereof with the New Jersey Attorney General, the Trust may grant an exception from the application of this section with respect to a particular contract, in keeping with N.J.A.C. 7:1D-2.9. In the alternative, the Trust may suspend or debar any such person, or take such action as may be appropriate, pursuant to N.J.A.C. 7:1D-2.

Include in Exhibit No. 2 is a list of contractors and subcontractors who are debarred from public works pursuant to NJSA 34:11-56.37 and 38, no contract will be awarded or made to the listed CONTRACTOR's or subcontractors.

19.08 Small Business Concerns Owned and Controlled by Socially and Economically Disadvantaged Individuals (SEDs) (NJAC 7:22-9)

It is the policy of the PVSC to promote award of contracts to Socially and Economically Disadvantaged (SED) small business enterprises by stipulating specific requirements for involving such businesses in contracting. The failure of the Contractor to demonstrate a good faith effort to achieve the goals set forth herein by utilizing best efforts to implement the SED utilization plan will constitute an event of default of the Agreement. PVSC shall designate a compliance officer who shall be responsible for coordinating SED utilization efforts for the Agreement and for monitoring compliance with the plan. PVSC reserves the right to audit the Contractor's SED records to insure compliance with this provision. Socially and economically disadvantaged businesses definitions and associated terms are defined in the NJAC 7:22-9.2.

The CONTRACTOR is advised that not less than ten (10) percent of the total amount of all contracts for building, materials or services for the project shall be awarded to small

business concerns owned and controlled by socially and economically disadvantaged individuals as defined in Section 637 (a) and 637 (d) of the Small Business Act (15USC, 637 (a) and 637 (d)), and any regulations promulgated thereto.

When soliciting services from subcontractors, the Contractor must include the 10% goal in its Proposals. Contract work cannot commence until the PVSC has approved the Contractor's SED Utilization Plan.

The CONTRACTOR's Plan to meet SED Utilization Requirements shall be submitted by the successful bidder within 30 days of Contract award to the PVSC. To be approvable, the SED Utilization Plan for subcontractors, suppliers and construction, must detail the steps taken or be taken by the CONTRACTOR to provide for SED utilization for the total fair share percentage established by the Agreement. It must further provide adequate documentation to evidence the CONTRACTOR's efforts to date and planned efforts toward achieving the goal over the duration of the project.

Additional guidance on implementation of SED Requirements is included under NJAC 7:22-9 et seq. as given in the attached. Copies of Form OEO-002, SED Participation Building Phase Quarterly Reporting Form for Contracting Agencies and Contractors; and Form OEO-003, SED Participation Monthly Progress Report are included for CONTRACTOR's use. The CONTRACTOR shall comply with all requirements imposed by the OWNER in order to fulfill the SED Utilization Requirements, as further clarified in PVSC's SED Utilization Plan as given in the attached. (See exhibits 5 through 8 for the aforementioned documents).

19.09 Termination of Loans

Termination of loans by the Department shall be conducted as follows:

1. The Department may terminate a Fund loan in whole or in part for good cause. The term "good cause" shall include but not be limited to:

   i. Substantial failure to comply with the terms and conditions of the Fund loan agreement;

   ii. Default by the recipient;

   iii. A determination that the Fund loan was obtained by fraud:

   iv. Without good cause therefor, substantial performance of this project work has not occurred;

   v. Gross abuse or corrupt practices in the administration of the project have occurred; or

   vi. Fund moneys have been used for non-allowable costs.

2. The Department shall give written notice to the recipient (certified mail, return receipt requested) of its intent to terminate a Fund loan, in whole or in part, at least 30 days prior to the intended date of termination.

3. The Department shall afford the recipient an opportunity for consultation prior to any termination. After such opportunity for consultation, the Department may, in writing (certified mail, return receipt requested), terminate the Fund loan in whole or in part.

(b) Project termination by the recipient shall be subject to the following:

1. A recipient shall not unilaterally terminate the project work for which a Fund loan has been awarded, except for good cause and subject to negotiations and payment of appropriate termination settlement costs. The recipient shall promptly give written notice to the Department of any complete or partial termination of the project work by the recipient.

2. If the Department determines that there is good cause for the termination of all or any portion of a project for which the Fund loan has been awarded, the Department may enter into a termination agreement or unilaterally terminate the Fund loan effective with the date of cessation of the project work by the recipient. The determination to terminate the Fund loan shall be solely within the discretion of the Department. If the Department determines not to terminate, the recipient shall remain bound by the terms and conditions of the Fund loan agreement.

3. If the Department determines that a recipient has ceased work on a project without good cause, the Department may unilaterally terminate the Fund loan pursuant to this section.

(c) The Department and recipient may enter into a mutual agreement to terminate at any time pursuant to terms which are consistent with this subchapter. The agreement shall establish the effective date of termination of the project and the schedule for repayment of the Fund loan.

(d) Upon termination, the recipient may be required to immediately refund or repay to the State the entire amount of the Fund loan moneys received. If the loan is guaranteed by a security/deficiency agreement may have to be brought into effect to ensure the entire repayment of the Fund loan. The Department may, at its discretion, authorize the immediate repayment of a specific portion of the Fund loan and allow the remaining balance to be repaid in accordance with a revised Fund loan repayment schedule.

(e) The recipient shall reduce the amount of outstanding commitments insofar as possible and report to the Department the uncommitted balance of Fund moneys awarded under the Fund loan. The recipient shall make no new commitments without the Department's specific approval thereof. The Department shall make the final determination of the allowability of termination costs.

(f) In addition to any termination action, the Department retains the right to pursue other legal remedies as may be available under federal, State and local law as warranted.

19.10 Davis Bacon Act

The CONTRACTOR shall comply with the requirements of the Davis Bacon Act as given in the attached Exhibit 3.

19.11 Construction of Wastewater Treatment Facilities (NJAC 7:14-2)

Chapter 7:14 of NJAC shall have precedence over other potentially contradictory language elsewhere in the contract documents. A copy of Chapter 14 is available from the State of New Jersey and is available for review at the offices of the Passaic Valley Sewerage Commission.

THE PARTICULAR PREVAILING WAGE SCHEDULES INCLUDED IN THIS CONTRACT ARE NOT REPRINTED HERE DUE TO SIZE.

EXHIBIT NO. 2

LIST OF DEBARRED CONTRACTORS AND SUBCONTRACTORS

State of New Jersey

DEPARTMENT OF LABOR AND WORKFORCE DEVELOPMENT
PO BOX 389
TRENTON, NEW JERSEY 08625-0389

January 21, 2015

LISTED CONTRACTORS AND SUBCONTRACTORS

PURSUANT TO N.J.S.A 34:11-56.37 AND 34:11-56.38 OF THE PREVAILING WAGE ACT

NO PUBLIC WORKS CONTRACT MAY BE AWARDED TO ANY OF THE FOLLOWING CONTRACTORS AND SUBCONTRACTORS OR TO ANY FIRM, CORPORATION OR PARTNERSHIP IN WHICH THEY HAVE AN INTEREST UNTIL THE EXPIRATION DATE GIVEN.

CONTRACTORS AND SUBCONTRACTORS	ADDRESS	EXPIRATION DATE
4 S Logging & Lumber Co., Inc.	**130 Sheeley Road Ext., Kersey, PA 15846**	**05/29/2016**
George Heigel, Vice-President	350 Main Street, Kersey, PA 15846	
Carole Johnson, Secretary	390 Seneca Road, St marys, PA 15857	
Shawn Sheeley, President	130 Sheeley Road, Kersey, PA 15846	
A & H Contracting, Inc.	**33 Eastwood Blvd., Manalapan, NJ 07726**	**05/27/2017**
A & M Remodelling	**10017 Jeans Street, 1st Floor, Philadelphia, PA 19116**	**11/15/2015**
Artem Melnyk, Member	8653 Glenloch Street #2, Philadelphia, PA 19136	
A.J. Skora Inc.	**1982 Route 9, Toms River, NJ 08753**	**08/18/2016**
Andrzej Skora, President	67 Cox Cro Road, Toms River, NJ 08755	
AB Contracting & Develpmernt LLC	**191 Central Ave, 2nd Floor, Newark, NJ 07101**	**11/26/2016**
Michael Santos, President	988 Johnson Place, Apt. 4, Union, NJ 07083	
ACC Construction LLC	**2303 Owen Ct., Toms River, NJ 08755**	**02/11/2016**
Christopher Zimmermann, President	2303 Owen Court, Toms River, NJ 08755	
ACC Contractors Corp.	**105 11th Street, Hoboken, NJ 07030**	**05/21/2016**
Robert Lueders, Owner	1008 Ridge Drive, Union, NJ 07083	
Advanced Spray Technology	**6384 Tollgate Road, Zionsville, PA 18092**	**01/14/2016**
Robert Woods, President	6384 Tollgate Road, Zionsville, PA 18092	
All County Pipeline & Site Excavation LLC	**164 Ball Ave, Parsippany, NJ 07054**	**04/21/2017**
Christine Charles, Vice-President	396 Cherry Lane, Mendham, NJ 07945	
Eric Charles, President	396 Cherry Lane, Mendham, NJ 07945	
Allied Construction LLC. **Allied Construction Management, LLC**	**100 Dobbs Lane, Suite 102, Cherry Hill, NJ 08034**	**10/21/2016**
Alfred Sciubba, Managing Member	3 Chadwick Drive, Voorhees Twp., NJ 08043	
AMC Industries LLC **same**	**P.O. Box-760, Holmdel, NJ 07733**	**08/04/2016**
Denise Mautone, Member	18A South Bears Street, Holmdel, NJ 07733	
Anna Mautone, Member	88 Stilwell Road, Holmdel, NJ 07733	
Lisa Mautone, Member	25 Roberts Road, Holmdel, NJ 07733	

CONTRACTORS AND SUBCONTRACTORS	ADDRESS	EXPIRATION DATE
American Air Systems Group	**10 Franklin Avenue, Edison, NJ 08837**	**10/01/2015**
Thomas O'Connell, President	499 Grace Hill Road, Monroe Twp, NJ 08837	
American Eagle Contractor, Inc.	**420 Broadway, Long Branch, NJ 07740**	**08/11/2017**
Agustin Zuniga, President	420 Broadway, Long Branch, NJ 07740	
American Welding Services **American Welding Services, Inc.**	**1041 Glassboro Rd D-2, Williamstown, NJ 08094**	**07/09/2017**
Brian O'Shea, Owner	1041 Glassboro Rd. D-2, Williamstown, NJ 08094	
Anchorage Construction Corp.	**95 Wall Street, Suite 506, New York City, NY 10005**	**02/06/2016**
Lauren Campanella, President	948 Sinclair Avenue, Staten Island, NY 10309	
Andre Campanella, Vice-President	948 Sinclair Ave, Staten Island, NY 10309	
Anew Fence & Railings	**292 Church Street, Aberdeen, NJ 07747**	**09/16/2015**
Donald Eastmond, Owner	292 Church Street, Aberdeen, NJ 07747	
Artco Contracting & Development **Artco Contracting & Development, Inc.**	**35 Elmwood Ave, Unit 2B, Union, NJ 07083**	**08/26/2016**
Peter Santos, President	35 Elmwood Ave, Unit 2B, Union, NJ 07083	
B & B Atlantic LLC	**526 Sheridan Ave., Roselle, NJ 07203**	**12/01/2016**
Florian Dobre, Partner	526 Sheridan Ave, Roselle, NJ 07203	
Barzzini Construction	**65 Fern St, Browns Mills, NJ 08015**	**09/15/2017**
John Sorrentino, Owner	65 Fern St, Browns Mills, NJ 08015	
BCA Trucking LLC	**10 Pleasant Place, Kearny, NJ 07032**	**08/04/2016**
BCA Trucking, LLC	**P.O. Box 5806, Newark, NJ 07105**	**08/04/2016**
David Bastos, Managing Member	10 Pleasant Place, Kearny, NJ 07032	
Bechi Contracting LLC (EBA Painters) **Bechi Contracting LLC**	**549 Summit Ave, Maplewood, NJ 07470**	**03/25/2016**
Rony Barahona, Member	549 Summit Ave, Maplewood, NJ 07040	
Beckett Enterprises, Inc.	**P.O. Box 334, Malaga, NJ 08328**	**01/05/2017**
Wesley J. Beckett Jr., President	110 Oak Avenue, Malaga, NJ 08328	
Blue Skies Electric L.L.C.	**326 Coles Mill Road, Williamstown, NJ 08094**	**01/06/2017**
Scott Frasca, Manager	326 Coles Mill Road, Williamstown, NJ 08094	
Rachel Frasca, Owner	326 Coles Mill Road, Williamstown, NJ 08094	
BP Enterprises, Inc.	**408 West 129th Street, Apt. 7, New York City, NY 10027**	**01/13/2016**
Branson Pickney, Owner	408 West 129th Street, Apt. 7, New York, NY 10027	
Brothers Landscaping **J.H. Brothers Inc.**	**169 Robertsville Rd., Freehold, NJ 07728**	**01/05/2018**
Brad J. Moini, President	101 Buttonwood Lane, Freehold, NJ 07728	
Buckler Associates, Inc.	**182 Wycoff Way West, East Brunswick, NJ 08816**	**01/02/2016**
Bert L. Buckler, President	182 Wycoff Way West, East Brunswick, NJ 08816	
Calvin's Floor Service,aka Calvin's Carpet Service	**126 Winding Ridge Road, Dover, DE 19904**	**06/11/2016**
Calvin Hudson, Owner	126 Winding Ridge Road, Dover, DE 19904	
Caslo Drywall Corp.	**644 East 2nd St, Unit 2, Plainfield, NJ 07060**	**04/22/2017**
Luis Oliveras, Owner	644 East 2nd St., Plainfield, NJ 07060	
Centurion Companies Inc.	**795 Susquehanna Avenue, Franklin Lakes, NJ 07417**	**07/24/2016**
Glen P. Poppe, Secretary	795 Susquehanna Ave, Franklin Lakes, NJ 07417	
Christopher Poppe, President	317 Greenridge Road, Franklin Lakes, NJ 07417	
CGT Construction, Inc.	**10 Franklin Avenue, Edison, NJ 08837**	**02/10/2016**
Thomas O'Connell, President	449 Grace Hill Road, Monroe, NJ 08817	

CONTRACTORS AND SUBCONTRACTORS	ADDRESS	EXPIRATION DATE
Chalmers Construction LLC.	**435 Minnisink Road, Totowa, NJ 07512**	**11/20/2016**
Shawn Chalmers, Owner	337 Crown Street, Brooklyn, NY 11211	
Keith Mishoe, Owner	341 Seaton Avenue, Roselle Park, NJ 07204	
Chanez Landscaping, LLC	**PO Box 5646, New Brunswick, NJ 08903**	**09/23/2017**
Noe Chanez, Principal	55 Miller Ave., Somerset, NJ 08873	
Citadel Environmental Consultants	**1 Center Circle, Woodbridge, NJ 07095**	**01/14/2016**
William Muzzio Jr., Owner	597 Lyman Ave, Woodbridge, NJ 07095	
Cityline Contracting Inc.	**556 Humboldt Street, Brooklyn, NY 11222**	**08/03/2017**
Dorothy Dobiecka, President	556 Humboldt Street, Brooklyn, NY 11222	
Andrzej Citak, Vice-President	556 Humboldt St, Brooklyn, NY 11222	
Cobra Communications & Installations, LLC	**26 Spencer Place, Garfield, NJ 07026**	**12/10/2017**
Giovanny Bustos, Owner	26 Spencer Place, Garfield, NJ 07026	
Commercial Flooring Center of New Jersey	**P.O. Box-1033, West Caldwell, NJ 07007**	**01/08/2015**
Maryjo Torchia, President	P.O. Box-1033, West Caldwell, NJ 07007	
Leonard Torchia, Member	5 Lucy Court, Pompton Plains, NJ 07444	
Coplen Management, Inc.	**828 Highland Ave, Paramus, NJ 07652**	**06/25/2016**
Mahesh Patel, Owner	828 Highland Ave, Paramus, NJ 07652	
CPS Mechanical Contractors, Inc.	**203 Woods Ave, Bergenfield, NJ 07621**	**12/15/2017**
Margaret Sherman, President	203 Woods Avenue, Bergenfield, NJ 07621	
CRC General Constructors Inc.	**137 1/2 Washington Ave, Suite 290, Belleville, NJ 07109**	**08/11/2016**
Antonio Gomes Jr., President	41 Hamilton Ave, Kearny, NJ 07032	
Crider Americas Solar LLC	**6063 FM 535, Cedar Creek, TX 78612**	**05/11/2017**
Steven Crider, Member	507 Pressler Street, Apt. 2128, Austin, TX 78703	
Harold Marshall, Jr., Member	1800 Eva Street, Austin, TX 78704	
Crossroad Construction Corp.	**312 Emmet Street, Newark, NJ 07114**	**05/12/2016**
Antonio Gomes Sr., President	164 Green Street, Newark, NJ 07105	
Cunhas Construction Inc.	**35 Carmen Ct, Floor-1, Newark, NJ 07105**	**10/22/2017**
Nuno Cunha, Owner	35 Carmen Ct., Newark, NJ 07105	
D & B Partners LLC	**89 Jeanne Court, Stamford, CT 06905**	**08/08/2016**
same		
Michael F. Ferro Jr., Member	89 Jeanne Court, Stamford, CT 06905	
John Giannattasio, Member	89 Jeanne Court, Stamford, CT 06905	
D. Simonetti, Inc.	**35 Hayes Street, Elmsford, NY 10523**	**02/07/2015**
David Simonetti, Vice-President	8 Hightor Road, New City, NY 10956	
Domenico Simonetti, President	6 Hanford Place, Tarrytown, NY 10591	
Dean Development Inc.	**One North Rhoda Street, Monroe Township, NJ 08831**	**02/06/2015**
William Bocra, President	One North Rhoda Street, Monroe Township, NJ 08831	
Demrex Industrial Services, Inc.	**1300 Industrial Boulevard, Unit 5, Southampton, PA 18966**	**01/29/2015**
Barry Portnoy, President	1300 Industrial Boulevard, Unit 5, Southampton, PA 18966	
Designer Impressions	**1002 Taunton Ave, West Berlin, NJ 08091**	**11/15/2015**
Daniel Mena, Owner	1002 Taunton Ave, West Berlin, NJ 08091	
Diamond State Wall Systems, LLC	**1640 Nixon Dr Ste 285, Moorestown, NJ 08057**	**02/05/2016**
Nick Cerelli, Member	1640 Nixon Dr. Ste. 205, Moorestown, NJ 08057	
Division Ten Installations, LLC	**29 Monmouth Road, Monroe Township, NJ 08831**	**04/02/2017**
Kevin G. Eib, President	29 Monmouth Road, Monroe Twp., NJ 08831	
DMH Trucking, Inc.	**79 Myrtle Ave, Mickleton, NJ 08056**	**08/22/2015**
Joe Hilt, President	79 Myrtle Ave, Mickleton, NJ 08056	

CONTRACTORS AND SUBCONTRACTORS	ADDRESS	EXPIRATION DATE
East Coast Touch Enterprises LLC	**152 Jackson St., Newark, NJ 07105**	**08/11/2017**
Frank Loureier, Vice-President	152 Jefferson St., Newark, NJ 07105	
Nelson DeOliveira, President	276 Highland Ave, Kearney, NJ 07032	
East Commercial Construction	**111 Prospect St. Apt 4F, Westfield, NJ 07090**	**07/29/2015**
Stephen Gallagher, Owner	221 Coolidge Street, Suite 11, Linden, NJ 07036	
Eastern American Renovation Corp.	**565 Fairview Ave., Ridgewood, NY 11385-1947**	**04/18/2015**
Tomasz Markowski, President	2026 Himrod Road, RIdgewood, NY 11385	
Edward J. Albert & Son Inc.	**20 Wilson Avenue West, East Hanover, NJ 07936**	**03/25/2016**
John Albert, Vice-President	66 Cherokee Street, Rockaway, NJ 07866	
Elizabeth S. Albert, Secretary	20 Wilson Avenue West, East Hanover, NJ 07936	
Joseph Albert, Vice-President	28 Emanual Street, East Hanover, NJ 07936	
Thomas E. Albert, President	1343 South Beverwyck Road, Parsippany, NJ 07054	
Elevator Medic Corporation	**55 Brookview Drive, Woodcliff Lake, NJ 07677**	**02/24/2017**
Patrick DellAquila, President	55 Brookview Drive, Woodcliff Lake, NJ 07677	
Emanuel Drywall Services, Inc	**64 Grandview Ave, North Plainfield, NJ 07060**	**04/30/2017**
Cesar Garcia, Owner	64 Grandview Ave, North Plainfield, NJ 07060	
Envirocare Enterprises, Inc.	**358 Broadway, Suite 202, Newark, NJ 07104**	**05/15/2017**
Envirocare Enterprises, Inc.		
UJU A. Obiorah, President	259 West Forest Avenue, Englewood, NJ 07631	
Inno Obiorah, Manager	658 Rutgers Pl, Paramus, NJ 07652	
Estrada & Roca LLC	**468 9th Street, Palisades Park, NJ 07650**	**05/30/2016**
Hector Estrada, Owner	432 52nd Street Apt 2, West New York, NJ 07093	
Jose Roca, Owner	468 9th St, Apt # 2, Palisades Park, NJ 07650	
Euro Construction	**70 Bordendown-Chesterfied, Rd., Chesterfield, NJ 08022**	**02/24/2017**
Ireneusz Waluk, Owner	70 Bordentown-Chesterfiel, Rd., Chesterfield, NJ 08515	
Five Star Quality Construction	**141 Rte. 130 South, Suite 192, Cinnaminson, NJ 08077**	**04/22/2017**
Alicirio Jose Santana Pires, Owner	141 RT. 130 South, Suite 192, Cinnaminson, NJ 08077	
Fortress Construction Co., Inc.	**66 6 th Ave., Long Branch, NJ 07740**	**07/29/2015**
Fernando F. Pinho, President	66 6 th Ave., Long Branch, NJ 07740	
Frank J. Muratore, Jr., Inc.	**1828 Herbert Boulevard, Williamstown, NJ 08094**	**10/09/2015**
Frank J. Muratore		
Frank J. Muratore Jr., Owner	1828 Herbert Boulevard, Williamstown, NJ 08094	
Frank Montgomery Builder	**42 Bryant Rd., Waretown, NJ 08758**	**07/10/2017**
Frank Montgomery, Owner	42 Bryant Rd., Waretown, NJ 08758	
G&G Drywall, Inc.	**256 Grove St., North Plainfield, NJ 07060**	**03/05/2015**
Efrain Gonzalez, Owner	256 Grove St., North Plainfield, NJ 07060	
G.W. Smith Construction, Inc.	**584 Erial Road, Sicklerville, NJ 08081**	**04/17/2016**
Lisa L. Smith, Vice-President	584 Erial Road, Sicklerville, NJ 08081	
Gary W. Smith, President	584 Erial Road, Sicklerville, NJ 08081	
Gale Force Telecommunications Inc	**211 Jewett Road, Upper Nyack, NY 10960**	**12/01/2016**
Garza Contracting LLC	**768 Chambers Street, Trenton, NJ 08619**	**04/27/2017**
John Garza, Owner	768 Chambers St., Trenton, NJ 08611	
George's Carpet	**105 Cedar Ave, Oaklyn, NJ 08107**	**02/18/2016**
George Tassogloy		
George Tassogloy, Owner	105 Cedar Ave, Woodlynne, NJ 08107	

CONTRACTORS AND SUBCONTRACTORS	ADDRESS	EXPIRATION DATE
Globo Contracting Corporation	**562 Jernee Mill Rd., Sayreville, NJ 08872**	**01/13/2016**
Manuel Martins, Treasurer	15 Center Street, South River, NJ 08882	
Rogerio Martins, Vice-President	46 Grove Street, South River, NJ 08882	
Antonio Martins, President	215 Princeton Road, Parlin, NJ 08859	
GM Masonry, Inc.	**99 Hillside Terrace, Parsippany, NJ 07054**	**02/06/2016**
George McGee, President	99 Hillside Terrace, Parsippany, NJ 07054	
Grab Heating and Air Conditioning, LLC.	**35 Jersey Street, East Rutherford, NJ 07073**	**05/14/2016**
Zbigniew Grabowski, Owner	35 Jersey Street, East Rutherford, NJ 07073	
Green Diamond Roofing & Live Roof, LLC	**3515 Frankford Ave, Philadelphia, PA 19134**	**08/04/2016**
Jazmine Price, President	744 South St Unit 65, Phildelphia, PA 19147	
Green Oasis Maintenance, Inc.	**409 Bennetts Lane, Somerset, NJ 08873**	**04/18/2015**
Franco S. DiMeglio, President	409 Bennetts Lane, Somerset, NJ 08873	
GSR Architectural, Inc	**200 Mountain Avenue, Middlesex, NJ 08846**	**08/13/2016**
Gary Russo, President	3 Premier Way, Manalapan, NJ 07726	
Harlow Contracting, Inc.	**4771 Route 212, PO Box 147, Durham, PA 18039**	**04/21/2016**
Albert J Harlow Jr, President	515 Summit Lane, Riegelsville, PA 18077	
HFM Labor Ready LLC	**459 Rt 38 West, Maple Shade, NJ 08052**	**01/05/2018**
HFM Labor Ready LLC		
Keith Ludwig, Member	459 Rt 38 West, Maple Shade, NJ 08052	
Highway Safety Systems Inc.	**716 White Horse Pike, Hammonton, NJ 08037**	**01/19/2018**
William J. Doyle, President	200 Pine Rd., Hammonton, NJ 08037	
I.K.E. Electrical Corp.	**100 W. Forest Avenue, Building E, Englewood, NJ 07631**	**07/20/2017**
Rebecca Adika, Secretary	76 Alpine Dr., Closter, NJ	
Angelo Castelli, President	48 E. Central Blvd., Palisades Park, NJ 07650	
Yitzhak Adika, Vice-President	76 Alpine Drive, Closter, NJ 07624	
IBS, Inc.	**1929 Darby Road, Havertown, PA 19083**	**05/15/2017**
Christopher Rymal, Owner	1929 Darby Rd., Havertown, PA 19083	
Ideal Elevator Services	**55 Brookview Dr., Woodcliff Lake, NJ 07677**	**02/24/2017**
Patrick Dell'Aquila		
Patrick Dell'Aquila, President	55 Brookview Drive, Woodcliff Lake, NJ 07677	
Industrial Concrete Const. of NJ, Inc.	**P.O. Box 9349, Lyndhurst, NJ 07071**	**06/26/2016**
Lori A. Frisina, President	235 Grand Avenue, Rutherford, NJ 07070	
Infinity Construction & Son, LLC	**870 Lamont Ave., Staten Island, NY 10309**	**04/15/2016**
Pat Sellitti, Owner	870 Lamont Ave., Staten Island, NY 10309	
J.D.S Electric, Inc.	**149 Montross Ave., Rutherford, NJ 07070**	**01/06/2018**
Joe DeSalvo, Jr., Owner	149 Montross Ave., Rutherford, NJ 07070	
Jamcon Construction LLC	**100 Springdale Road, Cherry Hill, NJ 08003**	**01/12/2017**
John Schiavo, Managing Member	6 Justa Lane, Cherry Hill, NJ 08003	
James Rough Bleachers	**12767 Van Horne Rd., Meadville, PA 16335**	**03/21/2016**
James Rough, Owner	12767 Van Horne Rd., Meadville, PA 16335	
JD Scaffold Inc.	**13353 NE 17th Ave, North Miami, FL 33181**	**08/24/2017**
Randy Garciga, Owner	13353 NE 17th Avenue, North Miami, FL 33181	
Jersey Wall Concepts, LLC	**24 Westminster Boulevard,, Apt. G, South Amboy, NJ 08879**	**03/25/2015**
Matus Madar, Managing Member	75 Hart Street, Sayreville, NJ 08872-1123	
JIC-ELCO Inc.	**2 Island Pond Road, Derry, NH 03038**	**08/26/2015**
Frederick Ellis, President	2 Island Pond Road, Derry, NH 03038	

CONTRACTORS AND SUBCONTRACTORS	ADDRESS	EXPIRATION DATE
John Gustafson Excavating, Inc.	**216 Union Street, Montgomery, NY 12549**	**04/09/2016**
John Gustafson, President	39 Charles Street, Montgomery, NY 12549	
Johnson's Construction Inc.	**1258 N. East Avenue, Vineland, NJ 08360**	**01/24/2016**
Henry Johnson, Owner	1258 N. East Avenue, Vineland, NJ 08360	
Joseph Csakvary, Inc.	**163 Breakneck Road, Highland Lakes, NJ 07422**	**11/03/2016**
Joseph Csakvary, President	163 Breakneck Road, Highland Lakes, NJ 07422	
JTG Scaffolding & Hoisting LLC	**309 West Elizabeth Avenue, Linden, NJ 07036**	**10/22/2017**
Randy Garciga, Owner	13353 NE 17th Avenue, Miami, FL 33181	
K & S Fabrication & Welding, LLC	**23 North Street, Bergenfield, NJ 07621**	**01/12/2018**
Simon Walcott, Owner	43 Fairview Avenue, Bergenfield, NJ 07621	
K&K Construction LLC	**685 Bergen Blvd., Ridgefield, NJ 07657**	**06/09/2017**
Ki Kuk Kim, Partner	685 Bergan Blvd., Ridgefield, NJ 07657	
Kwang Hee Kim, Partner	685 Bergen Blvd., Ridgefield, NJ 07657	
Keystone Steel Structures Inc.	**3010 Compass Road, Honey Brook, PA 19344**	**09/14/2017**
Elam King, Member	6285 Plank Road, Narvon, PA 17555	
L and Y Roofing, LLC	**183 Belmont Avenue, Haledon, NJ 07522**	**03/16/2017**
Luis Vargas, Owner	291 Jefferson Street, Paterson, NJ 07522	
Lombardi Enterprises, Inc.	**2901 South Clinton Avenue, South Plainfield, NJ 07080**	**12/09/2017**
Alan Lombardi, President	26 Whispering Way, Berkeley Hights., NJ 07922	
Ann Lombardi, Secretary	26 Whispeiring Way, Berkelely Hights, NJ 07922	
Lucas Construction Services	**31 Glassboro Rd, Monroeville, NJ 08343**	**10/11/2015**
Mark Lucas, Owner	, ,	
Mar Builders	**165 Brunswick Street, Newark, NJ 07114**	**05/07/2015**
Mar Builders, Inc.		
Nuno Ferreira, President	295 Baltursol Way, Springfield, NJ 07081	
Marvin Ardon Painting	**52 S. Jefferson St., Orange, NJ 07070**	**12/03/2016**
Marvin Alexander Ardon, Owner	52 South Jefferson St., Orange, NJ 07050	
Mason Tech, LLC	**35 Eighth St. Suite 7, Passaic, NJ 07055**	**08/09/2015**
Mariusz Zielonka, President	30 Carolyn Ct., E. Hanover, NJ 07936	
Iwona Zielonka, Vice-President	30 Carolyn Ct., E. Hanover, NJ 07936	
Mattina Construction LLC	**22 Toms River Road, Jackson, NJ 08527**	**12/14/2017**
Vincent Mattina, Owner	22 Toms River Rd, Jackson, NJ 08527	
Matt's Plumbing and Heating, Inc.	**168 W. Sylvania Avenue, Neptune City, NJ 07753**	**01/31/2015**
Matthew J. Gannon, President	16 Abbott Ave., Ocean Grove, NJ 07756	
Metroplex Products Co. Inc.	**377 Deans Rhode Hall Road, Monroe, NJ 08831**	**01/06/2018**
Peter Herring, President	164 South Moetz Drive, Milltown, NJ 08850	
MF Speed Construction, LLC.	**65-67 7th Ave. East, 1st Floor, Newark, NJ 07104**	**10/16/2016**
Fernando Lopes, President	65-67 7th Ave., East 1st Floor, Newark, NJ 07104	
Magda Zamprogno, Other	65-67 7th Ave., East 1st Floor, Newark, NJ 07104	
MG Topflight	**6 Spruce Meadows Dr., Monroe, NJ 08831**	**07/28/2017**
Ashish Thomas, Owner	6 Spruce Meadows Dr., Monroe, NJ 08831	
Midwest Construction, Inc.	**114 Brace Road, Cherry Hill, NJ 08034**	**07/23/2017**
George Antonas, President	114 Brace Road, Cherry Hill, NJ 08034	
MJM Painting LLC	**77 Littleton Road, PO Box 226, Morris Plains, NJ 07950**	**04/11/2016**
Michael Contreras, Owner	77 Littleton Road, Morris Plains, NJ 07950	

CONTRACTORS AND SUBCONTRACTORS	ADDRESS	EXPIRATION DATE
Monmouth Construction LLC	**201 3rd Ave., Bradley Beach, NJ 07720-1251**	**03/11/2016**
same		
Shawn F. Mowery, Member	1A Maple Leaf Drive, Holmdel, NJ 07733	
National Architectural Products Inc.	**1711 Ginesi Drive, Suite 2, Freehold, NJ 07728**	**02/18/2016**
James Yuhasz, Vice-President	4 Grant Dr., Cream Ridge, NJ 08514	
Antonene Yuhasz, President	4 Grant Dr., Cream Ridge, NJ 08510	
Natural View Landscapes LLC	**513 West Summer Ave, Minotola, NJ 08341**	**01/05/2017**
Zachary Kouhoupt, President	5923 Peach St, Mays Landing, NJ 08330	
NDA & Construction, LLC	**161 Thomas St, Unit 1, Newark, NJ 07114**	**12/10/2017**
Nester Torres, Owner	161 Thomas St, Unit 1, Newark, NJ 07114	
Nicola Matera & Sons L.L.C.	**48 Old Jacksonville Road, Towaco, NJ 07082**	**10/20/2016**
William Vlasich, Managing Member	7 Ginkgo Court, Upper Saddle River, NJ 07458	
Sheila Vlasich, Managing Member	7 Ginkgo Court, Upper Saddle River, NJ 07458	
Noe's Concrete Inc	**30 Euclid Ave, Medford, NY 11753**	**06/06/2016**
Noe Alatorre, Owner	30 Euclid Ave, Medford, NY 11763	
Noreast, Inc.	**410 North Avenue East, Cranford, NJ 07016**	**05/15/2017**
David Zohak, President	210 Orange Avenue, Cranford, NJ 07016	
Karen Zohak, Vice-President	210 Orange Avenue, Cranford, NJ 07016	
Ocean Blue Builders LLC	**711 Carol Avenue, Oakhurst, NJ 07755**	**11/05/2017**
John Riley Jr, Managing Member	140 Harrison Avenue, Fair Haven, NJ 07704	
OCM Construction	**203 Main Street, #204, Flemington, NJ 08822**	**08/11/2017**
OCM Construction, LLC		
William Mitchell, Owner	22 Greenwood Place, Flemington, NJ 08822	
Ohana Metal & Iron Works Inc.	**60 Miller Road, Montgomery, NY 12549**	**08/05/2017**
Erezy Ohana, Owner	60 Miller Road, Montgomery, NY 12549	
Old City Remodeling	**1406 Lexington Pl., Elizabeth, NJ 07208**	**06/09/2016**
Fabricio Franco, Owner	1406 Lexington Pl., Elizabeth, NJ 07208	
Patriot Carpentry, LLC	**111 Coach House Square, Pooler, GA 31322**	**03/25/2016**
Richard Dube, Principal	111 Coach House Square, Pooler, GA 31322	
Patti Construction, LLC	**2700 Hamilton Blvd., P.O. Box 169, South Plainfield, NJ 07080**	**01/13/2016**
James Patti, Owner	,,	
Paul Sexton	**462 10th Ave., Paterson, NJ 07510**	**07/10/2017**
Paul Sexton, Owner	462 10th Ave., Paterson, NJ	
Pax Construction Corp.	**67 Highway 36, West Long Branch, NJ 07764**	**10/16/2017**
Antonio Pereira, President	159 Locust Avenue, West Long Branch, NJ 07764	
Julio Pereira, Vice-President	304 Crimson Circle, Oakhurst, NJ 07755	
PER Construction LLC	**67 State Route 36, Suite #4, West Long Branch, NJ 07764**	**10/16/2017**
Manuel Pereira, Owner	194 Monmouth Ave., Long Branch, NJ 07740	
Peter Giancola & Sons Incorporated	**89 Unwin Drive, Hamilton, NJ 08610**	**07/29/2015**
Gregory J. Costa, President	2168 South Olden Avenue, Trenton, NJ 08610	
Vincent C. Costa, Vice-President	835 Estates Boulevard, Hamilton Township, NJ 08650	
Mark Gilbert, Secretary	89 Unwin Drive, Trenton, NJ 08610	
Pinnacle Construction & Renovation Corp.	**1632 Stephen Street, Ridgewood, NY 11385**	**03/25/2015**
Roman Olejnik, President	1882 Putnam Ave., Ridgewood, NY 11385	
itbull Electric, Inc.	**415 Commerce Lane, Suite 2, West Berlin, NJ 08091**	**06/26/2015**
John J. Tomasello, President	140 Ryans Run, Sicklerville, NJ 08081	

CONTRACTORS AND SUBCONTRACTORS	ADDRESS	EXPIRATION DATE
PL Stone & Stucco **Jozef Kosicky / Lucia Kosicky**	**15 Parkwood Dr., Apt. 1, South Amboy, NJ 08879**	**03/31/2016**
Jozef Kosicky, Owner	15 L Parkwood Dr., South Amboy, NJ 08879	
Pozo Mechanical Inc.	**187 Cortlandt Street, Belleville, NJ 07109**	**01/14/2016**
Alipio H. Pozo, Owner	187 Cortlamdt Street, Belleville, NJ 07109	
Precise Builders LLC	**402 Market St, Newark, NJ 07105**	**05/27/2017**
John Domingues, Owner	402 Market St, Newark, NJ 07105	
RAM Custom Flooring LLC	**PO Box 26, Chatham, NJ 07928**	**08/06/2015**
Andrew Smith, Owner	1612 Edmund Terrace, Union, NJ 07087	
Ranco Mechanical, Inc.	**P. O. Box 510, Augusta, NJ 07860**	**10/28/2016**
Kenneth Davis, President	2 Melba Drive, Newton, NJ 07860	
Anthony Davis, Vice-President	363 Northfield Avenue, Livingston, NJ 07039	
Raymond Mozak Plumbing & Heating	**1423 Teresa Drive, Fort Lee, NJ 07024**	**09/03/2016**
Raymond G. Mozak, Owner	1423 Teresa Drive, Fort Lee, NJ 07024	
Real Construction LLC	**1984 Whitesville Rd, Toms River, NJ 08757**	**11/23/2017**
Arkadiusz Chwedczuk, Owner	716 11th Avenue, Toms River, NJ 08757	
Ren Construction	**1984 Whitesville Road, Toms River, NJ 08755**	**07/09/2017**
Albert Chwedczuk, Owner	1984 Whitesville Road, Toms River, NJ 087055	
Retail Store Painting	**202 Karen Drive, Scranton, PA 18505**	**01/12/2018**
John Thomas, President	202 Karen Drive, Scranton, PA 18505	
Ribles Locksmith & Hardware	**613 15th Ave., Belmar, NJ 07719**	**07/10/2017**
Evelyn McDermott, Owner	613 15th Ave, Belmar, NJ 07719	
Riteway Construction, Inc.	**20 Cherry Hill Lane,, Apt. D, Old Bridge, NJ 08857-4737**	**02/27/2015**
Isidro Mirassol, President	20 D Cherry Hill Lane, Old Bridge, NJ 08857	
Robert M. Mesmer, LLC	**24 Sand Bridge Rd., Elmer, NJ 08318**	**12/11/2017**
Robert Mesmer, Managing Member	24 Sand Bridge Road, Elmer, NJ 08318	
S & J Contractors LLC	**2815 Green Ave, Bristol, PA 19007**	**08/22/2015**
Janusz Brzezinski, President	PO Box 1118, Bristol, PA 19007	
S & S Carpet	**25 Jocynda Road, Flanders, NJ 07836**	**10/10/2015**
Steven Simoni, President	, ,	
S & S Electric, LLC	**108 Oak Glen Road, Toms River, NJ 08753**	**01/12/2018**
Al Shan, President	108 Oak Glen Road, Toms River, NJ 08753	
Samco Construction Co. LLC	**413-415 South Seventh St., Elizabeth, NJ 07202**	**07/02/2016**
Anthony Mirabile, President	413-415 South Seventh St., Elizabeth, NJ 07202	
Saravia Concrete Pumping Corp.	**223-10, 113th St, Queens Village, NY 11429**	**08/18/2016**
Jerson Saravia, Owner	223-10, 113th St, Queens Vaillage, NY 11429	
Schenley Construction Inc.	**731 Warwick Turnpike, Hewitt, NJ 07421**	**09/20/2015**
Diane Deaver, President	29 Crystal Farm Rd., Warwick, NY 10990	
Kenneth Deaver, Vice-President	29 Crystal Farm Rd., Warwick, NY 10990	
Seaport Builders, L.L.C. **Seaport Builders, L.L.C.**	**505 Buhler Ave, % Grace Leatherman, Pine Beach, NJ 08741**	**05/02/2015**
Grace Leatherman, Owner / Officer	611 Vista Ct., Pine Beach, NJ 08741	
Seminole Construction, LLC	**128 Bartlett Ave, West Creek, NJ 08092**	**12/19/2015**
Sandra Morizzo, Managing Member	311 Holyoke, Beach Haven, NJ 08008	
Shoreline Marine Construction, LLC	**213 West Edgewood Ave, Linwood, NJ 08221**	**06/03/2016**
Kenneth Pontari, Partner	213 West Edgewood Ave., Linwood, NJ 08221	

CONTRACTORS AND SUBCONTRACTORS	ADDRESS	EXPIRATION DATE
SPMG Construction Inc.	**3001 Route 130, Apt. 8D, Delran, NJ 08075**	**03/31/2016**
Robledo Morais, President	3001 Route 130 Apt 8D, Delran, NJ 08075	
?-One LLc	**2816 Coronado Way, Vero Beach, FL 32960**	**07/21/2016**
Lee Dinenberg, President	2816 Coronado Way, Vero Beacj, FL 32960	
Starr Contracting LLC	**247 Raritan Boulevard, Cliffwood Beach, NJ 07735**	**02/27/2015**
Martin Starr, Owner / Officer	247 Raritan Boulevard, Cliffwood Beach, NJ 07735	
Structural Safety Incorporated	**716 White Horse Pike, Hammonton, NJ 08037**	**04/04/2015**
Gina Doyle, President	716 White Horse Pike, Hammonton, NJ 08037	
Super Stars Construction Inc	**58 Steiner Ave, Neptune City, NJ 07753**	**08/11/2017**
Juan Riano, Owner	58 Steiner Ave., Neptune City, NJ 07753	
T. Fiore Demolition, Inc.	**457 Wilson Avenue, Newark, NJ 07105**	**04/02/2017**
same		
Theodore Fiore, Owner	9 Silver Spring Court, East Hanover, NJ 07936	
Tabor Acoustical, Inc.	**431 South Main Street, Williamstown, NJ 08094**	**12/19/2015**
Joseph Gallagher, President	859 Coles Mill Road, Williamstown, NJ 08094	
Tabor Mill Work of South Jersey, Inc.	**858 Coles Mill Road, Williamstown, NJ 08094**	**01/09/2016**
Joseph Gallagher, President	858 Coles Mill Road, Williamstown, NJ 08094	
TAU Associates Plumbing & Mechanical LLC	**91 Graham St., Jersey City, NJ 07307**	**12/17/2016**
Lek Tauthong, Owner	91 Graham St, Jersey City, NJ 07307	
Team Equipment LLC	**26 East Garden Place, Pompton Plains, NJ 07444**	**07/02/2016**
William Morrissary		
William Morrissey, President	59 Lynwood Road, Cedar Grove, NJ 07009	
Tela Stretch Systems, LLC	**9 Wycoff Terrace, Fair Lawn, NJ 07410**	**02/05/2016**
Robert Gude, Owner	9 Wycoff Terrace, Fairlawn, NJ 07410	
Testa Corp.	**360 Audubon Road, Wakefield, MA 01880**	**05/27/2017**
Steven D. Testa, Owner	6 North Hill Dr., Lynnfield, MA 01940	
The Boca Bay Group	**16 South Avenue West, Suite 267, Cranford, NJ 07016**	**05/20/2016**
Barbara Marano, President	163 Hillcreek Ave, Cranford, NJ 07016	
The Grace Brothers	**311 Colonial Road, Edgewater Park, NJ 08010**	**01/08/2017**
James T. Grace, Owner	14 Surrey Lane, Williingboro, NJ 08046	
Jethro Grace Jr., Owner	311 Colonial Road, Edgewater Park, NJ 08010	
Thomas Clark Fiberglass, LLC	**145 Old Halfway Road, Barnegat, NJ 08005**	**10/22/2017**
Thomas Clark, Owner / Officer	145 Old Halfway Rd., Barnegat, NJ 08005	
TJD Construction	**138 Stonehenge Dr, Toms River, NJ 08753**	**02/24/2017**
Ted Dobrzanski		
Ted Dobrzanski, CEO	138 Stonehenge Dr, Toms River, NJ 08753	
Trinity Paving, LLC	**245 Clayton Road, Monroeville, NJ 08343-2652**	**10/20/2017**
Michele Doyle, Member	115 Millstone Way, Monroeville, NJ 08343	
Trinity Phoenix Corp.	**149 Garfield Avenue, Staten Island, NY 10305**	**03/05/2016**
Mike Keller, Vice-President	233 Lexington Avenue, Dumont, NJ 07628	
Joseph Free, President	149 Garfield Avenue, Staten Island, NY 10305	
Tri-State Insulators, LLC	**1038 Old York Rd., Raritan, NJ 08869**	**07/17/2016**
Tracy Cavallaro, President	1038 Old York Road, Raritan, NJ 08869	
True Line Wire Guidance Installation, Inc.	**7095 Shaffer Drive, Downs, IL 61736**	**02/27/2015**
Kenneth C. Myszka, President	7095 Shaffer Drive, Downs, IL 61736	
urfscapes LLC	**3477 So.Blackhorse Pike, Williamstown, NJ 08094**	**05/27/2017**
Jeffrey Grize, Owner	3477 S. Blackhorse Pike, Williamstown, NJ 08094	

CONTRACTORS AND SUBCONTRACTORS	ADDRESS	EXPIRATION DATE
UBU Sports **Turf Industry, Inc.**	**3525 Old Dixie Highway, Dalton, GA 30721**	**08/03/2017**
Mark Nicholls, President	3525 Old Dixie Highway, Dalton, GA 30721	
United Lab Equipment, Inc.	**136 Taylor Drive, Depew, NY 14043-3015**	**09/20/2015**
Ryan Hawkins, Manager	235 North Bryant St., Depew, NY 14086	
United Metal Construction LLC	**949 Spring View Drive, Southampton, PA 18966**	**10/24/2015**
Andrew Juodenko, Owner / Officer	949 Spring View Drive, South Hampton, PA 19114	
Vercon Building & Maintenance Corp.	**11 Arboretum Drive, Jackson, NJ 08527**	**05/11/2017**
Allanur Islambekov, Owner	11 Arboretum Dr., Jackson, NJ 08527	
Verrone Flooring, LLC.	**57 Weinmanns Blvd., Wayne, NJ 07470**	**02/15/2015**
Bill Verrone, Owner / Officer	57 Weinmanns Blvd, Wayne, NJ 07470	
Victor Construction , Inc	**4615 N. Front St, 2nd Floor, Philadelphia, PA 19140**	**04/22/2017**
Tania Felix-Claudio, Owner	4615 N. front St., 2nd Floor, Philadelphia, PA 19140	
Vito Braccia Concrete and Building Contractors Inc	**536 Easton Road, Horsham, PA 19044**	**07/26/2015**
Vito Braccia, President	184 Fairway Road, Ambler, PA 19002	
Wallmasters Modular Inc.	**226 Mutual Avenue, Winchester, KY 40391**	**07/28/2017**
Timothy Morrison, President	2745 SR668N, Junction City, OH 43748	
Watertrol, Inc.	**PO Box 163, Cranford, NJ 07016**	**04/18/2015**
Janice Papandrea, President	1065 Johnston Drive, Watchung, NJ 07060	
Wilder Drywall **Wilder Drywall, Inc.**	**101 Lookout Pass, Stormville, NY 12582**	**08/04/2016**
Susan Wilder, President	101 Lookout Pass, Stormville, NY 12582	

LIST OF DEBARRED OWNERS/OFFICERS

1/21/2015

Owners/ Officers	Address	Company Name
Yitzhak Adika, Vice-President	76 Alpine Drive, Closter, NJ 07624	I.K.E. Electrical Corp.
Rebecca Adika, Secretary	76 Alpine Dr., Closter, NJ	I.K.E. Electrical Corp.
Noe Alatorre, Owner	30 Euclid Ave, Medford, NY 11763	Noe's Concrete Inc
Elizabeth S. Albert, Secretary	20 Wilson Avenue West, East Hanover, NJ 07936	Edward J. Albert & Son Inc.
Joseph Albert, Vice-President	28 Emanual Street, East Hanover, NJ 07936	Edward J. Albert & Son Inc.
Thomas E. Albert, President	1343 South Beverwyck Road, Parsippany, NJ 07054	Edward J. Albert & Son Inc.
John Albert, Vice-President	66 Cherokee Street, Rockaway, NJ 07866	Edward J. Albert & Son Inc.
George Antonas, President	114 Brace Road, Cherry Hill, NJ 08034	Midwest Construction, Inc.
Marvin Alexander Ardon, Owner	52 South Jefferson St., Orange, NJ 07050	Marvin Ardon Painting
Rony Barahona, Member	549 Summit Ave, Maplewood, NJ 07040	Bechi Contracting LLC (EBA Painters) Bechi Contracting LLC
David Bastos, Managing Member	10 Pleasant Place, Kearny, NJ 07032	BCA Trucking, LLC
Wesley J. Beckett Jr., President	110 Oak Avenue, Malaga, NJ 08328	Beckett Enterprises, Inc.
William Bocra, President	One North Rhoda Street, Monroe Township, NJ 08831	Dean Development Inc.
Vito Braccia, President	184 Fairway Road, Ambler, PA 19002	Vito Braccia Concrete and Building Contractors In
Janusz Brzezinski, President	PO Box 1118, Bristol, PA 19007	S & J Contractors LLC
Bert L. Buckler, President	182 Wycoff Way West, East Brunswick, NJ 08816	Buckler Associates, Inc.
Giovanny Bustos, Owner	26 Spencer Place, Garfield, NJ 07026	Cobra Communications & Installations, LLC
Lauren Campanella, President	948 Sinclair Avenue, Staten Island, NY 10309	Anchorage Construction Corp.
Andre Campanella, Vice-President	948 Sinclair Ave, Staten Island, NY 10309	Anchorage Construction Corp.
Angelo Castelli, President	48 E. Central Blvd., Palisades Park, NJ 07650	I.K.E. Electrical Corp.
Tracy Cavallaro, President	1038 Old York Road, Raritan, NJ 08869	Tri-State Insulators, LLC
Nick Cerelli, Member	1640 Nixon Dr. Ste. 205, Moorestown, NJ 08057	Diamond State Wall Systems, LLC
Shawn Chalmers, Owner	337 Crown Street, Brooklyn, NY 11211	Chalmers Construction LLC.
Noe Chanez, Principal	55 Miller Ave., Somerset, NJ 08873	Chanez Landscaping, LLC
Eric Charles, President	396 Cherry Lane, Mendham, NJ 07945	All County Pipeline & Site Excavation LLC
Christine Charles, Vice-President	396 Cherry Lane, Mendham, NJ 07945	All County Pipeline & Site Excavation LLC
Arkadiusz Chwedczuk, Owner	716 11th Avenue, Toms River, NJ 08757	Real Construction LLC
Albert Chwedczuk, Owner	1984 Whitesville Road, Toms River, NJ 087055	Ren Construction
Andrzej Citak, Vice-President	556 Humboldt St, Brooklyn, NY 11222	Cityline Contracting Inc.
Thomas Clark, Owner / Officer	145 Old Halfway Rd., Barnegat, NJ 08005	Thomas Clark Fiberglass, LLC
Michael Contreras, Owner	77 Littleton Road, Morris Plains, NJ 07950	MJM Painting LLC
Gregory J. Costa, President	2168 South Olden Avenue, Trenton, NJ 08610	Peter Giancola & Sons Incorporated
Vincent C. Costa, Vice-President	835 Estates Boulevard, Hamilton Township, NJ 08650	Peter Giancola & Sons Incorporated
Steven Crider, Member	507 Pressler Street, Apt. 2128, Austin, TX 78703	Crider Americas Solar LLC
Joseph Csakvary, President	163 Breakneck Road, Highland Lakes, NJ 07422	Joseph Csakvary, Inc.
Nuno Cunha, Owner	35 Carmen Ct., Newark, NJ 07105	Cunhas Construction Inc.
Anthony Davis, Vice-President	363 Northfield Avenue, Livingston, NJ 07039	Ranco Mechanical, Inc.
Kenneth Davis, President	2 Melba Drive, Newton, NJ 07860	Ranco Mechanical, Inc.
Diane Deaver, President	29 Crystal Farm Rd., Warwick, NY 10990	Schenley Construction Inc.
Kenneth Deaver, Vice-President	29 Crystal Farm Rd., Warwick, NY 10990	Schenley Construction Inc.
Patrick DellAquila, President	55 Brookview Drive, Woodcliff Lake, NJ 07677	Elevator Medic Corporation
Patrick Dell'Aquila, President	55 Brookview Drive, Woodcliff Lake, NJ 07677	Ideal Elevator Services Patrick Dell'Aquila East Coast Touch Enterprises LLC
Nelson DeOliveira, President	276 Highland Ave, Kearney, NJ 07032	J.D.S Electric, Inc.
Joe DeSalvo, Jr., Owner	149 Montross Ave., Rutherford, NJ 07070	Green Oasis Maintenance, Inc.
Franco S. DiMeglio, President	409 Bennetts Lane, Somerset, NJ 08873	SP-One LLc
Lee Dinenberg, President	2816 Coronado Way, Vero Beacj, FL 32960	Cityline Contracting Inc.
Dorothy Dobiecka, President	556 Humboldt Street, Brooklyn, NY 11222	

Owners/ Officers	Address	Company Name
Florian Dobre, Partner	526 Sheridan Ave, Roselle, NJ 07203	B & B Atlantic LLC
Ted Dobrzanski, CEO	138 Stonehenge Dr, Toms River, NJ 08753	TJD Construction
		Ted Dobrzanski
John Domingues, Owner	402 Market St, Newark, NJ 07105	Precise Builders LLC
Gina Doyle, President	716 White Horse Pike, Hammonton, NJ 08037	Structural Safety Incorporated
Michele Doyle, Member	115 Millstone Way, Monroeville, NJ 08343	Trinity Paving, LLC
William J. Doyle, President	200 Pine Rd., Hammonton, NJ 08037	Highway Safety Systems Inc.
Richard Dube, Principal	111 Coach House Square, Pooler, GA 31322	Patriot Carpentry, LLC
Donald Eastmond, Owner	292 Church Street, Aberdeen, NJ 07747	Anew Fence & Railings
Kevin G. Eib, President	29 Monmouth Road, Monroe Twp., NJ 08831	Division Ten Installations, LLC
Frederick Ellis, President	2 Island Pond Road, Derry, NH 03038	JIC-ELCO Inc.
Hector Estrada, Owner	432 52nd Street Apt 2, West New York, NJ 07093	Estrada & Roca LLC
Tania Felix-Claudio, Owner	4615 N. front St., 2nd Floor, Philadelphia, PA 19140	Victor Construction , Inc
Nuno Ferreira, President	295 Baltursol Way, Springfield, NJ 07081	Mar Builders
		Mar Builders, Inc.
Michael F. Ferro Jr., Member	89 Jeanne Court, Stamford, CT 06905	D & B Partners LLC
		same
Theodore Fiore, Owner	9 Silver Spring Court, East Hanover, NJ 07936	T. Fiore Demolition, Inc.
		same
Fabricio Franco, Owner	1406 Lexington Pl., Elizabeth, NJ 07208	Old City Remodeling
Scott Frasca, Manager	326 Coles Mill Road, Williamstown, NJ 08094	Blue Skies Electric L.L.C.
Rachel Frasca, Owner	326 Coles Mill Road, Williamstown, NJ 08094	Blue Skies Electric L.L.C.
Joseph Free, President	149 Garfield Avenue, Staten Island, NY 10305	Trinity Phoenix Corp.
Lori A. Frisina, President	235 Grand Avenue, Rutherford, NJ 07070	Industrial Concrete Const. of NJ, Inc.
Stephen Gallagher, Owner	221 Coolidge Street, Suite 11, Linden, NJ 07036	East Commercial Construction
Joseph Gallagher, President	859 Coles Mill Road, Williamstown, NJ 08094	Tabor Acoustical, Inc.
Joseph Gallagher, President	858 Coles Mill Road, Williamstown, NJ 08094	Tabor Mill Work of South Jersey, Inc.
Matthew J. Gannon, President	16 Abbott Ave., Ocean Grove, NJ 07756	Matt's Plumbing and Heating, Inc.
Cesar Garcia, Owner	64 Grandview Ave, North Plainfield, NJ 07060	Emanuel Drywall Services, Inc
Randy Garciga, Owner	13353 NE 17th Avenue, Miami, FL 33181	JTG Scaffolding & Hoisting LLC
Randy Garciga, Owner	13353 NE 17th Avenue, North Miami, FL 33181	JD Scaffold Inc.
John Garza, Owner	768 Chambers St., Trenton, NJ 08611	Garza Contracting LLC
John Giannattasio, Member	89 Jeanne Court, Stamford, CT 06905	D & B Partners LLC
		same
Mark Gilbert, Secretary	89 Unwin Drive, Trenton, NJ 08610	Peter Giancola & Sons Incorporated
Antonio Gomes Jr., President	41 Hamilton Ave, Kearny, NJ 07032	CRC General Constructors Inc.
Antonio Gomes Sr., President	164 Green Street, Newark, NJ 07105	Crossroad Construction Corp.
Efrain Gonzalez, Owner	256 Grove St., North Plainfield, NJ 07060	G&G Drywall, Inc.
Zbigniew Grabowski, Owner	35 Jersey Street, East Rutherford, NJ 07073	Grab Heating and Air Conditioning, LLC.
James T. Grace, Owner	14 Surrey Lane, Williingboro, NJ 08046	The Grace Brothers
Jethro Grace Jr., Owner	311 Colonial Road, Edgewater Park, NJ 08010	The Grace Brothers
Jeffrey Grize, Owner	3477 S. Blackhorse Pike, Williamstown, NJ 08094	Turfscapes LLC
Robert Gude, Owner	9 Wycoff Terrace, Fairlawn, NJ 07410	Tela Stretch Systems, LLC
John Gustafson, President	39 Charles Street, Montgomery, NY 12549	John Gustafson Excavating, Inc.
Albert J Harlow Jr, President	515 Summit Lane, Riegelsville, PA 18077	Harlow Contracting, Inc.
Ryan Hawkins, Manager	235 North Bryant St., Depew, NY 14086	United Lab Equipment, Inc.
George Heigel, Vice-President	350 Main Street, Kersey, PA 15846	4 S Logging & Lumber Co., Inc.
Peter Herring, President	164 South Moetz Drive, Milltown, NJ 08850	Metroplex Products Co. Inc.
Joe Hilt, President	79 Myrtle Ave, Mickleton, NJ 08056	DMH Trucking, Inc.
Calvin Hudson, Owner	126 Winding Ridge Road, Dover, DE 19904	Calvin's Floor Service,aka Calvin's Carpet Service
Allanur Islambekov, Owner	11 Arboretum Dr., Jackson, NJ 08527	Vercon Building & Maintenance Corp.
Henry Johnson, Owner	1258 N. East Avenue, Vineland, NJ 08360	Johnson's Construction Inc.
Carole Johnson, Secretary	390 Seneca Road, St marys, PA 15857	4 S Logging & Lumber Co., Inc.

Owners/ Officers	Address	Company Name
Andrew Juodenko, Owner / Officer	949 Spring View Drive, South Hampton, PA 19114	United Metal Construction LLC
Mike Keller, Vice-President	233 Lexington Avenue, Dumont, NJ 07628	Trinity Phoenix Corp.
Kwang Hee Kim, Partner	685 Bergen Blvd., Ridgefield, NJ 07657	K&K Construction LLC
Ki Kuk Kim, Partner	685 Bergan Blvd., Ridgefield, NJ 07657	K&K Construction LLC
Elam King, Member	6285 Plank Road, Narvon, PA 17555	Keystone Steel Structures Inc.
Jozef Kosicky, Owner	15 L Parkwood Dr., South Amboy, NJ 08879	PL Stone & Stucco Jozef Kosicky / Lucia Kosicky
Zachary Kouhoupt, President	5923 Peach St, Mays Landing, NJ 08330	Natural View Landscapes LLC
Grace Leatherman, Owner / Officer	611 Vista Ct., Pine Beach, NJ 08741	Seaport Builders, L.L.C. Seaport Builders, L.L.C.
Alan Lombardi, President	26 Whispering Way, Berkeley Hights., NJ 07922	Lombardi Enterprises, Inc.
Ann Lombardi, Secretary	26 Whispeiring Way, Berkelely Hights, NJ 07922	Lombardi Enterprises, Inc.
Fernando Lopes, President	65-67 7th Ave., East 1st Floor, Newark, NJ 07104	MF Speed Construction, LLC.
Frank Loureier, Vice-President	152 Jefferson St., Newark, NJ 07105	East Coast Touch Enterprises LLC
Mark Lucas, Owner	, ,	Lucas Construction Services
Keith Ludwig, Member	459 Rt 38 West, Maple Shade, NJ 08052	HFM Labor Ready LLC HFM Labor Ready LLC
Robert Lueders, Owner	1008 Ridge Drive, Union, NJ 07083	ACC Contractors Corp.
Matus Madar, Managing Member	75 Hart Street, Sayreville, NJ 08872-1123	Jersey Wall Concepts, LLC
Barbara Marano, President	163 Hillcreek Ave, Cranford, NJ 07016	The Boca Bay Group /
Tomasz Markowski, President	2026 Himrod Road, RIdgewood, NY 11385	Eastern American Renovation Corp.
Harold Marshall, Jr., Member	1800 Eva Street, Austin, TX 78704	Crider Americas Solar LLC
Rogerio Martins, Vice-President	46 Grove Street, South River, NJ 08882	Globo Contracting Corporation
Antonio Martins, President	215 Princeton Road, Parlin, NJ 08859	Globo Contracting Corporation
Manuel Martins, Treasurer	15 Center Street, South River, NJ 08882	Globo Contracting Corporation
Vincent Mattina, Owner	22 Toms River Rd, Jackson, NJ 08527	Mattina Construction LLC
Lisa Mautone, Member	25 Roberts Road, Holmdel, NJ 07733	AMC Industries LLC same
Anna Mautone, Member	88 Stilwell Road, Holmdel, NJ 07733	AMC Industries LLC same
Denise Mautone, Member	18A South Bears Street, Holmdel, NJ 07733	AMC Industries LLC same
Evelyn McDermott, Owner	613 15th Ave, Belmar, NJ 07719	Ribles Locksmith & Hardware
George McGee, President	99 Hillside Terrace, Parsippany, NJ 07054	GM Masonry, Inc.
Artem Melnyk, Member	8653 Glenloch Street #2, Philadelphia, PA 19136	A & M Remodelling
Daniel Mena, Owner	1002 Taunton Ave, West Berlin, NJ 08091	Designer Impressions
Robert Mesmer, Managing Member	24 Sand Bridge Road, Elmer, NJ 08318	Robert M. Mesmer, LLC
Anthony Mirabile, President	413-415 South Seventh St., Elizabeth, NJ 07202	Samco Construction Co. LLC
Isidro Mirassol, President	20 D Cherry Hill Lane, Old Bridge, NJ 08857	Riteway Construction, Inc.
Keith Mishoe, Owner	341 Seaton Avenue, Roselle Park, NJ 07204	Chalmers Construction LLC.
William Mitchell, Owner	22 Greenwood Place, Flemington, NJ 08822	OCM Construction OCM Construction, LLC
Brad J. Moini, President	101 Buttonwood Lane, Freehold, NJ 07728	Brothers Landscaping J.H. Brothers Inc.
Frank Montgomery, Owner	42 Bryant Rd., Waretown, NJ 08758	Frank Montgomery Builder
Robledo Morais, President	3001 Route 130 Apt 8D, Delran, NJ 08075	SPMG Construction Inc.
Sandra Morizzo, Managing Member	311 Holyoke, Beach Haven, NJ 08008	Seminole Construction, LLC
Timothy Morrison, President	2745 SR668N, Junction City, OH 43748	Wallmasters Modular Inc.
William Morrissey, President	59 Lynwood Road, Cedar Grove, NJ 07009	Team Equipment LLC William Morrissary
Shawn F. Mowery, Member	1A Maple Leaf Drive, Holmdel, NJ 07733	Monmouth Construction LLC same
Raymond G. Mozak, Owner	1423 Teresa Drive, Fort Lee, NJ 07024	Raymond Mozak Plumbing & Heating
Frank J. Muratore Jr., Owner	1828 Herbert Boulevard, Williamstown, NJ 08094	Frank J. Muratore, Jr., Inc. Frank J. Muratore
William Muzzio Jr., Owner	597 Lyman Ave, Woodbridge, NJ 07095	Citadel Environmental Consultants

Owners/ Officers	Address	Company Name
Kenneth C. Myszka, President	7095 Shaffer Drive, Downs, IL 61736	True Line Wire Guidance Installation, Inc.
Mark Nicholls, President	3525 Old Dixie Highway, Dalton, GA 30721	UBU Sports
UJU A. Obiorah, President	259 West Forest Avenue, Englewood, NJ 07631	Turf Industry, Inc. Envirocare Enterprises, Inc.
Inno Obiorah, Manager	658 Rutgers Pl, Paramus, NJ 07652	Envirocare Enterprises, Inc. Envirocare Enterprises, Inc. Envirocare Enterprises, Inc.
Thomas O'Connell, President	449 Grace Hill Road, Monroe, NJ 08817	CGT Construction, Inc.
Thomas O'Connell, President	499 Grace Hill Road, Monroe Twp, NJ 08837	American Air Systems Group
Erezy Ohana, Owner	60 Miller Road, Montgomery, NY 12549	Ohana Metal & Iron Works Inc.
Roman Olejnik, President	1882 Putnam Ave., Ridgewood, NY 11385	Pinnacle Construction & Renovation Corp.
Luis Oliveras, Owner	644 East 2nd St., Plainfield, NJ 07060	Caslo Drywall Corp.
Brian O'Shea, Owner	1041 Glassboro Rd. D-2, Williamstown, NJ 08094	American Welding Services
Janice Papandrea, President	1065 Johnston Drive, Watchung, NJ 07060	American Welding Services, Inc. Watertrol, Inc.
Mahesh Patel, Owner	828 Highland Ave, Paramus, NJ 07652	Coplen Management, Inc.
James Patti, Owner	, ,	Patti Construction, LLC
Julio Pereira, Vice-President	304 Crimson Circle, Oakhurst, NJ 07755	Pax Construction Corp.
Antonio Pereira, President	159 Locust Avenue, West Long Branch, NJ 07764	Pax Construction Corp.
Manuel Pereira, Owner	194 Monmouth Ave., Long Branch, NJ 07740	PER Construction LLC
Branson Pickney, Owner	408 West 129th Street, Apt. 7, New York, NY 10027	BP Enterprises, Inc.
Fernando F. Pinho, President	66 6 th Ave., Long Branch, NJ 07740	Fortress Construction Co., Inc.
Alicirio Jose Santana Pires, Owner	141 RT. 130 South, Suite 192, Cinnaminson, NJ 08077	Five Star Quality Construction
Kenneth Pontari, Partner	213 West Edgewood Ave., Linwood, NJ 08221	Shoreline Marine Construction, LLC
Christopher Poppe, President	317 Greenridge Road, Franklin Lakes, NJ 07417	Centurion Companies Inc.
Glen P. Poppe, Secretary	795 Susquehanna Ave, Franklin Lakes, NJ 07417	Centurion Companies Inc.
Barry Portnoy, President	1300 Industrial Boulevard, Unit 5, Southampton, PA 18966	Demrex Industrial Services, Inc.
Alipio H. Pozo, Owner	187 Cortlamdt Street, Belleville, NJ 07109	Pozo Mechanical Inc.
Jazmine Price, President	744 South St Unit 65, Phildelphia, PA 19147	Green Diamond Roofing & Live Roof, LLC
Juan Riano, Owner	58 Steiner Ave., Neptune City, NJ 07753	Super Stars Construction Inc
John Riley Jr, Managing Member	140 Harrison Avenue, Fair Haven, NJ 07704	Ocean Blue Builders LLC
Jose Roca, Owner	468 9th St, Apt # 2, Palisades Park, NJ 07650	Estrada & Roca LLC
James Rough, Owner	12767 Van Horne Rd., Meadville, PA 16335	James Rough Bleachers
Gary Russo, President	3 Premier Way, Manalapan, NJ 07726	GSR Architectural, Inc
Christopher Rymal, Owner	1929 Darby Rd., Havertown, PA 19083	IBS, Inc.
Peter Santos, President	35 Elmwood Ave, Unit 2B, Union, NJ 07083	Artco Contracting & Development
Michael Santos, President	988 Johnson Place, Apt. 4, Union, NJ 07083	Artco Contracting & Development, Inc. AB Contracting & Develpmernt LLC
Jerson Saravia, Owner	223-10, 113th St, Queens Vaillage, NY 11429	Saravia Concrete Pumping Corp.
John Schiavo, Managing Member	6 Justa Lane, Cherry Hill, NJ 08003	Jamcon Construction LLC
Alfred Sciubba, Managing Member	3 Chadwick Drive, Voorhees Twp., NJ 08043	Allied Construction LLC.
Pat Sellitti, Owner	870 Lamont Ave., Staten Island, NY 10309	Allied Construction Management, LLC Infinity Construction & Son, LLC
Paul Sexton, Owner	462 10th Ave., Paterson, NJ	Paul Sexton
Al Shan, President	108 Oak Glen Road, Toms River, NJ 08753	S & S Electric, LLC
Shawn Sheeley, President	130 Sheeley Road, Kersey, PA 15846	4 S Logging & Lumber Co., Inc.
Margaret Sherman, President	203 Woods Avenue, Bergenfield, NJ 07621	CPS Mechanical Contractors, Inc.
David Simonetti, Vice-President	8 Hightor Road, New City, NY 10956	D. Simonetti, Inc.
Domenico Simonetti, President	6 Hanford Place, Tarrytown, NY 10591	D. Simonetti, Inc.
Steven Simoni, President	, ,	S & S Carpet
Andrzej Skora, President	67 Cox Cro Road, Toms River, NJ 08755	A.J. Skora Inc.
Gary W. Smith, President	584 Erial Road, Sicklerville, NJ 08081	G.W. Smith Construction, Inc.
Lisa L. Smith, Vice-President	584 Erial Road, Sicklerville, NJ 08081	G.W. Smith Construction, Inc.
Andrew Smith, Owner	1612 Edmund Terrace, Union, NJ 07087	RAM Custom Flooring LLC

Owners/ Officers	Address	Company Name
John Sorrentino, Owner	65 Fern St, Browns Mills, NJ 08015	Barzzini Construction
Martin Starr, Owner / Officer	247 Raritan Boulevard, Cliffwood Beach, NJ 07735	Starr Contracting LLC
George Tassogloy, Owner	105 Cedar Ave, Woodlynne, NJ 08107	George's Carpet George Tassogloy
Lek Tauthong, Owner	91 Graham St, Jersey City, NJ 07307	TAU Associates Plumbing & Mechanical LLC
Steven D. Testa, Owner	6 North Hill Dr., Lynnfield, MA 01940	Testa Corp.
John Thomas, President	202 Karen Drive, Scranton, PA 18505	Retail Store Painting
Ashish Thomas, Owner	6 Spruce Meadows Dr., Monroe, NJ 08831	MG Topflight
John J. Tomasello, President	140 Ryans Run, Sicklerville, NJ 08081	Pitbull Electric, Inc.
Leonard Torchia, Member	5 Lucy Court, Pompton Plains, NJ 07444	Commercial Flooring Center of New Jersey
Maryjo Torchia, President	P.O. Box-1033, West Caldwell, NJ 07007	Commercial Flooring Center of New Jersey
Nester Torres, Owner	161 Thomas St, Unit 1, Newark, NJ 07114	NDA & Construction, LLC
Luis Vargas, Owner	291 Jefferson Street, Paterson, NJ 07522	L and Y Roofing, LLC
Bill Verrone, Owner / Officer	57 Weinmanns Blvd, Wayne, NJ 07470	Verrone Flooring, LLC.
Sheila Vlasich, Managing Member	7 Ginkgo Court, Upper Saddle River, NJ 07458	Nicola Matera & Sons L.L.C.
William Vlasich, Managing Member	7 Ginkgo Court, Upper Saddle River, NJ 07458	Nicola Matera & Sons L.L.C.
Simon Walcott, Owner	43 Fairview Avenue, Bergenfield, NJ 07621	K & S Fabrication & Welding, LLC
Ireneusz Waluk, Owner	70 Bordentown-Chesterfiel, Rd., Chesterfield, NJ 08515	Euro Construction
Susan Wilder, President	101 Lookout Pass, Stormville, NY 12582	Wilder Drywall Wilder Drywall, Inc.
Robert Woods, President	6384 Tollgate Road, Zionsville, PA 18092	Advanced Spray Technology
Antonene Yuhasz, President	4 Grant Dr., Cream Ridge, NJ 08510	National Architectural Products Inc.
James Yuhasz, Vice-President	4 Grant Dr., Cream Ridge, NJ 08514	National Architectural Products Inc.
Magda Zamprogno, Other	65-67 7th Ave., East 1st Floor, Newark, NJ 07104	MF Speed Construction, LLC.
Mariusz Zielonka, President	30 Carolyn Ct., E. Hanover, NJ 07936	Mason Tech, LLC
Iwona Zielonka, Vice-President	30 Carolyn Ct., E. Hanover, NJ 07936	Mason Tech, LLC
Christopher Zimmermann, President	2303 Owen Court, Toms River, NJ 08755	ACC Construction LLC
Karen Zohak, Vice-President	210 Orange Avenue, Cranford, NJ 07016	Noreast, Inc.
David Zohak, President	210 Orange Avenue, Cranford, NJ 07016	Noreast, Inc.
Agustin Zuniga, President	420 Broadway, Long Branch, NJ 07740	American Eagle Contractor, Inc.

EXHIBIT NO. 3

DAVIS BACON ACT – LABOR STANDARDS PROVISIONS FOR FEDERALLY ASSISTED CONSTRUCTION CONTRACTS (EPA FORM 5720-4)

AND

USEPA ATTACHMENT 6 – REQUIREMENTS FOR SUBRECIPIENTS THAT ARE GOVERNMENT ENTITIES

Content Last Revised: **Current as of 3/11/2014**

CFR **Code of Federal Regulations Pertaining to ESA**

Title 29 – **Labor** Chapter I

Part 5 - **Labor Standards Provisions Applicable to Contracts Covering Federally Financed and Assisted Construction**

Subpart A - **Davis-Bacon and Related Acts Provisions and Procedures**

Section Number: 5.5 Contract provisions and related matters.

(a) The Agency head shall cause or require the contracting officer to insert in full in any contract in excess of $2,000 which is entered into for the actual construction, alteration and/or repair, including painting and decorating, of a public building or public work, or building or work financed in whole or in part from Federal funds or in accordance with guarantees of a Federal agency or financed from funds obtained by pledge of any contract of a Federal agency to make a loan, grant or annual contribution (except where a different meaning is expressly indicated), and which is subject to the labor standards provisions of any of the acts listed in § 5.1, the following clauses (or any modifications thereof to meet the particular needs of the agency, *Provided,* That such modifications are first approved by the Department of Labor):

(1) *Minimum wages.* (i) All laborers and mechanics employed or working upon the site of the work (or under the United States Housing Act of 1937 or under the Housing Act of 1949 in the construction or development of the project), will be paid unconditionally and not less often than once a week, and without subsequent deduction or rebate on any account (except such payroll deductions as are permitted by regulations issued by the Secretary of Labor under the Copeland Act (29 CFR part 3)), the full amount of wages and bona fide fringe benefits (or cash equivalents thereof) due at time of payment computed at rates not less than those contained in the wage determination of the Secretary of Labor which is attached hereto and made a part hereof, regardless of any contractual relationship which may be alleged to exist between the contractor and such laborers and mechanics.

Contributions made or costs reasonably anticipated for bona fide fringe benefits under section 1(b)(2) of the Davis-Bacon Act on behalf of laborers or mechanics are considered wages paid to such laborers or mechanics, subject to the provisions of paragraph (a)(1)(iv) of this section; also, regular contributions made or costs incurred for more than a weekly period (but not less often than quarterly) under plans, funds, or programs which cover the particular weekly period, are deemed to be constructively made or incurred during such weekly period. Such laborers and mechanics shall be paid the appropriate wage rate and fringe benefits on the wage determination for the

classification of work actually performed, without regard to skill, except as provided in § 5.5(a)(4). Laborers or mechanics performing work in more than one classification may be compensated at the rate specified for each classification for the time actually worked therein: *Provided,* That the employer's payroll records accurately set forth the time spent in each classification in which work is performed. The wage determination (including any additional classification and wage rates conformed under paragraph (a)(1)(ii) of this section) and the Davis-Bacon poster (WH-1321) shall be posted at all times by the contractor and its subcontractors at the site of the work in a prominent and accessible place where it can be easily seen by the workers.

(ii)(A) The contracting officer shall require that any class of laborers or mechanics, including helpers, which is not listed in the wage determination and which is to be employed under the contract shall be classified in conformance with the wage determination. The contracting officer shall approve an additional classification and wage rate and fringe benefits therefore only when the following criteria have been met:

(*1*) The work to be performed by the classification requested is not performed by a classification in the wage determination; and

(*2*) The classification is utilized in the area by the construction industry; and

(*3*) The proposed wage rate, including any bona fide fringe benefits, bears a reasonable relationship to the wage rates contained in the wage determination.

(B) If the contractor and the laborers and mechanics to be employed in the classification (if known), or their representatives, and the contracting officer agree on the classification and wage rate (including the amount designated for fringe benefits where appropriate), a report of the action taken shall be sent by the contracting officer to the Administrator of the Wage and Hour Division, Employment Standards Administration, U.S. Department of Labor, Washington, DC 20210. The Administrator, or an authorized representative, will approve, modify, or disapprove every additional classification action within 30 days of receipt and so advise the contracting officer or will notify the contracting officer within the 30-day period that additional time is necessary.

(C) In the event the contractor, the laborers or mechanics to be employed in the classification or their representatives, and the contracting officer do not agree on the proposed classification and wage rate (including the amount designated for fringe benefits, where appropriate), the contracting officer shall refer the questions, including the views of all interested parties and the recommendation of the contracting officer, to the Administrator for determination. The Administrator, or an authorized representative, will issue a determination within 30 days of receipt and so advise the contracting officer or will notify the contracting officer within the 30-day period that additional time is necessary.

(D) The wage rate (including fringe benefits where appropriate) determined pursuant to paragraphs (a)(1)(ii) (B) or (C) of this section, shall be paid to all workers performing

work in the classification under this contract from the first day on which work is performed in the classification.

(iii) Whenever the minimum wage rate prescribed in the contract for a class of laborers or mechanics includes a fringe benefit which is not expressed as an hourly rate, the contractor shall either pay the benefit as stated in the wage determination or shall pay another bona fide fringe benefit or an hourly cash equivalent thereof.

(iv) If the contractor does not make payments to a trustee or other third person, the contractor may consider as part of the wages of any laborer or mechanic the amount of any costs reasonably anticipated in providing bona fide fringe benefits under a plan or program, *Provided,* That the Secretary of Labor has found, upon the written request of the contractor, that the applicable standards of the Davis-Bacon Act have been met. The Secretary of Labor may require the contractor to set aside in a separate account assets for the meeting of obligations under the plan or program.

(2) *Withholding.* The (write in name of Federal Agency or the loan or grant recipient) shall upon its own action or upon written request of an authorized representative of the Department of Labor withhold or cause to be withheld from the contractor under this contract or any other Federal contract with the same prime contractor, or any other federally-assisted contract subject to Davis-Bacon prevailing wage requirements, which is held by the same prime contractor, so much of the accrued payments or advances as may be considered necessary to pay laborers and mechanics, including apprentices, trainees, and helpers, employed by the contractor or any subcontractor the full amount of wages required by the contract. In the event of failure to pay any laborer or mechanic, including any apprentice, trainee, or helper, employed or working on the site of the work (or under the United States Housing Act of 1937 or under the Housing Act of 1949 in the construction or development of the project), all or part of the wages required by the contract, the (Agency) may, after written notice to the contractor, sponsor, applicant, or owner, take such action as may be necessary to cause the suspension of any further payment, advance, or guarantee of funds until such violations have ceased.

(3) *Payrolls and basic records.* (i) Payrolls and basic records relating thereto shall be maintained by the contractor during the course of the work and preserved for a period of three years thereafter for all laborers and mechanics working at the site of the work (or under the United States Housing Act of 1937, or under the Housing Act of 1949, in the construction or development of the project). Such records shall contain the name, address, and social security number of each such worker, his or her correct classification, hourly rates of wages paid (including rates of contributions or costs anticipated for bona fide fringe benefits or cash equivalents thereof of the types described in section 1(b)(2)(B) of the Davis-Bacon Act), daily and weekly number of hours worked, deductions made and actual wages paid. Whenever the Secretary of Labor has found under 29 CFR 5.5(a)(1)(iv) that the wages of any laborer or mechanic include the amount of any costs reasonably anticipated in providing benefits under a plan or program described in section 1(b)(2)(B) of the Davis-Bacon Act, the contractor shall maintain records which show that the commitment to provide such benefits is enforceable, that the plan or program is financially responsible, and that the plan or

program has been communicated in writing to the laborers or mechanics affected, and records which show the costs anticipated or the actual cost incurred in providing such benefits. Contractors employing apprentices or trainees under approved programs shall maintain written evidence of the registration of apprenticeship programs and certification of trainee programs, the registration of the apprentices and trainees, and the ratios and wage rates prescribed in the applicable programs.

(ii)(A) The contractor shall submit weekly for each week in which any contract work is performed a copy of all payrolls to the (write in name of appropriate federal agency) if the agency is a party to the contract, but if the agency is not such a party, the contractor will submit the payrolls to the applicant, sponsor, or owner, as the case may be, for transmission to the (write in name of agency). The payrolls submitted shall set out accurately and completely all of the information required to be maintained under 29 CFR 5.5(a)(3)(i), except that full social security numbers and home addresses shall not be included on weekly transmittals. Instead the payrolls shall only need to include an individually identifying number for each employee (*e.g.* , the last four digits of the employee's social security number). The required weekly payroll information may be submitted in any form desired. Optional Form WH-347 is available for this purpose from the Wage and Hour Division Web site at *http://www.dol.gov/esa/whd/forms/wh347instr.htm* or its successor site. The prime contractor is responsible for the submission of copies of payrolls by all subcontractors. Contractors and subcontractors shall maintain the full social security number and current address of each covered worker, and shall provide them upon request to the (write in name of appropriate federal agency) if the agency is a party to the contract, but if the agency is not such a party, the contractor will submit them to the applicant, sponsor, or owner, as the case may be, for transmission to the (write in name of agency), the contractor, or the Wage and Hour Division of the Department of Labor for purposes of an investigation or audit of compliance with prevailing wage requirements. It is not a violation of this section for a prime contractor to require a subcontractor to provide addresses and social security numbers to the prime contractor for its own records, without weekly submission to the sponsoring government agency (or the applicant, sponsor, or owner).

(B) Each payroll submitted shall be accompanied by a "Statement of Compliance," signed by the contractor or subcontractor or his or her agent who pays or supervises the payment of the persons employed under the contract and shall certify the following:

(*1*) That the payroll for the payroll period contains the information required to be provided under § 5.5 (a)(3)(ii) of Regulations, 29 CFR part 5, the appropriate information is being maintained under § 5.5 (a)(3)(i) of Regulations, 29 CFR part 5, and that such information is correct and complete;

(*2*) That each laborer or mechanic (including each helper, apprentice, and trainee) employed on the contract during the payroll period has been paid the full weekly wages earned, without rebate, either directly or indirectly, and that no deductions have been made either directly or indirectly from the full wages earned, other than permissible deductions as set forth in Regulations, 29 CFR part 3;

(3) That each laborer or mechanic has been paid not less than the applicable wage rates and fringe benefits or cash equivalents for the classification of work performed, as specified in the applicable wage determination incorporated into the contract.

(C) The weekly submission of a properly executed certification set forth on the reverse side of Optional Form WH-347 shall satisfy the requirement for submission of the "Statement of Compliance" required by paragraph (a)(3)(ii)(B) of this section.

(D) The falsification of any of the above certifications may subject the contractor or subcontractor to civil or criminal prosecution under section 1001 of title 18 and section 231 of title 31 of the United States Code.

(iii) The contractor or subcontractor shall make the records required under paragraph (a)(3)(i) of this section available for inspection, copying, or transcription by authorized representatives of the (write the name of the agency) or the Department of Labor, and shall permit such representatives to interview employees during working hours on the job. If the contractor or subcontractor fails to submit the required records or to make them available, the Federal agency may, after written notice to the contractor, sponsor, applicant, or owner, take such action as may be necessary to cause the suspension of any further payment, advance, or guarantee of funds. Furthermore, failure to submit the required records upon request or to make such records available may be grounds for debarment action pursuant to 29 CFR 5.12.

(4) *Apprentices and trainees* —(i) *Apprentices.* Apprentices will be permitted to work at less than the predetermined rate for the work they performed when they are employed pursuant to and individually registered in a bona fide apprenticeship program registered with the U.S. Department of Labor, Employment and Training Administration, Office of Apprenticeship Training, Employer and Labor Services, or with a State Apprenticeship Agency recognized by the Office, or if a person is employed in his or her first 90 days of probationary employment as an apprentice in such an apprenticeship program, who is not individually registered in the program, but who has been certified by the Office of Apprenticeship Training, Employer and Labor Services or a State Apprenticeship Agency (where appropriate) to be eligible for probationary employment as an apprentice. The allowable ratio of apprentices to journeymen on the job site in any craft classification shall not be greater than the ratio permitted to the contractor as to the entire work force under the registered program. Any worker listed on a payroll at an apprentice wage rate, who is not registered or otherwise employed as stated above, shall be paid not less than the applicable wage rate on the wage determination for the classification of work actually performed. In addition, any apprentice performing work on the job site in excess of the ratio permitted under the registered program shall be paid not less than the applicable wage rate on the wage determination for the work actually performed. Where a contractor is performing construction on a project in a locality other than that in which its program is registered, the ratios and wage rates (expressed in percentages of the journeyman's hourly rate) specified in the contractor's or subcontractor's registered program shall be observed. Every apprentice must be paid at not less than the rate specified in the registered program for the apprentice's level of progress, expressed as a percentage of the journeymen hourly rate specified in the

applicable wage determination. Apprentices shall be paid fringe benefits in accordance with the provisions of the apprenticeship program. If the apprenticeship program does not specify fringe benefits, apprentices must be paid the full amount of fringe benefits listed on the wage determination for the applicable classification. If the Administrator determines that a different practice prevails for the applicable apprentice classification, fringes shall be paid in accordance with that determination. In the event the Office of Apprenticeship Training, Employer and Labor Services, or a State Apprenticeship Agency recognized by the Office, withdraws approval of an apprenticeship program, the contractor will no longer be permitted to utilize apprentices at less than the applicable predetermined rate for the work performed until an acceptable program is approved.

(ii) *Trainees.* Except as provided in 29 CFR 5.16, trainees will not be permitted to work at less than the predetermined rate for the work performed unless they are employed pursuant to and individually registered in a program which has received prior approval, evidenced by formal certification by the U.S. Department of Labor, Employment and Training Administration. The ratio of trainees to journeymen on the job site shall not be greater than permitted under the plan approved by the Employment and Training Administration. Every trainee must be paid at not less than the rate specified in the approved program for the trainee's level of progress, expressed as a percentage of the journeyman hourly rate specified in the applicable wage determination. Trainees shall be paid fringe benefits in accordance with the provisions of the trainee program. If the trainee program does not mention fringe benefits, trainees shall be paid the full amount of fringe benefits listed on the wage determination unless the Administrator of the Wage and Hour Division determines that there is an apprenticeship program associated with the corresponding journeyman wage rate on the wage determination which provides for less than full fringe benefits for apprentices. Any employee listed on the payroll at a trainee rate who is not registered and participating in a training plan approved by the Employment and Training Administration shall be paid not less than the applicable wage rate on the wage determination for the classification of work actually performed. In addition, any trainee performing work on the job site in excess of the ratio permitted under the registered program shall be paid not less than the applicable wage rate on the wage determination for the work actually performed. In the event the Employment and Training Administration withdraws approval of a training program, the contractor will no longer be permitted to utilize trainees at less than the applicable predetermined rate for the work performed until an acceptable program is approved.

(iii) *Equal employment opportunity.* The utilization of apprentices, trainees and journeymen under this part shall be in conformity with the equal employment opportunity requirements of Executive Order 11246, as amended, and 29 CFR part 30.

(5) *Compliance with Copeland Act requirements.* The contractor shall comply with the requirements of 29 CFR part 3, which are incorporated by reference in this contract.

(6) *Subcontracts.* The contractor or subcontractor shall insert in any subcontracts the clauses contained in 29 CFR 5.5(a)(1) through (10) and such other clauses as the (write in the name of the Federal agency) may by appropriate instructions require, and also a clause requiring the subcontractors to include these clauses in any lower tier

subcontracts. The prime contractor shall be responsible for the compliance by any subcontractor or lower tier subcontractor with all the contract clauses in 29 CFR 5.5.

(7) *Contract termination: debarment.* A breach of the contract clauses in 29 CFR 5.5 may be grounds for termination of the contract, and for debarment as a contractor and a subcontractor as provided in 29 CFR 5.12.

(8) *Compliance with Davis-Bacon and Related Act requirements.* All rulings and interpretations of the Davis-Bacon and Related Acts contained in 29 CFR parts 1, 3, and 5 are herein incorporated by reference in this contract.

(9) *Disputes concerning labor standards.* Disputes arising out of the labor standards provisions of this contract shall not be subject to the general disputes clause of this contract. Such disputes shall be resolved in accordance with the procedures of the Department of Labor set forth in 29 CFR parts 5, 6, and 7. Disputes within the meaning of this clause include disputes between the contractor (or any of its subcontractors) and the contracting agency, the U.S. Department of Labor, or the employees or their representatives.

(10) *Certification of eligibility.* (i) By entering into this contract, the contractor certifies that neither it (nor he or she) nor any person or firm who has an interest in the contractor's firm is a person or firm ineligible to be awarded Government contracts by virtue of section 3(a) of the Davis-Bacon Act or 29 CFR 5.12(a)(1).

(ii) No part of this contract shall be subcontracted to any person or firm ineligible for award of a Government contract by virtue of section 3(a) of the Davis-Bacon Act or 29 CFR 5.12(a)(1).

(iii) The penalty for making false statements is prescribed in the U.S. Criminal Code, 18 U.S.C. 1001.

(b) *Contract Work Hours and Safety Standards Act.* The Agency Head shall cause or require the contracting officer to insert the following clauses set forth in paragraphs (b)(1), (2), (3), and (4) of this section in full in any contract in an amount in excess of $100,000 and subject to the overtime provisions of the Contract Work Hours and Safety Standards Act. These clauses shall be inserted in addition to the clauses required by § 5.5(a) or 4.6 of part 4 of this title. As used in this paragraph, the terms *laborers* and *mechanics* include watchmen and guards.

(1) *Overtime requirements.* No contractor or subcontractor contracting for any part of the conract work which may require or involve the employment of laborers or mechanics shall require or permit any such laborer or mechanic in any workweek in which he or she is employed on such work to work in excess of forty hours in such workweek unless such laborer or mechanic receives compensation at a rate not less than one and one-half times the basic rate of pay for all hours worked in excess of forty hours in such workweek.

(2) *Violation; liability for unpaid wages; liquidated damages.* In the event of any violation of the clause set forth in paragraph (b)(1) of this section the contractor and any subcontractor responsible therefor shall be liable for the unpaid wages. In addition, such contractor and subcontractor shall be liable to the United States (in the case of work done under contract for the District of Columbia or a territory, to such District or to such territory), for liquidated damages. Such liquidated damages shall be computed with respect to each individual laborer or mechanic, including watchmen and guards, employed in violation of the clause set forth in paragraph (b)(1) of this section, in the sum of $10 for each calendar day on which such individual was required or permitted to work in excess of the standard workweek of forty hours without payment of the overtime wages required by the clause set forth in paragraph (b)(1) of this section.

(3) *Withholding for unpaid wages and liquidated damages.* The (write in the name of the Federal agency or the loan or grant recipient) shall upon its own action or upon written request of an authorized representative of the Department of Labor withhold or cause to be withheld, from any moneys payable on account of work performed by the contractor or subcontractor under any such contract or any other Federal contract with the same prime contractor, or any other federally-assisted contract subject to the Contract Work Hours and Safety Standards Act, which is held by the same prime contractor, such sums as may be determined to be necessary to satisfy any liabilities of such contractor or subcontractor for unpaid wages and liquidated damages as provided in the clause set forth in paragraph (b)(2) of this section.

(4) *Subcontracts.* The contractor or subcontractor shall insert in any subcontracts the clauses set forth in paragraph (b)(1) through (4) of this section and also a clause requiring the subcontractors to include these clauses in any lower tier subcontracts. The prime contractor shall be responsible for compliance by any subcontractor or lower tier subcontractor with the clauses set forth in paragraphs (b)(1) through (4) of this section.

(c) In addition to the clauses contained in paragraph (b), in any contract subject only to the Contract Work Hours and Safety Standards Act and not to any of the other statutes cited in § 5.1, the Agency Head shall cause or require the contracting officer to insert a clause requiring that the contractor or subcontractor shall maintain payrolls and basic payroll records during the course of the work and shall preserve them for a period of three years from the completion of the contract for all laborers and mechanics, including guards and watchmen, working on the contract. Such records shall contain the name and address of each such employee, social security number, correct classifications, hourly rates of wages paid, daily and weekly number of hours worked, deductions made, and actual wages paid. Further, the Agency Head shall cause or require the contracting officer to insert in any such contract a clause providing that the records to be maintained under this paragraph shall be made available by the contractor or subcontractor for inspection, copying, or transcription by authorized representatives of the (write the name of agency) and the Department of Labor, and the contractor or subcontractor will permit such representatives to interview employees during working hours on the job.

(The information collection, recordkeeping, and reporting requirements contained in the following paragraphs of this section were approved by the Office of Management and Budget:

Paragraph	OMB Control Number
(a)(1)(ii)(B)	1215-0140
(a)(1)(ii)(C)	1215-0140
(a)(1)(iv)	1215-0140
(a)(3)(i)	1215-0140,
	1215-0017
(a)(3)(ii)(A)	1215-0149
(c)	1215-0140,
	1215-0017

[48 FR 19540, Apr. 29, 1983, as amended at 51 FR 12265, Apr. 9, 1986; 55 FR 50150, Dec. 4, 1990; 57 FR 28776, June 26, 1992; 58 FR 58955, Nov. 5, 1993; 61 FR 40716, Aug. 5, 1996; 65 FR 69693, Nov. 20, 2000; 73 FR 77511, Dec. 19, 2008]

EFFECTIVE DATE NOTE: At 58 FR 58955, Nov. 5, 1993, § 5.5 was amended by suspending paragraph (a)(1)(ii) indefinitely.

ATTACHMENT 6

Wage Rate Requirements Under FY 2012 Full-Year Continuing Appropriation

Preamble

With respect to the Clean Water and Safe Drinking Water State revolving Funds, EPA provides capitalization grants to each State which in turn provides subgrants or loans to eligible entities within the State.

Typically, the subrecipients are municipal or other local governmental entities that manage the funds.

For these types of recipients, the provisions set forth under Roman Numeral I, below, shall apply.

Although EPA and the State remain responsible for ensuring subrecipients' compliance with the wage rate requirements set forth herein, **those subrecipients shall have the primary responsibility to maintain payroll records** as described in **Section 3(ii)(A)**, below and for compliance as described in **Section I-5.**

Occasionally, the subrecipient may be a private for profit or not for profit entity.

For these types of recipients, the provisions set forth in Roman Numeral II, shall apply.

Although EPA and the State remain responsible for ensuring subrecipients' compliance with the wage rate requirements set forth herein, **those subrecipients shall have the primary responsibility to maintain payroll records as described in Section II-3(ii)(A), and for compliance as described in Section II-5.**

I. Requirements for Subrecipients that are Governmental Entities:

The following terms and conditions specify how recipients will assist EPA in meeting its Davis-Bacon (DB) responsibilities when DB applies to EPA awards of financial assistance under the FY 2012 Full-Year Continuing Appropriation with respect to State recipients and **subrecipients that are governmental entities. If a subrecipient has questions regarding when DB applies, obtaining the correct DB wage determinations, DB provisions, or compliance monitoring, it may contact the State recipient.** The recipient or subrecipient may also obtain additional guidance from DOL's web site at **http://www.dol.gov/esa/whd/recovery/**

1. Applicability of the Davis- Bacon (DB) prevailing wage requirements.

Under the FY 2012 Full-Year Continuing Appropriation, DB prevailing wage requirements apply to the construction, alteration, and repair of treatment works carried out in whole or in part with assistance made available by a State water pollution control revolving fund and to any construction project carried out in whole or in part by assistance made available by a drinking water treatment revolving loan fund. If a subrecipient encounters a unique situation at a site that presents uncertainties regarding DB applicability, the subrecipient must discuss the situation with the recipient State before authorizing work on that site.

2. Obtaining Wage Determinations.

(a) Subrecipients shall obtain the wage determination for the locality in which a covered activity subject to DB will take place prior to issuing requests for bids, proposals, quotes or other methods for soliciting contracts (solicitation) for activities subject to DB. These wage determinations shall be incorporated into solicitations and any subsequent contracts. Prime contracts must contain a provision requiring that subcontractors follow the wage determination incorporated into the prime contract.

(i) While the solicitation remains open, the subrecipient shall monitor www.wdol.gov weekly to ensure that the wage determination contained in the solicitation remains current. The subrecipients shall amend the solicitation if DOL issues a modification more than 10 days prior to the closing date (i.e. bid opening) for the solicitation. If DOL modifies or supersedes the applicable wage determination less than 10 days prior to the closing date, the subrecipients may request a finding from the State recipient that there is not a reasonable time to notify interested contractors of the modification of the wage determination. The State recipient will provide a report of its findings to the subrecipient.

(ii) If the subrecipient does not award the contract within 90 days of the closure of the solicitation, any modifications or supersedes DOL makes to the wage determination contained in the solicitation shall be effective unless the State recipient, at the request of the subrecipient, obtains an extension of the 90 day period from DOL pursuant to 29 CFR 1.6(c)(3)(iv). The subrecipient shall

monitor www.wdol.gov on a weekly basis if it does not award the contract within 90 days of closure of the solicitation to ensure that wage determinations contained in the solicitation remain current.

(b) If the subrecipient carries out activity subject to DB by issuing a task order, work assignment or similar instrument to an existing contractor (ordering instrument) rather than by publishing a solicitation, the subrecipient shall insert the appropriate DOL wage determination from www.wdol.gov into the ordering instrument.

(c) Subrecipients shall review all subcontracts subject to DB entered into by prime contractors to verify that the prime contractor has required its subcontractors to include the applicable wage determinations.

(d) As provided in 29 CFR 1.6(f), DOL may issue a revised wage determination applicable to a subrecipient's contract after the award of a contract or the issuance of an ordering instrument if DOL determines that the subrecipient has failed to incorporate a wage determination or has used a wage determination that clearly does not apply to the contract or ordering instrument. If this occurs, the subrecipient shall either terminate the contract or ordering instrument and issue a revised solicitation or ordering instrument or incorporate DOL's wage determination retroactive to the beginning of the contract or ordering instrument by change order. The subrecipient's contractor must be compensated for any increases in wages resulting from the use of DOL's revised wage determination.

3. **Contract and Subcontract provisions.**

(a) **The subrecipient(s) shall insert in full in any contract in excess of $2,000** which is entered into for the actual construction, alteration and/or repair, including painting and decorating, of a treatment work under the CWSRF or a construction project under the DWSRF financed in whole or in part from Federal funds or in accordance with guarantees of a Federal agency or financed from funds obtained by pledge of any contract of a Federal agency to make a loan, grant or annual contribution (except where a different meaning is expressly indicated), and which is subject to the labor standards provisions of any of the acts listed in § 5.1 or the FY 2012 Full-Year Continuing Appropriation, **the following clauses**:

(1) Minimum wages.

(i) All laborers and mechanics employed or working upon the site of the work will be paid unconditionally and not less often than once a week, and without subsequent deduction or rebate on any account (except such payroll deductions as are permitted by regulations issued by the Secretary of Labor under the Copeland Act (29 CFR part 3)), the full amount of wages and bona fide fringe benefits (or cash equivalents thereof) due at time of payment computed at rates not less than those contained in the wage determination of the Secretary of Labor which is attached hereto and made a part hereof, regardless of any contractual relationship which may be alleged to exist between the contractor and such laborers and mechanics.

Contributions made or costs reasonably anticipated for bona fide fringe benefits under section 1(b)(2) of the Davis-Bacon Act on behalf of laborers or mechanics are considered wages paid to such laborers or mechanics, subject to the provisions of paragraph (a)(1)(iv) of this section;

also, regular contributions made or costs incurred for more than a weekly period (but not less often than quarterly) under plans, funds, or programs which cover the particular weekly period, are deemed to be constructively made or incurred during such weekly period. Such laborers and mechanics shall be paid the appropriate wage rate and fringe benefits on the wage determination for the classification of work actually performed, without regard to skill, except as provided in § 5.5(a)(4). Laborers or mechanics performing work in more than one classification may be compensated at the rate specified for each classification for the time actually worked therein: Provided that the employer's payroll records accurately set forth the time spent in each classification in which work is performed. The wage determination (including any additional classification and wage rates conformed under paragraph (a)(1)(ii) of this section) and the Davis-Bacon poster (WH-1321) shall be posted at all times by the contractor and its subcontractors at the site of the work in a prominent and accessible place where it can be easily seen by the workers.

Subrecipients may obtain wage determinations from the U.S. Department of Labor's web site, www.dol.gov.

(ii)(A) The subrecipient(s), on behalf of EPA, shall require that any class of laborers or mechanics, including helpers, which is not listed in the wage determination and which is to be employed under the contract shall be classified in conformance with the wage determination. The State award official shall approve a request for an additional classification and wage rate and fringe benefits therefore only when the following criteria have been met:

(1) The work to be performed by the classification requested is not performed by a classification in the wage determination; and

(2) The classification is utilized in the area by the construction industry; and

(3) The proposed wage rate, including any bona fide fringe benefits, bears a reasonable relationship to the wage rates contained in the wage determination.

(B) If the contractor and the laborers and mechanics to be employed in the classification (if known), or their representatives, and the subrecipient(s) agree on the classification and wage rate (including the amount designated for fringe benefits where appropriate), documentation of the action taken and the request, including the local wage determination shall be sent by the subrecipient (s) to the State award official. The State award official will transmit the request, to the Administrator of the Wage and Hour Division, Employment Standards Administration, U.S. Department of Labor, Washington, DC 20210 and to the EPA DB Regional Coordinator concurrently. The Administrator, or an authorized representative, will approve, modify, or disapprove every additional classification request within 30 days of receipt and so advise the State award official or will notify the State award official within the 30-day period that additional time is necessary.

(C) In the event the contractor, the laborers or mechanics to be employed in the classification or their representatives, and the subrecipient(s) do not agree on the proposed classification and wage rate (including the amount designated for fringe benefits, where appropriate), the award official shall refer the request and the local wage determination, including the views of all interested parties and the recommendation of the State award official, to the Administrator

for determination. The request shall be sent to the EPA DB Regional Coordinator concurrently. The Administrator, or an authorized representative, will issue a determination within 30 days of receipt of the request and so advice the contracting officer or will notify the contracting officer within the 30-day period that additional time is necessary.

(D) The wage rate (including fringe benefits where appropriate) determined pursuant to paragraphs (a)(1)(ii)(B) or (C) of this section, shall be paid to all workers performing work in the classification under this contract from the first day on which work is performed in the classification.

(iii) Whenever the minimum wage rate prescribed in the contract for a class of laborers or mechanics includes a fringe benefit which is not expressed as an hourly rate, the contractor shall either pay the benefit as stated in the wage determination or shall pay another bona fide fringe benefit or an hourly cash equivalent thereof.

(iv) If the contractor does not make payments to a trustee or other third person, the contractor may consider as part of the wages of any laborer or mechanic the amount of any costs reasonably anticipated in providing bona fide fringe benefits under a plan or program, Provided, That the Secretary of Labor has found, upon the written request of the contractor, that the applicable standards of the Davis-Bacon Act have been met. The Secretary of Labor may require the contractor to set aside in a separate account assets for the meeting of obligations under the plan or program.

(2) **Withholding.** The subrecipient(s), shall upon written request of the EPA Award Official or an authorized representative of the Department of Labor, withhold or cause to be withheld from the contractor under this contract or any other Federal contract with the same prime contractor, or any other federally-assisted contract subject to Davis-Bacon prevailing wage requirements, which is held by the same prime contractor, so much of the accrued payments or advances as may be considered necessary to pay laborers and mechanics, including apprentices, trainees, and helpers, employed by the contractor or any subcontractor the full amount of wages required by the contract. In the event of failure to pay any laborer or mechanic, including any apprentice, trainee, or helper, employed or working on the site of the work, all or part of the wages required by the contract, the (Agency) may, after written notice to the contractor, sponsor, applicant, or owner, take such action as may be necessary to cause the suspension of any further payment, advance, or guarantee of funds until such violations have ceased.

(3) Payrolls and basic records.

(i) Payrolls and basic records relating thereto shall be maintained by the contractor during the course of the work and preserved for a period of three years thereafter for all laborers and mechanics working at the site of the work. Such records shall contain the name, address, and social security number of each such worker, his or her correct classification, hourly rates of wages paid (including rates of contributions or costs anticipated for bona fide fringe benefits or cash equivalents thereof of the types described in section 1(b)(2)(B) of the Davis-Bacon Act), daily and weekly number of hours worked, deductions made and actual wages paid. Whenever the Secretary of Labor has found under 29 CFR 5.5(a)(1)(iv) that the wages of any laborer or mechanic include the amount of any costs reasonably anticipated in providing

benefits under a plan or program described in section 1(b)(2)(B) of the Davis-Bacon Act, the contractor shall maintain records which show that the commitment to provide such benefits is enforceable, that the plan or program is financially responsible, and that the plan or program has been communicated in writing to the laborers or mechanics affected, and records which show the costs anticipated or the actual cost incurred in providing such benefits. Contractors employing apprentices or trainees under approved programs shall maintain written evidence of the registration of apprenticeship programs and certification of trainee programs, the registration of the apprentices and trainees, and the ratios and wage rates prescribed in the applicable programs.

(ii)(A) The contractor shall submit weekly, for each week in which any contract work is performed, a copy of all payrolls to the subrecipient, that is, the entity that receives the sub-grant or loan from the State capitalization grant recipient. Such documentation shall be available on request of the State recipient or EPA. As to each payroll copy received, the subrecipient shall provide written confirmation in a form satisfactory to the State indicating whether or not the project is in compliance with the requirements of 29 CFR 5.5(a)(1) based on the most recent payroll copies for the specified week. The payrolls shall set out accurately and completely all of the information required to be maintained under 29 CFR 5.5(a)(3)(i), except that full social security numbers and home addresses shall not be included on the weekly payrolls. Instead the payrolls shall only need to include an individually identifying number for each employee (e.g., the last four digits of the employee's social security number). The required weekly payroll information may be submitted in any form desired. Optional Form WH-347 is available for this purpose from the Wage and Hour Division Web site at http://www.dol.gov/esa/whd/forms/wh347instr.htm or its successor site. The prime contractor is responsible for the submission of copies of payrolls by all subcontractors. Contractors and subcontractors shall maintain the full social security number and current address of each covered worker, and shall provide them upon request to the subrecipient(s) for transmission to the State or EPA if requested by EPA, the State, the contractor, or the Wage and Hour Division of the Department of Labor for purposes of an investigation or audit of compliance with prevailing wage requirements. It is not a violation of this section for a prime contractor to require a subcontractor to provide addresses and social security numbers to the prime contractor for its own records, without weekly submission to the subrecipient(s).

(B) Each payroll submitted shall be accompanied by a "Statement of Compliance," signed by the contractor or subcontractor or his or her agent who pays or supervises the payment of the persons employed under the contract and shall certify the following:

(1) That the payroll for the payroll period contains the information required to be provided under § 5.5 (a)(3)(ii) of Regulations, 29 CFR part 5, the appropriate information is being maintained under § 5.5 (a)(3)(i) of Regulations, 29 CFR part 5, and that such information is correct and complete;

(2) That each laborer or mechanic (including each helper, apprentice, and trainee) employed on the contract during the payroll period has been paid the full weekly wages earned, without rebate, either directly or indirectly, and that no deductions have been made either directly or indirectly from the full wages earned, other than permissible deductions as set forth in Regulations, 29 CFR part 3;

(3) That each laborer or mechanic has been paid not less than the applicable wage rates and fringe benefits or cash equivalents for the classification of work performed, as specified in the applicable wage determination incorporated into the contract.

(C) The weekly submission of a properly executed certification set forth on the reverse side of Optional Form WH-347 shall satisfy the requirement for submission of the "Statement of Compliance" required by paragraph (a)(3)(ii)(B) of this section.

(D) The falsification of any of the above certifications may subject the contractor or subcontractor to civil or criminal prosecution under section 1001 of title 18 and section 231 of title 31 of the United States Code.

(iii) The contractor or subcontractor shall make the records required under paragraph (a)(3)(i) of this section available for inspection, copying, or transcription by authorized representatives of the State, EPA or the Department of Labor, and shall permit such representatives to interview employees during working hours on the job. If the contractor or subcontractor fails to submit the required records or to make them available, the Federal agency or State may, after written notice to the contractor, sponsor, applicant, or owner, take such action as may be necessary to cause the suspension of any further payment, advance, or guarantee of funds. Furthermore, failure to submit the required records upon request or to make such records available may be grounds for debarment action pursuant to 29 CFR 5.12.

(4) Apprentices and trainees--

(i) Apprentices. Apprentices will be permitted to work at less than the predetermined rate for the work they performed when they are employed pursuant to and individually registered in a bona fide apprenticeship program registered with the U.S. Department of Labor, Employment and Training Administration, Office of Apprenticeship Training, Employer and Labor Services, or with a State Apprenticeship Agency recognized by the Office, or if a person is employed in his or her first 90 days of probationary employment as an apprentice in such an apprenticeship program, who is not individually registered in the program, but who has been certified by the Office of Apprenticeship Training, Employer and Labor Services or a State Apprenticeship Agency (where appropriate) to be eligible for probationary employment as an apprentice. The allowable ratio of apprentices to journeymen on the job site in any craft classification shall not be greater than the ratio permitted to the contractor as to the entire work force under the registered program. Any worker listed on a payroll at an apprentice wage rate, who is not registered or otherwise employed as stated above, shall be paid not less than the applicable wage rate on the wage determination for the classification of work actually performed. In addition, any apprentice performing work on the job site in excess of the ratio permitted under the registered program shall be paid not less than the applicable wage rate on the wage determination for the work actually performed. Where a contractor is performing construction on a project in a locality other than that in which its program is registered, the ratios and wage rates (expressed in percentages of the journeyman's hourly rate) specified in the contractor's or subcontractor's registered program shall be observed. Every apprentice must be paid at not less than the rate specified in the registered program for the apprentice's level of progress, expressed as a percentage of the journeymen hourly rate specified in the applicable wage determination. Apprentices shall be paid fringe benefits in accordance with the provisions of the apprenticeship program. If the apprenticeship program does not specify

fringe benefits, apprentices must be paid the full amount of fringe benefits listed on the wage determination for the applicable classification. If the Administrator determines that a different practice prevails for the applicable apprentice classification, fringes shall be paid in accordance with that determination. In the event the Office of Apprenticeship Training, Employer and Labor Services, or a State Apprenticeship Agency recognized by the Office, withdraws approval of an apprenticeship program, the contractor will no longer be permitted to utilize apprentices at less than the applicable predetermined rate for the work performed until an acceptable program is approved.

(ii) Trainees. Except as provided in 29 CFR 5.16, trainees will not be permitted to work at less than the predetermined rate for the work performed unless they are employed pursuant to and individually registered in a program which has received prior approval, evidenced by formal certification by the U.S. Department of Labor, Employment and Training Administration. The ratio of trainees to journeymen on the job site shall not be greater than permitted under the plan approved by the Employment and Training Administration. Every trainee must be paid at not less than the rate specified in the approved program for the trainee's level of progress, expressed as a percentage of the journeyman hourly rate specified in the applicable wage determination. Trainees shall be paid fringe benefits in accordance with the provisions of the trainee program. If the trainee program does not mention fringe benefits, trainees shall be paid the full amount of fringe benefits listed on the wage determination unless the Administrator of the Wage and Hour Division determines that there is an apprenticeship program associated with the corresponding journeyman wage rate on the wage determination which provides for less than full fringe benefits for apprentices. Any employee listed on the payroll at a trainee rate who is not registered and participating in a training plan approved by the Employment and Training Administration shall be paid not less than the applicable wage rate on the wage determination for the classification of work actually performed. In addition, any trainee performing work on the job site in excess of the ratio permitted under the registered program shall be paid not less than the applicable wage rate on the wage determination for the work actually performed. In the event the Employment and Training Administration withdraws approval of a training program, the contractor will no longer be permitted to utilize trainees at less than the applicable predetermined rate for the work performed until an acceptable program is approved.

(iii) Equal employment opportunity. The utilization of apprentices, trainees and journeymen under this part shall be in conformity with the equal employment opportunity requirements of Executive Order 11246, as amended, and 29 CFR part 30.

(5) Compliance with Copeland Act requirements. The contractor shall comply with the requirements of 29 CFR part 3, which are incorporated by reference in this contract.

(6) Subcontracts. The contractor or subcontractor shall insert in any subcontracts the clauses contained in 29 CFR 5.5(a)(1) through (10) and such other clauses as the EPA determines may by appropriate, and also a clause requiring the subcontractors to include these clauses in any lower tier subcontracts. The prime contractor shall be responsible for the compliance by any subcontractor or lower tier subcontractor with all the contract clauses in 29 CFR 5.5.

(7) Contract termination; debarment. A breach of the contract clauses in 29 CFR 5.5 may be grounds for termination of the contract, and for debarment as a contractor and a subcontractor as provided in 29 CFR 5.12.

(8) Compliance with Davis-Bacon and Related Act requirements. All rulings and interpretations of the Davis-Bacon and Related Acts contained in 29 CFR parts 1, 3, and 5 are herein incorporated by reference in this contract.

(9) Disputes concerning labor standards. Disputes arising out of the labor standards provisions of this contract shall not be subject to the general disputes clause of this contract. Such disputes shall be resolved in accordance with the procedures of the Department of Labor set forth in 29 CFR parts 5, 6, and 7. Disputes within the meaning of this clause include disputes between the contractor (or any of its subcontractors) and Subrecipient(s), State, EPA, the U.S. Department of Labor, or the employees or their representatives.

(10) Certification of eligibility.

(i) By entering into this contract, the contractor certifies that neither it (nor he or she) nor any person or firm who has an interest in the contractor's firm is a person or firm ineligible to be awarded Government contracts by virtue of section 3(a) of the Davis-Bacon Act or 29 CFR 5.12(a)(1).

(ii) No part of this contract shall be subcontracted to any person or firm ineligible for award of a Government contract by virtue of section 3(a) of the Davis-Bacon Act or 29 CFR 5.12(a)(1).

(iii) The penalty for making false statements is prescribed in the U.S. Criminal Code, 18 U.S.C. 1001.

4. <u>Contract Provision for Contracts in Excess of $100,000</u>.

(a) Contract Work Hours and Safety Standards Act. The subrecipient shall insert the following clauses set forth in paragraphs (a)(1), (2), (3), and (4) of this section in full in any contract in an amount in excess of $100,000 and subject to the overtime provisions of the Contract Work Hours and Safety Standards Act. These clauses shall be inserted in addition to the clauses required by Item 3, above or 29 CFR 4.6. As used in this paragraph, the terms laborers and mechanics include watchmen and guards.

(1) Overtime requirements. No contractor or subcontractor contracting for any part of the contract work which may require or involve the employment of laborers or mechanics shall require or permit any such laborer or mechanic in any workweek in which he or she is employed on such work to work in excess of forty hours in such workweek unless such laborer or mechanic receives compensation at a rate not less than one and one-half times the basic rate of pay for all hours worked in excess of forty hours in such workweek.

(2) Violation; liability for unpaid wages; liquidated damages. In the event of any violation of the clause set forth in paragraph (a)(1) of this section the contractor and any subcontractor responsible therefore shall be liable for the unpaid wages. In addition, such contractor and subcontractor shall be liable to the United States (in the case of work done under contract for

the District of Columbia or a territory, to such District or to such territory), for liquidated damages. Such liquidated damages shall be computed with respect to each individual laborer or mechanic, including watchmen and guards, employed in violation of the clause set forth in paragraph (a)(1) of this section, in the sum of $10 for each calendar day on which such individual was required or permitted to work in excess of the standard workweek of forty hours without payment of the overtime wages required by the clause set forth in paragraph (a)(1) of this section.

(3) **Withholding for unpaid wages and liquidated damages.** The subrecipient, upon written request of the EPA Award Official or an authorized representative of the Department of Labor, shall withhold or cause to be withheld, from any moneys payable on account of work performed by the contractor or subcontractor under any such contract or any other Federal contract with the same prime contractor, or any other federally-assisted contract subject to the Contract Work Hours and Safety Standards Act, which is held by the same prime contractor, such sums as may be determined to be necessary to satisfy any liabilities of such contractor or subcontractor for unpaid wages and liquidated damages as provided in the clause set forth in paragraph (a)(2) of this section.

(4) **Subcontracts.** The contractor or subcontractor shall insert in any subcontracts the clauses set forth in paragraph (a)(1) through (4) of this section and also a clause requiring the subcontractors to include these clauses in any lower tier subcontracts. The prime contractor shall be responsible for compliance by any subcontractor or lower tier subcontractor with the clauses set forth in paragraphs (a)(1) through (4) of this section.

(b) In addition to the clauses contained in Item 3, above, in any contract subject only to the Contract Work Hours and Safety Standards Act and not to any of the other statutes cited in 29 CFR 5.1, the Subrecipient shall insert a clause requiring that the contractor or subcontractor shall maintain payrolls and basic payroll records during the course of the work and shall preserve them for a period of three years from the completion of the contract for all laborers and mechanics, including guards and watchmen, working on the contract. Such records shall contain the name and address of each such employee, social security number, correct classifications, hourly rates of wages paid, daily and weekly number of hours worked, deductions made, and actual wages paid. Further, the Subrecipient shall insert in any such contract a clause providing hat the records to be maintained under this paragraph shall be made available by the contractor or subcontractor for inspection, copying, or transcription by authorized representatives of the (write the name of agency) and the Department of Labor, and the contractor or subcontractor will permit such representatives to interview employees during working hours on the job.

5. **Compliance Verification.**

(a) The subrecipient shall periodically interview a sufficient number of employees entitled to DB prevailing wages (covered employees) to verify that contractors or subcontractors are paying the appropriate wage rates. As provided in 29 CFR 5.6(a)(6), all interviews must be conducted in confidence. The subrecipient must use Standard Form 1445 (SF 1445) or equivalent documentation to memorialize the interviews. Copies of the SF 1445 are available from EPA on request.

(b) The subrecipient shall establish and follow an interview schedule based on its assessment of the risks of noncompliance with DB posed by contractors or subcontractors and the duration of the contract or subcontract. At a minimum, the subrecipient should conduct interviews with a representative group of covered employees within two weeks of each contractor or subcontractor's submission of its initial weekly payroll data and two weeks prior to the estimated completion date for the contract or subcontract. Subrecipients must conduct more frequent interviews if the initial interviews or other information indicates that there is a risk that the contractor or subcontractor is not complying with DB. Subrecipients shall immediately conduct necessary interviews in response to an alleged violation of the prevailing wage requirements. All interviews shall be conducted in confidence.

(c) The subrecipient shall periodically conduct spot checks of a representative sample of weekly payroll data to verify that contractors or subcontractors are paying the appropriate wage rates. The subrecipient shall establish and follow a spot check schedule based on its assessment of the risks of noncompliance with DB posed by contractors or subcontractors and the duration of the contract or subcontract. At a minimum, if practicable, the subrecipient should spot check payroll data within two weeks of each contractor or subcontractor's submission of its initial payroll data and two weeks prior to the completion date the contract or subcontract. Subrecipients must conduct more frequent spot checks if the initial spot check or other information indicates that there is a risk that the contractor or subcontractor is not complying with DB. In addition, during the examinations the subrecipient shall verify evidence of fringe benefit plans and payments thereunder by contractors and subcontractors who claim credit for fringe benefit contributions.

(d) The subrecipient shall periodically review contractors and subcontractors use of apprentices and trainees to verify registration and certification with respect to apprenticeship and training programs approved by either the U.S Department of Labor or a state, as appropriate, and that contractors and subcontractors are not using disproportionate numbers of, laborers, trainees and apprentices. These reviews shall be conducted in accordance with the schedules for spot checks and interviews described in Item 5(b) and (c) above.

(e) Subrecipients must immediately report potential violations of the DB prevailing wage requirements to the EPA DB contact listed above and to the appropriate DOL Wage and Hour District Office listed at http://www.dol.gov/esa/contacts/whd/america2.htm.

EXHIBIT NO. 4

CONTRACT MODIFICATION PROPOSAL AND ACCEPTANCE FORM

Use of the Change Order Form entitled "Contract Modification Proposal and Acceptance"

- When the Loanee wishes to issue a change to the contract, the attached "Contract Modification Proposal and Acceptance" form should be used as a request for proposal. Upon final settlement of the change, this same form is then completed and serves as the contract modification.
- The Loanee in requesting a proposal for a change would execute items 1 through 8 (exclusive of the revised contract price and duration data) and 9 through 12. Pages 1 and 2 of this form are then forwarded to the contractor, specifying scope of work and requesting the contractor's proposal.
- The contractor should execute page 2 of the form. He then submits pages 1 and 2 of the form as his proposal, attaching additional sheets as necessary to provide his detailed breakdown of costs.
- Upon negotiation of a final settlement, the Loanee completes page 1 of the form, and all concerned parties (Contractor, Engineer, Owner) sign this document as the contract modification.
- Page 3 of the form is executed by the Loanee for documentation of the change, and to provide the necessary details for review by the Regulatory Agencies.
- Submit a minimum of one original with raised engineer's seal and one copy. It is suggested that one original be kept for your records.

Detailed Instructions for Executing "Contract Modification Proposal and Acceptance" Form

Item 1. Enter the name of the Loanee.

Item 2. Enter State Project number.

Item 3. Enter the contract number or designation.

Item 4. Enter the number identifying this modification.

Item 5. Enter the name of the Contractor.

Item 6. Enter the project title and location.

Item 7. Requests a proposal for the specified change order work, but does not direct contractor to proceed. The owner or his authorized representative must execute this statement by signature with date and title blocks entered.

Item 8. Provide a clear description of the scope of work for this change. Upon final settlement of the modification costs, enter cost data by line item for unit priced items or by sum; and state total cost of this modification – net increase, decrease or no change in contract price. Enter appropriate information for any change in contract time, including number or calendar days involved. The modification is executed when all appropriate signatures are included.

Items 9 – 12. Same as items 1 – 4.

Item 13. Executed by the contractor, stating net effect of change in appropriate box for money and time. A detailed breakdown must be provided in this item; and appropriate signature of authorized representative of contractor included.

Item 14. Enter the Loanee's name and State Project number.

Item 15. Enter the contract number or designation.

Item 16. Enter number identifying this modification.

Item 17. Enter appropriate financial data.

Item 18. Explain and justify the reasons for this change order.

Item 19. Explain all other impacts resulting from this change with estimate of costs involved. This should include impact on other contractors and the Consulting Engineers.

Item 20. Document that negotiations were held as required by the regulations and explain the events leading to the final settlement in price and time. This statement should include, at a minimum, date and location of negotiations, persons attending, summary of negotiations leading to final price and time settlements, and a statement that the agreed-to price is "fair and reasonable".

CONTRACT MODIFICATION PROPOSAL AND ACCEPTANCE

1. ISSUING OFFICE	2. PROJECT NO.	3. CONTRACT NO.	4. MODIFICATION NO.
5. TO (CONTRACTOR)		6. PROJECT LOCATION AND DESCRIPTION	

7. A proposal is required for making the hereinafter described change in accordance with specification and drawing revisions cited herein or listed in attachment hereto. Submit your proposal in space indicated on Page 2, attach detailed breakdown of prime and sub-contract costs (See the clause of this contract entitled, "Changes". DO NOT start work under this proposed change until you receive a copy signed by the Contracting Officer or a directive to proceed).

Date	Type Name and Title	Signature

8. DESCRIPTION OF CHANGE: *Pursuant to the clause of this contract covering changes, the contractor shall furnish all labor and material, and all work necessary to accomplish the following described work:*

As a result of the above, the contract price is revised as follows:

ITEM NO.	ITEM DESCRIPTION	UNIT PRICE	ESTIMATED QUANTITY	TOTAL COST

TOTAL COST OF THIS MODIFICATION $ _____

The contract time is hereby: *increase* ☐ *decrease* ☐ or *remains the same* ☐ by _____ calendar days as a result of this modification.

The foregoing modification is hereby accepted:

CONTRACTOR	OWNER	(NJPE SEAL) ENGINEER
BY: _____	BY: _____	BY: _____
DATE: _____	DATE: _____	DATE: _____

APPROVAL:

STATE OF NEW JERSEY	DATE

CONTRACT MODIFICATION PROPOSAL AND ACCEPTANCE

9. ISSUING OFFICE	10. PROJECT NO.	11. CONTRACT NO.	12. MODIFICATION NO.

13. CONTRACTOR'S PROPOSAL - CHANGE IN CONTRACT PRICE
(Detailed breakdown, attach additional sheets as necessary)

(Proposed)

NET INCREASE	NET DECREASE	CALENDAR DAYS INCREASE
$ _____	$ _____	_____ DAYS

DATE:	TYPE NAME AND TITLE:	SIGNATURE:

CONTRACT MODIFICATION PROPOSAL AND ACCEPTANCE

14. ISSUING OFFICE & PROJECT NO.	15. CONTRACT NO.	16. MODIFICATION NO.

17. ORIGINAL CONTRACT BID PRICE..... $ _____
TOTAL OF PREVIOUS CHANGE ORDERS..... $ _____
TOTAL CONTRACT COST INCLUDING CHANGE ORDERS..... $ _____

18. NECESSITY FOR CHANGE AND REASON FOR OMISSION FROM PLANS AND SPECIFICATIONS:

19. OTHER IMPACTS RESULTANT OF THIS CHANGE:

20. RESUME OF NEGOTIATIONS OR RECOMMENDATIONS (Loanee's Representative):

DATE:	TYPE NAME AND TITLE OF LOANEE'S REPRESENTATIVE:	SIGNATURE:

EXHIBIT NO. 5

NJAC 7:22-9 AND
NJAC 7:22-10.11,12

NJAC 7:22-9

The rule below includes the amendments adopted to this subchapter on January 3, 2006.

Subchapter 9. Awarding Contracts for State Assisted Projects to Small Business Concerns Owned and Controlled by Socially and Economically Disadvantaged Individuals

7:22-9.1 Scope and purpose

(a) This subchapter establishes procedures for providing opportunities for socially and economically disadvantaged ("SED") contractors and vendors to supply materials and services under State financed construction contracts for environmental infrastructure facilities. To implement the policies established in N.J.S.A. 58:11B-26, 40:11A-41 et seq., and 52:32-17 et seq., this subchapter applies to environmental infrastructure projects receiving financial assistance from the Department and the Trust pursuant to N.J.A.C. 7:22-3, 4 and 6 and 7:22A-6 and 7. Under the provisions of N.J.A.C. 7:22-3, 4 and 6 and 7:22A-6 and 7, the Department and the Trust require recipients of Trust and Fund loans and other assistance to establish such programs for socially and economically disadvantaged small business concerns, to designate a project compliance officer, and to submit to the Department and Trust procurement plans for implementing the SED program. In addition, N.J.A.C. 7:22-3.17(a)24, 4.17(a)24, 6.17(a)24 and 7:22A-2.4(a) provide that a goal of not less than 10 percent be established for the award of contracts to small business concerns owned and controlled by one or more socially and economically disadvantaged individuals. The goal of 10 percent applies to the total amount of all contracts for building, materials and equipment, or services (including planning, design and building related activities) for a construction project. Where a local government unit has a SED participation goal which exceeds 10 percent of the total amount of all contracts, the local government unit must comply with both the Department's rules and the local minority and women-owned business ordinances.

(b) This subchapter also establishes the standards and procedures that will apply to the contracting agencies of grant or loan recipients in the awarding and making of contracts under their SED programs.

7:22-9.2 Definitions

The following words and terms, as used in this subchapter, will have the following meanings unless the content clearly indicates otherwise.

"Building" means the acquisition, erection, alteration, remodeling, improvement or extension of an environmental infrastructure facility.

"Construction" includes, but is not limited to:

1. The preliminary planning to determine the economic and engineering feasibility of environmental infrastructure facilities, the engineering, architectural, legal, fiscal, and economic investigations and studies, surveys, design, plans, working drawings, specifications, procedures, and other action necessary for the construction of environmental infrastructure facilities;

2. The building of, or purchase of land for, environmental infrastructure facilities; and

3. The inspection and supervision of the building of environmental infrastructure facilities.

"Contract" means any written agreement with a professional service or construction contractor related to the construction of an environmental infrastructure project.

"Contracting agency" means:

1. The governing body of a local government unit or any department, branch, board, commission, committee, authority, agency or officer of such local government unit possessing the authority to award and make contracts; or

2. The owner(s) or authorized representative(s) of a private entity.

"Contractor" means any party entering into a contract to provide or offering to provide building, materials and equipment, or services to a project sponsor for the construction of environmental infrastructure facilities. This includes, but is not limited to, planning and design, as well as building related services such as engineering, inspection and accounting.

"Contractor's plan" means the SED utilization plan submitted by the contractor to the project sponsor and to the Department establishing subcontracting opportunities that will fulfill the requirements of this subchapter.

"Department" means the New Jersey Department of Environmental Protection and its successors and assigns.

"Environmental infrastructure facilities" means wastewater treatment facilities, stormwater management facilities or water supply facilities.

"Financial agreement" means the legal instrument, including a grant agreement or loan agreement, executed between either the State of New Jersey or the Trust and the project sponsor for the construction of environmental infrastructure facilities.

"Local government unit" means a county, municipality, municipal or county sewerage or utility authority, municipal sewerage district, joint meeting, improvement authority or other political subdivision of the State authorized to construct, operate and maintain wastewater treatment or stormwater management facilities, or a State authority, district water supply commission, county, municipality, municipal or county utilities authority, municipal water district, joint meeting or any other political subdivision of the State authorized pursuant to law to operate or maintain a public water supply system or to construct, rehabilitate, operate or maintain water supply facilities or otherwise provide water for human consumption.

"New Jersey environmental infrastructure financing program" means the program for providing financing to project sponsors pursuant to N.J.A.C. 7:22-3, 4 and 6, and 7:22A-6 and 7.

"Office" means the Office of Equal Opportunity and Public Contract Assistance or other program of the Department of Environmental Protection with the responsibility for administration of this subchapter.

"Private entity" means the owner(s) of a nongovernmental community water system or a nonprofit noncommunity water system.

"Project" means the defined services for the construction of specified operable environmental infrastructure facilities as approved by the Department or the Trust in the project sponsor's financial agreement.

"Project compliance officer" means an officer or employee of the project sponsor who is designated by the project sponsor to monitor and enforce compliance with the affirmative action and SED requirements of the applicable program rules and this subchapter.

"Project plan" means the proposal submitted at the time of application by the project sponsor to the Department establishing the SED utilization plan and its requirements.

"Project sponsor" means any local government unit or private entity that seeks a loan or grant pursuant to N.J.A.C. 7:22-3, 4 and 6 and 7:22A-6 and 7.

"SED utilization plan" means a written document outlining the entire project work, the estimated length of time it will take to complete the project, each significant segment of the project on which SEDs will or may participate, and a description of how SEDs will be contacted.

"Socially and economically disadvantaged small business concern" or "SED" means any small business concern:

1. Which is at least 51 percent owned by one or more socially and economically disadvantaged individuals; or, in the case of a publicly owned business, at least 51 percent of the stock of which is owned by one or more socially and economically disadvantaged individuals; or, in the case of a joint venture, at least 51 percent of the beneficial ownership interests are legitimately held by a SED; and

2. Whose management and daily business operations are controlled by one or more socially and economically disadvantaged individuals; and

3. Which is a full participation subcontractor in that the SED is responsible for the execution of a distinct element of work and carries out the work responsibility by actually performing, managing and supervising the task involved. Any deviation from this definition will automatically classify the SED as a broker, middleman or passive conduit. These three functions are contrary to the spirit of the Trust Act and will not qualify a SED enterprise for State of New Jersey certification; and

4. Which has been certified pursuant to the New Jersey Uniform Certification Act (N.J.S.A. 52:27H-1 et seq.) or pursuant to the provisions of 49 CFR Part 23 by the New Jersey Commerce and Economic Growth Commission, the New Jersey Department of Transportation, the Port Authority of New York and New Jersey, the New Jersey Transit or other agencies deemed appropriate by the Office, as an eligible minority business or female business.

i. "Socially disadvantaged individuals" means those individuals who have been subjected to racial or ethnic prejudice or cultural bias because of their identity as a member of a group without regard to their individual qualities.

ii. "Economically disadvantaged individuals" means those socially disadvantaged individuals whose ability to compete in the free enterprise system has been impaired due to diminished capital and credit opportunities as compared to others in the same business area who are not socially disadvantaged.

iii. "Socially and economically disadvantaged individuals" shall include women, Black Americans, Hispanic Americans, Native Americans, Asian Americans, and members of other groups, or other individuals, found to be socially and economically disadvantaged by the Small Business Administration under Section 8(a) of the Small Business Act, as amended (15 USC 637(a)). Black Americans, Hispanic Americans, Native Americans and Asian Americans shall be defined as follows:

(1) "Black American" means a person having origins in any of the black racial groups in Africa;

(2) "Hispanic American" means a person of Spanish or Portuguese culture, with origins in Mexico, South or Central America, or the Caribbean Islands, regardless of race;

(3) "Asian American" means a person having origins in any of the original peoples of the Far East, Southeast Asia, Indian Subcontinent, Hawaii, or the Pacific Islands;

(4) "Native American" means a person having origins in any of the original peoples of North America.

"Small business concern" means a business which is independently owned and operated and which is not dominant in its field of operation. A business is independently owned and operated if the management which controls the business is responsible for both its daily and long term operations.

"Subcontract" means an agreement to perform a portion of a contract.

"Subcontractor" means a third party that is engaged by the contractor to perform part of the work under a subcontract.

"10 percent SED utilization," "10 percent goal" and "10 percent" means SED business concern participation, which includes 7 percent for minority-owned SED business concerns and 3 percent for women-owned SED business concerns.

"Trust" means the New Jersey Environmental Infrastructure Trust established pursuant to the Trust Act.

"Trust Act" means the New Jersey Environmental Infrastructure Trust Act (N.J.S.A. 58:11B-1 et seq.), as amended and/or supplemented.

7:22-9.3 SED utilization requirements for projects

(a) A goal of not less than 10 percent (or a higher percentage as may be required by Federal law) of the total amount of all contracts for building, materials and equipment, or services for a project funded by a New Jersey environmental infrastructure facilities financing program must be awarded to SEDs.

(b) The 10 percent SED utilization requirement shall be accomplished by the following:

1. Bids shall be solicited on an unrestricted basis. The bid documents, however, shall include a statement to the effect that the successful bidder must fulfill the SED utilization requirements by subcontracting portions or the work to SEDs; or

2. Contractors also have the option of establishing unrestricted bidding procedures to fulfill the 10 percent SED utilization requirement for the project.

7:22-9.4 Requirement to develop SED Utilization Plan

(a) Each project sponsor shall develop, in consultation with the Office, a plan for achieving its SED utilization requirements (the "project plan"). Development of a plan shall be completed before the Department and, when relevant, the Trust may approve an application pursuant to the applicable program rules

(b) The project plan shall identify those contracts proposed to be bid on an unrestricted basis. For each unrestricted contract, the project plan shall also identify the SED utilization requirements that the successful bidder shall meet.

(c) All contractors, including SED contractors, shall submit their own SED utilization plan ("contractor's plan"), for the aspects of the project covered by the contract, to the project sponsor and to the Office within 30 days of the awarding of a contract. The Contractor's Plan shall contain provisions to meet the specific SED utilization requirements imposed upon the contractor by the project sponsor as well as to meet the general SED utilization requirements for the project pursuant to this subchapter.

(d) If the contractor does not comply with the requirements of the contractor's plan and the project sponsor does not take steps to otherwise comply with N.J.A.C. 7:22-9.3(a), the Department and, in the case of a Trust loan, the Trust, may take any of the actions or combinations thereof specified in N.J.A.C. 7:22-3.40 through 3.44, 7:22-4.40 through 4.44, 7:22-6.40 through 6.44 and 7:22A-1.8 through 1.13.

7:22-9.5 (Reserved)

7:22-9.6 Notice of SED utilization opportunities

(a) All project sponsors, at least 30 days prior to public advertisement for bids, shall notify the agencies specified in N.J.A.C. 7:22-9.13(a)8, of the availability of opportunities for SEDs to provide

services, to bid on unrestricted contracts or subcontracts, or to provide any other necessary purchase or procurement. The notice shall include a description of the type and scope of the services involved.

(b) All notices shall include a statement to the effect that the project or contract is funded in part by New Jersey wastewater treatment financing programs and the successful bidder must comply with all the provisions of N.J.A.C. 7:22-9.1 et seq. for the participation of small business enterprises owned and controlled by socially and economically disadvantaged individuals.

7:22-9.7 Advertisements for SED utilization

(a) All advertisements for bids shall include a statement to the effect that the project or contract is funded in part by Jew Jersey environmental infrastructure financing programs and the successful bidder must comply with the provisions of N.J.A.C. 7:22-9 for the participation of small business enterprises owned and controlled by socially and economically disadvantaged individuals.

(b) The advertisement for bids shall indicate that:

1. Awards will be made only to socially and economically disadvantaged business concerns that are certified by the New Jersey Commerce, Economic Growth and Tourism Commission, the New Jersey Department of Transportation, the Port Authority of New York and New Jersey, New Jersey Transit or other agencies deemed appropriate by the Office as eligible minority businesses or female businesses; or

2. The invitation to bid is on an unrestricted basis whereby the successful bidder must fulfill the SED utilization requirements. The agencies specified in N.J.A.C. 7:22-9.13(a)8 will have a list of eligible SED firms and shall, upon request, provide them to the project sponsor. The project sponsor shall, during the advertisement phase, provide copies of the list to all contractors on unrestricted contracts.

(c) The advertisement for bids shall be in such newspaper or newspapers and other periodicals identified by the agencies specified in N.J.A.C. 7:22-9.13 as will best give notice thereof to appropriate bidders and shall be sufficiently in advance of the purchase or contract to promote competitive bidding. In no case shall the advertisement for bids be published less than 30 days prior to the date fixed for receiving bids on the purchase or contract.

(d) In the case of a set aside contract, the newspaper or newspapers in which the advertisement for bids appears shall be selected by the contracting agency in consultation with the Office.

(e) If there are no responses to the bid solicitation from SEDs or if the successful bidder's proposal does not meet the SED utilization requirements, the successful bidder shall advertise and continue the search for SED participants for a minimum of 30 days after the contract is awarded. The contract shall include a provision to this effect.

7:22-9.8 (Reserved)

7:22-9.9 (Reserved)

7:22-9.10 Lowest bid resulting in payment of unreasonable price

(a) If the contracting agency determines that the acceptance of the lowest responsible bid will result either in the payment of an unreasonable price or in a contract otherwise unacceptable pursuant to the statutes and rules governing public contracts, the contracting agency shall reject all bids.

(b) Bidders and the office shall be notified of the rejection of all bids, the reasons for the rejection, and the contracting agency's intent to solicit bids for a second time.

(c) If the contracting agency determines a second time that the acceptance of the lowest responsible bid will result either in the payment of an unreasonable price or in a contract otherwise unacceptable pursuant to the statutes and rules governing public contracts, the contracting agency shall reject all bids and notify the Office and, after receipt of the Office's approval, shall amend the project plan accordingly.

(d) Bidders shall be notified of the cancellation, the reasons for the cancellation and the contracting agency's intent to resolicit bids on an unrestricted basis. SEDs may participate in the bidding on an unrestricted basis.

7:22-9.11 Project compliance officer

(a) Each project sponsor shall designate an officer or employee to serve as its project compliance officer.

(b) The project compliance officer shall be responsible for coordinating SED utilization efforts on the project and for monitoring and enforcing compliance with the affirmative action and SED requirements of the applicable program rules.

(c) SED utilization requirements shall be an agenda item at all contract award meetings and, wherever applicable, at preconstruction conference meetings regardless of whether a loan or grant agreement has been executed or not. Each project sponsor shall be responsible for notifying the Office of the time and place of such meetings.

(d) The project compliance officer shall attend all monthly construction progress meetings.

7:22-9.12 Reports

(a) The contracting agency shall submit its planning and design SED utilization report to the Office at the time of filing of its grant/loan application.

(b) Each project compliance officer shall submit the contracting agency's monthly progress reports to the Office. Once all SED contractors have been obtained, submittal of this report will no longer be required.

(c) Each project compliance officer shall submit a periodic report on behalf of the project sponsor to the Office according to a schedule announced by the Office. At a minimum, this construction report shall be submitted quarterly; that is, January, April, July and October. Where appropriate, the Office may approve a variation in the frequency of reporting requirements specified in (b) through (d) of this section. This report shall include the following information:

1. The value of each contract and subcontract awarded to SEDs and the total dollar value and number of contracts and subcontracts awarded to SEDs;

2. The percentage of SED utilization in comparison to the cost of each contract, as well as the total percentage of SED utilization (including set aside contracts) in comparison to overall project costs;

3. The types and sizes of the participating SEDs and the nature of goods and services being provided; and

4. The efforts made to publicize and promote the project sponsor's SED utilization plan.

(d) Contractors shall submit a quarterly construction report to the project sponsor and to the Office. The project compliance officer may be contacted for assistance if needed.

(e) The report forms required by (a) through (d) above shall be obtained from the Office.

(f) The project compliance officer shall submit reports or information in addition to what is required by (a) through (c) above when requested to do so by the Office.

(g) Failure to comply with the reporting requirements of (a) through (d) and (f) above may subject the project sponsor to the remedies for noncompliance with State and Trust loan or grant conditions specified in the applicable program rules.

7:22-9.13 Assessment of compliance

(a) Where the Office determines that a project sponsor has failed or is failing to meet the 10 percent SED utilization requirement, the project sponsor shall, upon the written request of the Office, submit the following:

1. Advertisements;

2. Signed contracts and subcontracts;

3. Documentation of solicitations of bids from SEDs;

4. Copies of Requests for Proposals;

5. Records of telephone quotations;

6. (Reserved);

7. Adequate and timely notice for encouraging SED participation; and

8. Proof that the assistance of State Agencies was solicited, including:

Office of Equal Opportunity and Public Contract Assistance
New Jersey Department of Environmental Protection
PO Box 402
Trenton, New Jersey 08625-0402

Division for the Development of Small Businesses and Women Businesses and Minority Businesses
New Jersey Commerce and Economic Growth Commission
PO Box 835
1 West State Street
Trenton, New Jersey 08625-0835

(b) Where the project sponsor determines that a contractor has failed or is failing to meet the 10 percent SED utilization requirement, the contractor shall, upon the written request of the project sponsor, submit the documents specified in (a) above.

(c) The Office shall summarize in writing its evaluation of the reason given for noncompliance and the efforts made by the project sponsor or contractor to comply with its plan for achieving the 10 percent SED utilization requirement. The Office shall take into consideration good faith efforts made by the project sponsor or contractor to meet the goal to achieve the ten percent SED utilization requirement. These findings shall be submitted to the Department and, in the case of a Trust loan, to the Trust who, in conjunction with the Office, shall determine the nature and extent of the project sponsor's or contractor's noncompliance.

7:22-9.14 Penalties

Whenever a project sponsor or a contractor has failed to comply with the requirements of this subchapter, including the 10 percent requirement for SED utilization, the Department, or the Department and the Trust, in the case of a Trust loan recipient, may withhold all of the loan or grant money, or a portion thereof, and may take any of the other actions or combinations thereof specified in N.J.A.C. 7:22-3.40 through 3.44, 7:22-4.40 through 4.44, 7:22-6.40 through 6.44 and 7:22A-1.8 through 1.13 which are remedies for noncompliance with any of the conditions of a loan or grant.

7:22-9.15 Administrative hearings

(a) The Department and, in the case of a Trust loan, the Trust, shall make a determination regarding all disputes arising under this subchapter. The project sponsor shall specifically detail in writing the basis for its dispute. The Department and/or the Trust shall produce a decision in writing and mail or otherwise furnish a copy thereof to the project sponsor.

(b) A project sponsor may request an administrative hearing within 20 days of receipt of a decision by the Department and/or the Trust. The request for a hearing shall be sent to the Office of Legal Affairs, ATTENTION: Adjudicatory Hearing Requests, Department of Environmental Protection, PO Box 402, Trenton, New Jersey 08625-0402. The request for an administrative hearing shall specify in detail the basis for the appeal. Administrative hearings shall be conducted in accordance with the requirements of the Administrative Procedure Act, N.J.S.A. 52:14B-1 et seq. and the Uniform Administrative Procedure Rules, N.J.A.C. 1:1.

(c) Following receipt of a request for a hearing pursuant to (b) above, the Department and/or the Trust may attempt to settle the dispute by conducting such proceedings, meetings and conferences as deemed appropriate.

7:22-9.16 Severability

If any of the provisions of this subchapter are found to be invalid, the remainder of the provisions of this subchapter shall not be affected thereby.

NJAC 7:22-10.11
Design Requirements

NJ 7:22 – 10-12
Construction Phase Requirements

(c) A mailing list shall be developed by the Department for each project, for use by the Department to inform the public and other interested parties of its decisions regarding the project. The mailing list shall include elected officials, Federal, State and local government agencies, environmental groups, and other interested groups and individuals appropriate to the planning area for the proposed project.

(d) In addition to the public hearing, the Department may require supplemental measures to inform and solicit comments from the public under the following conditions:

1. Where factors, such as delays in project implementation or errors in cost estimation, result in significant increases in the user cost burden prior to the award of financial assistance, the project sponsor may be required to place a retail or display advertisement in the body of a newspaper of general circulation in the planning area which describes the proposed project and the revised costs, including user cost, and which establishes a comment period of 30 days. A summary of any public comment received during the comment period shall be submitted by the project sponsor to the Department. Based on the response of the public to the advertisement, the Department will determine if further project evaluation is required.

2. Where, as a result of the re-evaluation of the environmental review conducted in accordance with N.J.A.C. 7:22-10.7, the Department determines that significant changes in the project or project impact have occurred, which warrant public input, the Department may determine that a supplemental public advertisement as in (d)1 above or a public hearing as in (b) above is required prior to award of financial assistance.

3. Where notice of the public hearing does not comply with the requirements of (b) above or where significant project issues including costs or impacts were not dis closed, the Department may determine that a supplemental public advertisement as in (d)1 above or a public hearing as in (b) above is required prior to award of financial assistance.

7:22-10.11 Design requirements

(a) The project sponsor shall prepare design plans and specifications which conform to the project alternative selected and approved in planning pursuant to the provisions of N.J.A.C. 7:22-10.4, 10.5 or 10.6 and which include mitigating measures developed during planning and incorporated in the approved planning documentation. In addition, the design plans and specifications shall conform to the minimum standards for each area of concern which is applicable to the proposed project as set forth below. All activities which are a part of the comprehensive environmental infrastructure project(s) for the planning area must conform to the requirements of this section, regardless of the eligibility of individual components of the project.

1. Any design revisions of the project which differ from the project as approved during planning shall be specifically identified.

2. Where any on-going environmental protection measures will be the responsibility of the project sponsor, the project sponsor shall submit a letter prior to loan award specifying that it will adhere to the scope of work approved by the Department.

(b) The contract documents shall be prepared to clearly identify environmental and cultural resources protection measures and shall conform to the following:

1. The format of the contract documents shall consolidate environmental and cultural resource protection/restoration measures in a single section of the design specifications as well as on appropriate sheets of the design plans. The specifications which spell out the environmental and cultural resource protection/restoration measures shall be identified in the specifications as having precedence over other potentially contradictory language contained elsewhere in the design contract documents. The specifications shall clearly state that, in instances where the provisions of a Department-issued permit contradict a provision of the specifications (including those identified in this subchapter), the environmental resources protection and/or restoration and cultural resource mitigation measures identified in the Department-issued permit shall govern.

2. Environmental resources protection and/or restoration measures, and cultural resource mitigation measures should generally include the following subject areas:

i. General;
ii. Clearing;
iii. Erosion and sedimentation control;
iv. Protection of environmentally critical areas;
v. Stockpiling and waste disposal;
vi. Prohibited construction procedures;

vii. Dust control;
viii. Noise control;
ix. Cultural resources;
x. Dewatering;
xi. Restoration;
xii. Environmental maintenance bond; and
xiii. Inspection.

3. The method of payment for environmental and cultural resource protection/restoration measures shall be specified in the applicable section of the contract documents. Where restoration and maintenance of environmental quality are necessary outside of the designated construction area or when measures for maintenance of environmental quality are required after the date of completion and acceptance of the environmental infrastructure facilities, the project sponsor shall clearly state the contractor's responsibilities in the specifications. The Department may require the project sponsor to include separate unit bid items for environmental and cultural resource restoration and/or mitigation.

4. Where construction will occur within or adjacent to environmentally critical areas, as approved by the Department, those areas shall be identified on design plans.

(c) Every effort shall be made to prevent and correct problems associated with erosion and sedimentation which could occur during and after project construction. At a minimum, design specifications shall incorporate the following erosion and sedimentation control measures:

1. All erosion and sedimentation control measures shall be in place prior to any grading operations or construction of proposed facilities and shall be maintained until construction is complete and the construction area is stabilized. After restoration is complete, temporary control measures shall be removed and disposed of properly.

2. All erosion and sedimentation control measures shall be constructed and maintained in accordance with the "Standards for Soil Erosion and Sediment Control in New Jersey," prepared by the New Jersey State Soil Conservation Committee, 1999, incorporated herein by reference, as amended and supplemented. Copies of the "Standards for Soil Erosion and Sedimentation Control in New Jersey" are available for a fee from the New Jersey Department of Agriculture, Soil Conservation Committee, or from the office of any of the 16 local conservation districts.

3. Disturbed areas that will be exposed in excess of 10 days shall be temporarily seeded and/or mulched, until proper weather conditions exist for establishment of permanent vegetative cover.

(d) Site and access clearing must be confined to approved construction areas. Protection of existing vegetation must be practiced wherever possible. At a minimum, the project sponsor shall include provisions in the contract documents which conform to the following:

1. Temporary and permanent easement widths must be reduced to the minimum feasible for the proposed construction. Unless specifically approved by the Department, permanent access roads must not be more than eight feet wide and there shall be no permanent access roads in environmentally critical areas. Access roads may be paved only where absolutely necessary, as determined by the Department.

2. Only those portions of the site which are absolutely necessary and essential for construction shall be cleared. Whenever possible, excavation shall include the removal and storage of topsoil from the site for future use. The length of time of ground disturbance shall be reduced to the minimum practicable, especially in environmentally critical areas. Ground disturbance shall be avoided until immediately preceding construction to minimize exposure of soils.

3. Trees and shrubs within construction easements, which are not required to be removed to permit construction, shall be protected to the drip line with appropriate protection measures such as snow fencing or batter boards. Trees and shrubs whose removal is necessary to facilitate construction shall either be replanted at the same location or replaced with nursery stock of the same kind. Trees of greater than 12 inches in diameter should be preserved whenever possible by implementing slight shifts in alignment or tunneling under tree roots. Specimen trees, as identified in "New Jersey's Big Trees" (1998) published by the Department's Division of Parks and Forestry listing specimen trees in the State, shall be preserved.

4. Except in heavily wooded areas, the plans shall designate trees and shrubs which are to be protected as well as trees and shrubs which are to be removed. In addition, plans shall provide details which depict methods of protection to the drip line.

5. In heavily wooded areas, every effort shall be made to avoid the destruction of common native trees and shrubs so as not to unduly disturb the ecological balance or environmental quality of the area. Trees of 12 inch

diameter or greater should be preserved whenever possible and protected to the drip line. Where practical, common native trees and shrubs, of one through three inch caliper, which must be cleared from the construction area shall be stockpiled for use in restoration. Straggling roots shall be pruned. Trees which must be pruned to facilitate construction shall be cut cleanly and painted with tree paint. If a tree not intended to be removed is damaged, the wood shall be repaired according to common nursery practice and painted with tree paint.

(e) Restoration measures to be identified and designated on the environmental plans and specifications include the following: ground preparation, topsoiling, fertilizing, liming, reseeding, and replanting/replacement of trees and shrubs with native species. The aim of restoration is to restore the disturbed area to a condition as nearly equal to pre-disturbance condition as possible. The environmental specifications shall set forth the procedure for accomplishing these restoration measures. The plans shall include the location of various types of restoration and shall include details depicting typical methods to accomplish restoration. The provisions shall include the following ,when applicable:

1. Final restoration shall be undertaken as soon as an area is no longer needed for construction, stockpiling or access. Excavated material unsuitable for backfill as set forth at N.J.A.C. 7:14-2.13 and considered to be solid waste pursuant to N.J.A.C. 7:26-1.6 shall be removed from the construction site and disposed of at a sanitary landfill approved and licensed by the Department. Excess excavated material which is not considered to be solid waste pursuant to N.J.A.C. 7:26-1.6 shall be graded or removed in accordance with (1)3 below. When access roads are no longer needed, road fill shall be removed and the access area shall be restored to pre-disturbance conditions. Care should be taken to avoid damage to adjacent vegetation and to prevent the formation of depressions that would serve as mosquito pools.

2. Topsoil shall be replaced with adequate amounts of topsoil material to restore the disturbed area to its original, pre-disturbance grade and depth of topsoil.

3. Rates and types of fertilization, liming, and seeding shall be as recommended by the local Soil Conservation District based on soil tests and local conditions. Seed mixtures shall be selected that are best suited for the particular site conditions. Seed selection shall provide for a quickly germinating initial growth, to prevent erosion, and for a secondary growth that will survive without continuing maintenance. Mulching shall occur immediately after seeding, and in no case shall more than five days elapse between seeding and mulching.

4. In wooded areas, for a 50-foot wide construction easement, generally 10 trees should be planted for every 100 feet of length of the easement. More trees would be required in wider easements or densely wooded areas. Plans shall include a restoration schedule specifying the quantity, common and botanic names, sizes, and spacing of trees to be planted and the type of seed mixtures to be used from station to station. Trees to be replaced should be trees native to New Jersey suitable for the particular site and generally should conform to the list of trees found in the "Standards for Soil Erosion and Sediment Control in New Jersey," prepared by the New Jersey State Soil Conservation Committee, 1999, incorporated herein by reference, as amended and supplemented.

5. In landscaped areas, environmental features shall be replaced or restored to pre-disturbance condition or better. This includes sodding, replacement of trees and shrubs, fences, drives, and other landscape features in kind.

(f) A listing of prohibited construction procedures shall be incorporated into the specifications. These procedures include, but are not limited to, the following:

1. Dumping of spoil material into any stream corridor, any wetlands, any vernal habitats, any surface waters, any sites listed or eligible for listing on the New Jersey or National Registers of Historic Places, or at unspecified locations;

2. Indiscriminate, arbitrary or capricious operation of equipment in any stream corridors, wetlands, vernal habitats, or surface waters;

3. Pumping of silt-laden water from trenches or other excavations into any surface waters, stream corridors, wetlands or vernal habitats;

4. Damaging vegetation adjacent to or outside of the access road or the right-of-way;

5. Disposal of trees, brush and other debris in any stream corridors, wetlands, vernal habitats, surface waters or at unspecified locations;

6. Permanent or unspecified alteration of the flow line of any stream;

7. Open burning of project debris;

8. Use of calcium chloride, petroleum products, or other chemicals for dust control;

9. Use of asphaltic mulch binder; and

10. Any unpermitted discharge of sewage.

(g) Construction in wetlands shall conform to the requirements of the New Jersey Freshwater Wetlands

This is a courtesy copy of this rule. All of the Department's rules are compiled in Title 7 of the New Jersey Administrative Code. The rule below includes the amendments adopted to this subchapter on January 3, 2006.

Protection Act, N.J.S.A. 13:9B-1 et seq., and N.J.A.C. 7:7A.

(h) Stream crossings shall conform to the requirements of the Flood Hazard Area Control Act, N.J.S.A. 58:16A-50 et seq., and N.J.A.C. 7:13.

(i) Slopes exceeding 15 percent require special treatment. Specifications shall call for measures such as water diversion berms, sodding, or the use of jute or excelsior blankets. Hay bales shall be placed at the base of the slope prior to ground disturbance. Steep slopes that have been disturbed, if not sodded, shall be seeded and mulched immediately after construction is complete. Slope boards or other measures necessary to prevent slumping of the disturbed slope shall be incorporated, where appropriate.

(j) If there is the possibility of encountering acid-producing deposits in the course of construction, as identified during the planning process, special requirements and conditions will apply and shall be incorporated in the specifications as follows:

1. In vegetated areas, the top two feet of soil shall be stripped and stockpiled separately from the material to be excavated. A soils specialist, to be provided by the project sponsor, shall monitor the stripping operation. If any acid-producing deposits are identified, this material and any contaminated soil shall be disposed of on the same day. The presence of acid-producing deposits is detected by the use of the following tests:

i. Determining the pH of the soil when suspended in 0.5 Molar calcium chloride solution (of neutral pH). A pH value below 3.0 indicates presence of ferrous sulfate and presence of acid-producing deposits is strongly suspected.

ii. Test for sulfate by adding a drop of 10 percent barium chloride solution to a water extract of the material. If voluminous flocks of barium sulfate form immediately the presence of acid-producing deposits is strongly suspected.

2. The disposal site shall be approved by the Department. Any soil of this type disposed of shall be covered with a minimum of two feet of cover to prevent rapid oxidation and subsequent acid formation.

3. In both vegetated and paved areas, when acid-producing deposits are encountered, as determined by the soil specialist, excavated trench material shall be returned to the trench as follows:

i. Lower material first, followed by upper material.

ii. The top one to two inches of soil on which the deeper soil was stockpiled shall be scraped and placed below a depth of two feet.

iii. For pipeline construction, the quantity of material to be displaced by bedding and pipe, as well as soil scraped from the stockpile area, shall be subtracted from the deeper, excavated material and this quantity of deeper material removed to an approved disposal site and covered as described in (e)3 above.

iv. After backfilling the deeper soil, one ton of limestone per 2,000 square feet shall be spread over the deeper soil in the trench. This liming requirement is applicable in areas of well drained, nonsaturated soils, as determined by the soil specialist.

v. In vegetated areas, the top two feet of soil, stockpiled for this purpose, shall then be replaced. If the top two feet of soil was also contaminated, clean backfill material similar to the native topsoil shall be used in place of the contaminated material.

4. The excavated acid-producing deposits shall not be exposed for a period longer than eight hours. When acid-producing deposits are encountered, the trench opened in any construction day shall be backfilled and the areas cleaned up by the close of the day. Where this is impracticable, such as in the construction of pumping stations and treatment plants, exposed acid-producing deposits shall be covered with limestone screenings at a rate of 100 tons per acre and then covered with six inches of compacted soil within one week of exposure or before the exposed soil drops to pH 3, whichever occurs first. The pH shall be monitored daily under this procedure.

5. Temporary restoration of vegetated areas shall consist of mulching and shall be put in place at the end of each day's construction. Permanent restoration of the area shall begin as soon as construction is complete and after the results of incubation tests, where necessary, are available.

6. Prior to restoring vegetated areas, the soil specialist shall perform pH tests on the in-situ soil after the construction is completed. If the pH is below 4, intensive liming shall be required in order to make the soil suitable for plant survival.

7. Lime requirement tests shall be performed by the soil specialist to determine the lime application rates. This will require an incubation test in which the sample is oxidized for a period of six weeks, as follows:

i. The sample shall be air dried and ground so that the whole sample passes a 0.5 millimeter sieve.

ii. The lime requirement to reach pH 6.5 shall be determined initially, and again at two week intervals for six weeks, using standard soil testing techniques.

iii. The total lime requirement determined by this method can be extrapolated to the area under consideration.

8. A minimum of 30 tons of limestone per acre or the amount of lime required according to the incubation test result shall be applied prior to seeding and planting where the pH is less than 4. Where the pH is greater than 4, liming and fertilizing requirements set out in the planting and environmental specifications shall apply.

9. The spreading and mixing of the subsoil and any topsoil contaminated with acid-producing deposits around the site and beyond the site is prohibited. Areas used for stockpiling acid-producing deposits shall be minimized. Equipment used for excavation and backfilling shall be cleaned, to the extent practicable, at the end of each day's operation and the soil removed shall be placed in the trench below a depth of two feet. No construction shall take place during significant rainstorms or while the area is saturated to avoid smearing or spreading of the acid-producing deposits over the area.

(k) When dewatering will occur and a dewatering permit is not required, the contractor shall monitor for adverse effects to structures or wells due to dewatering and shall be responsible to remedy same to the satisfaction of the Department. Discharges from dewatering activities which contain silt are subject to the following controls:

1. All discharges from dewatering activities to surface waters, wetlands, vernal habitats, or storm sewers shall be free of sediment. Care shall be taken not to damage or kill vegetation by excessive watering or by damaging silt accumulation in the discharge area. If discharges are sediment laden, techniques shall be employed to remove sediment prior to discharge. A sedimentation basin shall be constructed and used as specified, where necessary, to protect vegetation and to achieve environmental objectives.

2. Sewer inlets within construction areas shall be pro vided with perimeter hay bales or other appropriate siltation control measures.

(l) Contract requirements with regard to the location and control of stockpile, storage and disposal areas whether provided by the project sponsor or the contractor, must conform to the following:

1. Only environmentally suitable stockpile sites may be used for the purposes of staging or storing materials, equipment and suitable trench backfill material. Environmentally suitable sites must be level, and devoid of mature stands of natural vegetation. Drainage facilities and features, wetlands, vernal habitats, and stream corridors are not environmentally suitable sites.

2. The boundary of the stockpile area shall be clearly marked by hay bales, silt fencing or another appropriate method. Where fill is to be stored in excess of 10 days, a suitable means of protecting excavated material from wind and water erosion shall be employed. Erosion control methods may include one or more of the following: mulching, sprinkling, silt fencing, haybaling and stone covering.

3. Excess excavated material which is not considered to be solid waste pursuant to N.J.A.C. 7:26-1.6 shall be graded on-site only to the extent needed to achieve preconstruction grade, unless otherwise specifically approved by the Department. The project sponsor shall ensure that the contractor removes the remainder from the site and disposes of it at a site approved by the project sponsor in accordance with the following:

i. Disposal sites selected by the contractor shall be evaluated and approved by the project sponsor prior to their use. Disposal sites may also be selected by the project sponsor. The project sponsor shall conduct periodic inspection of disposal sites to ensure compliance with the requirements of this subsection during the off-site disposal operation.

ii. The disposal of excess excavated material in wetlands, vernal habitats, stream corridors and floodplains is strictly prohibited, even if the permission of the property owner is obtained. The contractor shall be responsible to remove any fill improperly placed by the contractor at the contractor's expense and restore the area impacted.

iii. If excess excavated material is placed on private property, a hold harmless release in favor of the project sponsor and the Department shall be obtained from the property owner; and

iv. Prior to approval of a site for excess excavated material disposal, where the site exceeds 5,000 square feet, the project sponsor shall obtain, or shall ensure that the contractor or property owner has obtained, the appropriate certification of the soil erosion and sediment control plan in accordance with the State's standards for soil conservation (N.J.S.A. 4:24-1 et seq., also referred to as Chapter 251). Where the site is less than 5,000 square feet, the project sponsor shall advise the property owner of the need for erosion and sediment control and obtain a statement that the property owner accepts complete responsibility for implementation of appropriate methods to prevent erosion and sedimentation.

(m) In order to control dust, as often as required during each working day, and particularly prior to the conclusion of each working day, areas under immediate construction (including access roads and other areas

affected thereby) shall be swept and wet down with water sufficiently to lay dust. In addition, these areas shall be wet down during nonworking hours (including weekends) as often as required to keep the dust under control. The use of calcium chloride or petroleum products or other chemicals for dust control is prohibited.

(n) In order to limit noise impacts in the vicinity of sensitive receptors, construction operations and activities shall be limited as follows: Monday through Friday between the hours of 7:00 A.M. and 6:00 P.M. unless variances to these times are granted in times of emergency. No driving, pulling, or other operations entailing the use of vibratory hammers or compactors shall be permitted, other than between the hours of 8:00 A.M. and 5:00 P.M. The number of machines in operation at a given time shall be limited to the minimum practicable. All engine generators or pumps must have mufflers and be enclosed within a temporary structure.

(o) Provisions regarding the contractor's responsibility for cultural resource protection shall be included in contract documents that provide for the following:

1. If a cultural resource is encountered during the course of construction, the contractor is directed to halt all construction activities in that area. The contractor shall immediately contact the project sponsor who shall contact the Department. The Department will determine and require initiation of the appropriate actions in conformance with N.J.A.C. 7:22-10.8. .

2. The contractor shall not dispose of excess excavated material at, stockpile construction materials at, or obtain borrow material from, properties which are listed or eligible for listing on the New Jersey or National Registers of Historic Places.

(p) The project sponsor shall require that the contractor supply an environmental maintenance bond in the amount of $25,000 or 50 percent of the price bid for the materials needed to fulfill the environmental specifications, whichever is greater. The environmental maintenance bond shall provide that the contractor shall remedy, without cost, any defects which result from faulty workmanship or from failure to comply with the specifications and which develop during the period of one year from the expiration of the performance bond required pursuant to N.J.S.A. 40A:11-22.

(q) The project sponsor shall obtain photographs of existing conditions prior to the start of site and access clearing and construction. At a minimum, one eight inch by 10 inch color glossy print photograph shall be obtained for each 100 feet of the construction area. Special attention shall be given to environmentally critical areas and areas outside of the public right-of-way. Photographs shall be labeled by station so that upon completion of the construction, or during construction if necessary, subsequent photographs can be taken from the same control points. The project sponsor shall file copies of the above photographs with the Department. As a supplement to the required photographs, video documentation may be submitted to the Department, and is encouraged as a way of documenting site conditions.

7:22-10.12 Construction phase requirements

(a) The project sponsor must employ one, or more if warranted by the scope of the project, environmental inspector(s) to ensure that the requirements of the specifications relating to environmental and cultural resource protection and restoration are effectively carried out. Individuals designated as environmental inspectors by the project sponsor must possess, at a minimum, the education/experience qualifications of an Environmental Specialist employed with the Department. The Department will also conduct environmental inspections to oversee the conduct of the protection/restoration measures. Responsibilities of the project sponsor's environmental inspector(s) include the following:

1. Daily inspections of active work areas and periodic inspection of maintenance or restoration areas sufficient to ensure performance of protection measures in accordance with contract documents.

2. The maintenance of a daily job diary in which they shall record the progress of the work and of any problems encountered. The environmental inspectors shall notify the contractor in writing immediately upon noticing that environmental specifications are not being met.

3. At frequent intervals during construction, the recipient, the resident engineer, the environmental inspectors and the Department inspectors shall meet to review progress and to resolve difficulties that might result in unnecessary delays in the work. The Department shall notify the recipient if deficiencies are not immediately corrected. The recipient shall then direct compliance with environmental requirements.

(b) After award of a contract and before construction commences, a pre-construction conference shall be held. The recipient, the resident engineer, the environmental inspectors, the Department inspectors and the contractor should reach general agreement upon procedures to be followed to comply with the plans and

specifications intended to provide environmental and cultural resource protection and restoration that have been approved by the Department.

(c) A final inspection shall be required following completion of all construction and restoration work encompassed by each contract. The final inspection shall be conducted as follows:

1. Upon completion of all construction and restoration work of each contract of a project, the recipient shall submit a letter to the Department stating that the project (or contract) is ready for final inspection. No final inspection can be scheduled until formal notification is received.

2. The final inspection shall be a joint inspection with the recipient and/or the resident engineer, the environmental inspector, the contractor and representatives from the Department in attendance.

(d) The Department shall make periodic determinations and, following the final inspection, make a final determination regarding the adequacy of the contractor's performance of the specifications relative to environmental and cultural resource protection and restoration. If the performance is not acceptable, this finding and the procedures and schedules needed to effect acceptable performance will be conveyed in writing to the project sponsor. Failure of the project sponsor to comply with the Department's requirements may subject the project sponsor to the noncompliance provisions of N.J.A.C. 7:22-3.40, 4.40 and 6.40 and N.J.A.C. 7:22A-1.8.

EXHIBIT NO. 6

SED PARTICIPATION BUILDING PHASE QUARTERLY REPORT
(FORM OEO-002)

OFFICE OF EQUAL OPPORTUNITY
AND
PUBLIC CONTRACT ASSISTANCE

MUNICIPAL FINANCE
AND
CONSTRUCTION ELEMENT

SED PARTICIPATION

BUILDING PHASE

QUARTERLY REPORTING FORM

FOR

CONTRACTING AGENCIES & CONTRACTORS

(OEO-002)

New Jersey Department of Environmental Protection

REPORTING REQUIREMENTS ON SOCIALLY AND ECONOMICALLY DISADVANTAGED (SED) BUSINESS UTILIZATION

These instructions apply to reporting on the utilization of Socially and Economically Disadvantaged Businesses (MBEs/WBEs/SEDs) under the New Jersey Department of Environmental Protection and the New Jersey Environmental Infrastructure Financing Programs. They are intended to provide guidance to Project Sponsors and Contractors in filling out the Building Phase (SED) Utilization Form. The reporting requirements apply to all Contracting Agencies and Contractors pursuing New Jersey Financing Assistance through programs administered by the New Jersey Department of Environmental Protection and the New Jersey Environmental Infrastructure Trust pursuant to N.J.A.C. 7:22-3.; N.J.A.C. 7:22-4.; N.J.A.C. 7:22-6; N.J.A.C. 7:22A-6; N.J.A.C. 7:22-7.

Each Project Sponsor and Contractor must submit this building SED Report (Form OEO-002) quarterly on MBE/WBE utilization for each contract for which a Project Sponsor or its Contractor(s) awards a subagreement. The form must be submitted to the New Jersey Department of Environmental Protection (NJDEP), Office of Equal Opportunity, Public Contract Assistance within 15 days following the close of each fiscal year quarter (i.e., January 15, April 15, July 15, and October 15).

INSTRUCTIONS FOR FILLING OUT SED UTILIZATION REPORT

1. Read instructions carefully before completing form, and refer to N.J.A.C. 7:22-9.1 et seq. for further guidance.

2a. The name and address of Project Sponsor participating in the grant/loan programs for environmental infrastructure facilities.

2b. Name of the Project Compliance Officer responsible for submitting periodic reports.

3. Name and address of party contracting directly with the Project Sponsor.

4. Self-explanatory.

5a. The grant/loan project number for the agreement between the State of New Jersey and the Project Sponsor.

5b. The grant/loan project number for the contract between the Project Sponsor and its contractor(s).

6. Include brief description of project.

7. Self-explanatory.

8a. The county in which the Project Sponsor is located.

8b. The municipality in which the Project Sponsor is located.

9. The date of the agreement between the State of New Jersey and the Project Sponsor.

10a. The date of agreement between the Project Sponsor and the contractor.

10b. Self-explanatory.

11. Indicate MBE and WBE goals based upon project plan for SED utilization developed in consultation with the Office. These goals may vary depending upon local law. Where a Project Sponsor has a SED participation goal which exceeds ten percent, the Project Sponsor=s goal shall take precedence.

12. Enter the name, address and telephone number of each SED participating in the building phase as a subcontractor under agreement with the construction management firm or the Project Sponsor. Check applicable MBE or WBE status of each listed SED. Explain type of service rendered and list the total dollar amount of the subcontract. Each entry must be accompanied by a copy of the signed subcontract.

Restricted - Bids may be solicited on a restricted basis by setting aside a contract for building, materials and equipment, or services which is designated as a contract for which bids are invited and accepted only from SEDs.
Unrestricted - Bids may be solicited on an unrestricted basis and not designated for a set-aside contract, but the contract document shall include a statement to the effect that the successful bidder must fulfill the SED utilization requirements.

13. See instructions for Item 12. This section is designated for SEDs participating in the building phase of a project as a subcontractor under agreement with building contractor(s).

14. Person signing must be the designated Project Compliance Officer of the Project Sponsor. The contractor(s) or the authorized presentative of the contractor(s).

15. Additional comments or explanations. Refer to the specific item number on the form, if applicable.

OEO-002

NEW JERSEY DEPARTMENT OF ENVIRONMENTAL PROTECTION
NEW JERSEY MUNICIPAL FINANCE & CONSTRUCTION ELEMENT
OFFICE OF EQUAL OPPORTUNITY & PUBLIC CONTRACT ASSISTANCE

CONSTRUCTION REPORT

SOCIALLY AND ECONOMICALLY DISADVANTAGED (SED) BUSINESS UTILIZATION

1. ***Read Instructions Before Completing Form.***

2a. Project Sponsor

Name

_____

Address

_____

_____

2b. Project Compliance Officer _____

3. Contractor

Name

_____

Address

_____

_____

4. Financing Program *(check applicable program(s))*

_____a. Wastewater Treatment Fund _____b. Wastewater Treatment Trust _____c. Pinelands Infrastructure Trust

_____d. Stormwater Management _____e. Water Supply

5a. Project Number _____ 5b. Contract Number _____

6. Project Name _____

7. Contract Amount $_____

8a. County _____ 8b. Municipality _____

9. Date of Grant/Loan Agreement _____

10a. Date of Contract Award _____ 10b. Duration of Contract: Mo. _____ Days _____

11. STATE GOAL OR OTHER STANDARDS (IF ANY)

Contracting Agency=s Requirement

	DOLLAR AMOUNT	PERCENTAGE OF CONTRACT AMOUNT
MBE	$ _____	_____ %
WBE	$ _____	_____ %
TOTAL SED	$ _____	_____ %

12. A/E and Other Professional Service Subcontracts Awarded During the Building Phase

	Name, Address and Telephone No.	MBE/ WBE	Type of Service Rendered	Amount	Number	Dollar Amount	Subcontract Award	Subcontract (R/U)	Date of Subcontract	Type of Award*
1.										
	Number of Full-time Employees									
2.										
	Number of Full-time Employees									
3.										
	Number of Full-time Employees									
4.										
	Number of Full-time Employees									
5.										
	Number of Full-time Employees									
6.										
	Number of Full-time Employees									

** Restricted/Unrestricted*

13. Other Subcontract Awards Made Under the Building Phase

Name, Address and Telephone No.	MBE/ WBE	Type of Service Rendered	Dollar Amount	Subcontract Number	Subcontract Award	Date of Subcontract (R/U)	Type of Award*
1.							
Number of Full-time Employees							
2.							
Number of Full-time Employees							
3.							
Number of Full-time Employees							
4.							
Number of Full-time Employees							
5.							
Number of Full-time Employees							
6.							
Number of Full-time Employees							

** Restricted/Unrestricted*

14.

(Signature of Project Compliance Officer)	*(Signature of Contractor)*
(Title)	*(Title)*
(Date)	*(Date)*

15. Space Provided for Additional Comments or Explanations

EXHIBIT NO. 7

SED PARTICIPATION MONTHLY PROGRESS REPORT
(FORM OEO-003)

OFFICE OF EQUAL OPPORTUNITY
AND
PUBLIC CONTRACT ASSISTANCE

MUNICIPAL FINANCE
AND
CONSTRUCTION ELEMENT

SED PARTICIPATION

MONTHLY PROGRESS REPORT

(OEO-003)

New Jersey Department of Environmental Protection

OEO-003

NEW JERSEY DEPARTMENT OF ENVIRONMENTAL PROTECTION
SED UTILIZATION IN ENVIRONMENTAL INFRASTRUCTURE FINANCING PROGRAM

MONTHLY PROGRESS REPORT

Contractor_____

Project Number_____

Project Name_____

Contract Amount_____

Report Month/Year_____

The following information is required in order to assist the Project Compliance Officer and the New Jersey Department of Environmental Protection in monitoring the SED (small business enterprises owned and controlled by socially and economically disadvantaged individuals) Utilization progress and activity in the Environmental Infrastructure Financing Program. Each contractor shall respond to each of the listed items. Whenever evidence of completion of each item is available, copies of itemized documents are to be submitted to the Project Compliance Officer.

Over the past month has any action on any item taken place? Please explain each.

1.	Copies of Solicitation to SED=s	_____Yes	_____No
2.	Advertisement of bidding or procurement opportunities	_____Yes	_____No
3.	Evidence of negotiation with SEDs	_____Yes	_____No
4.	Copies of telephone quotes/negotiations	_____Yes	_____No
5.	Copies of signed subagreements	_____Yes	_____No
6.	Have any subcontracts been awarded in the past month	_____Yes	_____No

Please provide an explanation for Questions 1 through 6.

_____

_____

_____

_____

_____ _____

Signature of Contractor *Signature of Project Compliance Officer*

_____ _____

Date *Date*

EXHIBIT NO. 8

PVSC SED UTILIZATION PLAN

Passaic Valley Sewerage Commission (PVSC)

Socially and Economically Disadvantaged Utilization Plan

Introduction

It is the policy of the PVSC to promote award of contracts to Socially and Economically Disadvantaged (SED) small business enterprises by stipulating specific requirements for involving such businesses in contracting. The failure of the Contractor to demonstrate a good faith effort to achieve the goals set forth herein by utilizing best efforts to implement the SED utilization plan will constitute an event of default of the Agreement. PVSC shall designate a compliance officer who shall be responsible for coordinating SED utilization efforts for the Agreement and for monitoring compliance with the plan. PVSC reserves the right to audit the Contractor's SED records to insure compliance with this provision. Socially and economically disadvantaged businesses definitions and associated terms are defined in the NJAC 7:22-9.2.

SED's Scope and Purpose

The goal is established at 10% SED (combined MBE/WBE) participation. Fulfillment of the goal can be achieved through lower tier agreements with SEDs for services, supplies or construction necessary to complete the project. The Contractor must endeavor to meet the goal specified in the previous paragraph by taking and documenting the following affirmative steps to ensure that the SED businesses are used as sources of services, supplies or construction whenever possible by:

1. Placing SEDs on solicitation lists.

2. Assuring SED solicitation whenever they are potential sources.

3. Encouraging SED participation through the division of total requirements, when economically feasible, into smaller tasks or quantities.

4. Encouraging SED participation through the establishment of delivery schedules, where the work requirement permits.

5. Using the services and assistance of the Small Business Administration, the Minority Business Development Agency of the U.S. Department of Comm~rce, and the N.J. Department of Commerce and Economic Development, Division of Development for Businesses and Women and Minority Businesses.

When soliciting services from subcontractors, the Contractor must include the 10% goal in its Proposals. Contract work cannot commence until the PVSC has approved the Contractor's SED Utilization Plan.

Definitions

Definitions are incorporated herein by reference and can be found at N.J.A.C 7:22-9.2.

In-House Procedures
The Project Compliance Officer, or his designee, shall be responsible for coordinating' SED utilization efforts on the project, for monitoring and enforcing compliance with the affirmative action and the SED requirement.

SED utilization requirements shall be an agenda item at all contract award meetings and, wherever applicable, at preconstruction conference meetings regardless of whether a loan or grant agreement has been executed or not. Each project sponsor shall be responsible for notifying the Office of the time and place of such meetings.

The project compliance officer, or his designee, shall attend all monthly construction progress meetings. .

State of New Jersey SED Certification Requirement
Any SED firm proposed by the Contractor must be certified by a certifying agency in the State of New Jersey or be certifiable and pending certification, as verified by PVSC, in order to qualify toward the firm's fair share goals. Other certifications may be deemed acceptable, as approved by PVSC on a case by case basis.

For information purposes only, the State of New Jersey Department of Commerce and Economic Development Division of Development and Small Business and Women Minority Businesses Set Aside and Certification office maintains a state wide Certification Directory containing a list of SEDs who are accepted as such by the State of New Jersey and who might be interested in becoming suppliers or subcontractors for this contract.

SED Utilization Plan Requirements
Thirty (30) days after Notice of Award, the contractor must submit an approvable SED Utilization Plan to the PVSC. To be approvable, the SED Utilization Plan for subcontractors, suppliers and construction, must detail the steps taken or be taken by the Contractor to provide for SED utilization for the total fair share percentage established by the Agreement. It must further provide documentation to evidence the Contractor's efforts to date and planned efforts toward achieving the goal.

SED Utilization Plan Revisions
If a SED supply, service, or subcontract in the approved plan will not be procured, the Contractor must amend the plan. The Contractor must demonstrate a good faith effort to comply with the fair share percentage established in the Agreement by submitting documentation outlining the SED affirmative steps taken and the reasons for not engaging the SED. The Contractor must further revise the SED plan to detail the additional steps to be taken to reach the SED participation goal set forth herein as part ofthe required SED Utilization Plan Revision.

EXHIBIT NO. 9

NJAC 7:14-2

N.J.A.C. 7:14

WATER POLLUTION CONTROL ACT

Statutory authority: N.J.S.A. 13:1B-3 et seq., 13:1D-1 et seq., 13:1E-1 et seq., 58:10-23.11 et seq., 58:10A-1 et seq., 58:11-49 et seq., 58:11A-1 et seq. and 58:12A-1 et seq.

Date last amended: October 5, 2010

For regulatory history and effective dates, see the New Jersey Administrative Code

Table of Contents

SUBCHAPTER 1. (RESERVED)

SUBCHAPTER 2. CONSTRUCTION OF WASTEWATER TREATMENT FACILITIES

7:14-2.1 Construction procedures

The Department shall require and adhere to the procedures identified in this subchapter. Actions or procedures by owners, permittees, consultants, contractors, or other persons affected by this subchapter which are not in accordance with this subchapter shall not be acceptable to the Department. Where applicable, the Department may grant a waiver from any requirement of this subchapter upon presentation of written justification by the owner, permittee, consultant or contractor.

7:14-2.2 Record drawings; collector sewers, interceptor sewers and force mains

(a) The owner shall be responsible for the preparation of all record drawings required for sewer lines. This responsibility may be delegated to the owner's representative with adequate compensation for this service.

(b) This responsibility shall not be delegated or transferred to the contractor. The contractor shall assist the owner/engineer, by providing record information, when requested, during the progress of the work.

7:14-2.3 Permits

(a) Federal, State, county and municipal permits required as a result of the construction activity within the delineated site shall be obtained by the owner and associated fees shall be paid by the owner. In addition, permits required for construction activities on railroad properties shall be obtained by the owner.

(b) Exceptions to this section shall be a permit to use explosives for rock excavation and such other permits which by law are required to be obtained by the contractor.

(c) The owner shall make every reasonable effort to identify permits and fees and costs required as a result of the construction activity in effect 60 days prior to the receipt of construction bids. This responsibility may be delegated to the owner's engineer with adequate compensation for this service. The engineer shall be held harmless from any pen-

alty or action resulting from the failure to obtain a permit where every reasonable effort has been made by the engineer to obtain such permits. Conditions made a part of any permit shall be imposed upon the contractor as described in the contract or bid documents. Additional costs associated with a permit resulting from the construction activity which is beyond that stipulated in the contract shall be the responsibility of the contractor.

(d) Whenever necessary or appropriate the contractor shall assist the owner in the acquisition of permits.

(e) The Department may intercede and assist in the resolution of any problems resulting from the acquisition of any permits.

7:14-2.4 Easements/rights-of-way

An interruption of construction or an extension of contract time may be a basis for a claim by a contractor for additional cost when such interruption or extension is caused by the owner's inability to obtain an easement/right-of-way. Claims shall include any reasonable cost incurred by the contractor and shall be reviewed and approved by the owner prior to submission to the Department. The Department may approve all, any portion, or deny the cost for eligibility for projects funded under the Grant Program.

7:14-2.5 Field layout (baseline and monuments)

The owner shall be responsible to establish and confirm field controls prior to start of construction. The contractor shall not be liable to check the accuracy of field controls (baseline and monuments) for sewer pipe installation. However, the contractor's layout must be based on a minimum of two field control points. Whenever the contractor detects an error in the field controls during pipe installation, the contractor shall immediately notify the owner and the owner's engineer of such error with sufficient documentation. The contractor shall be held responsible for all corrective measures and associated costs for failure to notify the owner of such error.

7:14-2.6 Engineer design activities: plan scale and plan updating

(a) On occasion, projects do not go to construction within a reasonable time after the bid advertisement. During this period, utilities may be relocated or installed, as well as other changes which can take place that are unknown to the contractor. Because of this, problems can take place during construction and result in numerous change orders and increases in the cost of the project.

(b) The horizontal scale for construction plans for sewerage facilities shall not be less than one inch equals 100 feet. A larger horizontal scale shall be used where appropriate to show sufficient detail to construct the project. The vertical scale for construction plans for sewerage facilities shall be not less than one inch equals 10 feet. Based upon the best information available, the location of underground utilities and support structures for overhead utilities shall be shown on the plans.

(c) Construction plans for sewerage facilities shall be updated whenever the bid advertisement date exceeds one year after approval by the responsible State or Federal regulatory agency. The engineer shall receive adequate compensation for updating plans and specifications. All such revisions shall be noted and dated on the plans prior to bid.

7:14-2.7 Construction, overhead and profit factors for Extra Work compensation

(a) The contractor is entitled to all identifiable direct job costs associated with Extra Work excluding subcontractor's costs. For Extra Work not in excess of $ 10,000 the contractors may add up to 10 percent overhead factor to their identifiable direct job costs, but excluding the cost of any subcontracting, plus up to a 10 percent profit factor to their identifiable direct costs plus overhead amount.

(b) As general policy, these overhead and profit factors may be accepted by owners as reasonable in lieu of requiring the submission of additional supporting data. However, the owner must reserve its right to review any cost or profit element on a case-by-case basis, where the submission for overhead and profit is in excess of the 10 percent overhead and 10 percent profit indicated above.

(c) Cost increase in subcontracted work may be similarly handled and a prime contractor may add up to 10 percent to the total cost (including overhead and profit factors) incurred by the subcontractor. In such cases, the same reservations for rights shall apply.

(d) For Extra Work in the amount of $ 10,000 to $ 100,000, the above factors may be included initially for equitable adjustments but will be subject to negotiation, cost and pricing data, and owner review requirements. Federally funded projects will be governed by Federal regulations.

7:14-2.8 Payments to contractors

(a) At least 20 days before each monthly progress payment falls due for approval (but not more often than once per month), the contractor will submit to the engineer a partial payment estimate filled out and signed by the contractor covering the work performed during the period covered by the partial payment estimate and supported by such data as the engineer may reasonably require. Where any specific item(s) in the partial payment estimate is in dispute, the engineer may delete those costs from the estimate and approve the acceptable portion of the payment request. Payment requested for stored materials and/or equipment shall be subject to the following conditions being met or satisfied:

1. The materials and/or equipment shall be received in a condition satisfactory for incorporation in the work.

2. The materials and/or equipment shall be stored in such manner that they will not be damaged due to weather, construction operations or any other cause.

3. An invoice from the supplier shall be furnished for each item on which payment is requested.

4. The contractor shall furnish written proof from the supplier of 90 percent payment for the materials and/or equipment no later than 30 days after receipt of payment for same from the owner. The owner shall have the right to deduct from the next payment estimate an amount equal to the payment for said material and/or equipment if reasonable and adequate proof is not submitted.

(b) The contractor warrants and guarantees that title to all work, materials, and equipment covered by an Application for Payment, whether incorporated in the project or not, will pass to the owner upon the receipt of such payment by the contractor free and clear of all lien, claims, security interests or encumbrances (except 10 percent retention which may be withheld from suppliers and subcontractors to guarantee completion and performance). The engineer will after receipt of each partial payment estimate either indicate in writing his approval of payment and present the partial payment estimate to the owner, or return the partial payment estimate to the contractor indicating in writing his reasons for refusing to approve payment. In the latter case, the contractor may make the necessary corrections and resubmit the partial payment estimate. The owner shall review the partial payment estimate at its next regularly scheduled meeting and, if approved, payment shall be made available to the contractor within five days. The owner shall retain not more than two percent of the amount of each payment claimed. In accordance with EPA regulations, prime contractors are also required to make prompt payment to subcontractors and suppliers for eligible construction, material, and equipment costs. Generally, payments of all valid subcontractor and supplier requests for payment should be satisfied prior to the next succeeding request for progress payment by the prime contractor.

(c) When the work is substantially complete (Operational or Beneficial Occupancy), the withheld amount shall be further reduced below two percent but not less than twice the current market value of the work yet to be completed. On completion and acceptance of a part of the work on which the price is stated separately in the Contract Documents, payment shall be made in full including retained percentages, less authorized deductions. The contractor or owner may request assistance and guidance from the Department on disputes regarding retainage.

(d) "Substantial completion" as used in the context of this section shall mean satisfactory completion of major portions of the contract work, including inspection and testing, so that the facility may be turned over to the owner for its intended use or occupancy. The engineer shall certify the date of substantial completion and that date shall establish the beginning date of the warranty/guarantee period unless a prior date has been established.

7:14-2.9 Mobilization: unit price contracts for sewer construction

(a) Mobilization shall consist of the cost of initiating the contract. Payment for mobilization will be made at the lump sum price bid for this item in the proposal, which price shall include the cost of initiating the contract. The provisions for payment for the item mobilization supersede any provisions elsewhere in the specifications for including the costs of

these initial services and facilities in the prices bid for the various items scheduled in the proposal. The lump sum price bid for mobilization shall be payable to the contractor whenever he shall have completed 10 percent of the work of the contract. For the purposes of this item, 10 percent of the work shall be considered completed when the total of payments earned, exclusive of the amount bid for this item, shown on the monthly certificates of the approximate quantities of work done, shall exceed 10 percent of the total price bid for the contract.

(b) The lump sum price bid for mobilization is limited to the following maximum amounts:

Original Contract Amount (including Mobilization)		
From More Than	To and Including	Maximum Amount for Item of Mobilization
$ 0	$ 100,000	$ 3,000
100,000	500,000	15,000
500,000	1,000,000	30,000
1,000,000	2,000,000	60,000
2,000,000	3,000,000	90,000
3,000,000	4,000,000	120,000
4,000,000	5,000,000	125,000
5,000,000	6,000,000	150,000
6,000,000	7,000,000	175,000
7,000,000	10,000,000	200,000
10,000,000	--	2.5% of Amount Bid

7:14-2.10 Bid items for sewer pipe installation

(a) This section establishes bid items which shall be included in unit price contracts for sewer pipe installation where applicable.

Description			Unit of Measure
1.	Test Pits		Cubic Yard
2.	Stone Foundation (bedding)		Cubic Yard
3.	Select Material (below and above pipe grade)		Cubic Yard
4.	Rock Excavation (including removal and disposal of boulders)		Cubic Yard
5.	Wood Sheeting (install and remove where shown on plans)		Square Feet or1000 Board Feet
6.	Wood Sheeting (left in place where shown on plans)		Square Feet or1000 Board Feet
7.	Steel Sheeting (install and remove where shown on plans)		Square Feet orTons
8.	Steel Sheeting (left in place where shown on plans)		Square Feet orTons
9.	Permanent Pavement Gravel		Square Yard
10.	Pavement		
	i. Municipal:		
	(1)	Temporary which shall be removed (where applicable)	Square Yard
	(2)	Base	Square Yard
	(3)	Top	Square Yard
	ii. County:		
	(1)	Temporary which shall be removed (where applicable)	Square Yard
	(2)	Base	Square Yard
	(3)	Top	Square Yard
	iii. State:		
	(1)	Temporary which shall be removed (where applicable)	Square Yard

	(2) Base		Square Yard
	(3) Top		Square Yard
11.	Testing	Linear Feet	
12.	Concrete Cradle or Encasement (to be identified where applicable)	Cubic Yard	

7:14-2.11 Reasonable minimum unit prices

(a) This section establishes reasonable minimum unit prices for indeterminate items, where applicable, for sewer pipe installation. Indeterminate items are those items which may be anticipated and for which quantities cannot be determined.

(b) The reasonable minimum unit prices are to be established by the owner/engineer for the following items:

1. Stone Foundation;

2. Select Material;

3. Concrete Cradle or Encasement--Nonreinforced;

4. Concrete Cradle or Encasement--Reinforced;

5. Test Pits;

6. Rock Excavation;

7. Wood Sheeting (install and remove)--square feet or 1000 board feet;

8. Wood Sheeting (left in place)--square feet or 1000 board feet;

9. Steel Sheeting (install and remove)--square feet or tons;

10. Steel Sheeting (left in place)--square feet or tons.

7:14-2.12 Payment widths, trench backfill and roadway paving for Federally funded sewer projects

(a) This section establishes eligible payment widths for select fill used for trench backfill and roadway pavement for federally funded sewer projects.

(b) Select trench backfill payment width:

1. Select trench backfill will be eligible for grant funding when the excavated material is totally or partially unacceptable for reuse as trench backfill. When the unacceptable material must be replaced with approved select backfill in a trench with a depth of 10 feet or less from the top of the pipe, the eligible payment width shall be Bd as shown below. For trenches of a greater depth the maximum eligible payment width shall be Bd plus H for the depth of unsuitable material as measured at the time of excavation.

2. When trench width is less than Bd plus H, the actual width shall control the payment.

3. Bd equals Maximum trench width (measured at the top of the pipe) allowed by the engineer for the type and strength class of pipe being installed.

4. The owner/engineer must make every effort to minimize the use of select fill. Marginal backfill material (material which is not acceptable for use in the pipe envelope or as a subbase for roadways) will be limited to the midzone of the trench. The midzone is defined as that portion of the trench beginning two feet above the top of the pipe, after compaction of the pipe envelope, to a point two feet below the final road or easement elevation. The owner/engineer must make all final decisions concerning the above.

(c) Paving:

1. Maximum eligible payment width shall be the disturbed width plus two feet. In no case shall the maximum eligible payment width be greater than Bd plus H;

2. Maximum Eligible Pay Width equals Bd plus H;

3. Special considerations:

i. Pavement replacement shall, in all instances, be "like kind" replacement except where the replacement of the original thickness of roadway material will not yield a structurally stable surface over the disturbed trench area, or where the requirements of the responsible governmental jurisdiction specify roadway materials other than the original disturbed pavement. In these instances, the engineer should specify the minimum thickness necessary to obtain a structurally sound surface or to comply with established local, county or State road opening permit requirements. Such requirements shall be contained in the contract documents.

ii. Roadways where the original total pavement thickness is less than two inches and the pavement cannot be boxed and maintained during construction, will be eligible for "like kind" replacement outside of the eligible trench pavement width.

iii. Any deviation from the above should be submitted during the design phase (Step II) for approval if possible. In all instances, approvals must be obtained prior to soliciting bids.

iv. Reducing the pavement thickness specified by the engineer and spreading it across a wider area of the street will not be approved unless extenuating circumstances justify the need to pave a wider area. These situations will be considered on a case by case basis and must be submitted as a Change Order and receive approval prior to implementing such a change.

(d) Application of this section is mandatory for all Federal Grants awarded to projects, pursuant to the provisions of the Federal Clean Water Act (33 U.S.C. §§ 1251 et seq.) as amended, before October 1, 1998. For all Federal Grants awarded after October 1, 1998, the allowable costs shall be determined in accordance with the applicable provisions of the Financial Assistance Programs for Environmental Infrastructure Facilities rules at N.J.A.C. 7:22-5, Determination of Allowable Costs: Fund and Trust.

7:14-2.13 Excavation material unacceptable or conditionally acceptable for reuse as trench backfill

(a) The following trench excavation materials are unacceptable as trench backfill:

1. Any excavation materials that will cause damage to the piping systems;

2. Any excavation material that cannot be compacted or consolidated to yield the desired density as specified in the contract specifications;

3. Trees, stumps and foreign material.

(b) The following excavation materials are conditionally acceptable as trench backfill only if provided for in the contract specifications and the trench is located in a right-of-way, an easement, a roadway or an unimproved area:

1. Clay, organics and silt determined to be suitable in accordance with soil tests required by the owner/engineer.

2. Hard materials, such as blacktop, concrete, stone and rock.

i. The hard materials shall only be placed in the midzone of the trench beginning two feet above the top of the pipe, after compaction of the pipe envelope, to a point two feet below the final road or ground surface.

ii. Placement of the hard materials shall not create a potential hazard to the pipe or create voids that will cause adverse settlement.

iii. The maximum overall size of any piece of hard material shall be 12 inches.

(c) The Department may require that all trench backfill material not conforming to this subsection and contract specifications be removed and spoiled to a spoil site approved by the Department in accordance with the requirements of N.J.A.C. 7:26-1, for solid or hazardous wastes.

7:14-2.14 Construction equipment costs compensation for extra work

(a) The contractor is entitled to all identifiable direct job equipment costs associated with extra work. The compensable cost for construction equipment shall be based upon the most current costs established in "Rental Rates for Construction Equipment" and "Rental Rates for Older Construction Equipment" (Blue Book), Dataquest Incorporated, A.C. Nielsen Company, San Jose, CA, 1983.

(b) Overhead and profits factors allowed in N.J.A.C. 7:14-2.7, shall only be applied to the rates charged for rental equipment used by the contractor for extra work.

7:14-2.15 Substantial and final completion of pipe projects; contractor's guarantees

(a) The contractor shall notify the owner/engineer in writing when the contract work is substantially complete as defined by N.J.A.C. 7:14-2.8(d). Within a reasonable time, the owner/engineer shall inspect the work.

(b) If the owner/engineer considers the work to be substantially complete, and before the Certificate of Substantial Completion is issued, the contractor shall:

1. Submit a construction schedule for the remaining work to be completed, and

2. Warrant and guarantee, for a period of one year or for a period as otherwise specified, from the date of Substantial Completion, that the completed work is free from defects due to faulty materials, equipment or workmanship. The Performance Bond shall remain in effect through the guarantee period.

(c) If the owner/engineer does not consider the work to be substantially complete, the engineer shall notify the contractor in writing, listing the items to be completed or corrected.

1. The contractor shall correct or complete items identified in writing within a reasonable time as specified in the contract documents, including repairs of any damage resulting from such defects to other work completed under the contract.

2. If the contractor fails to make such corrections within a reasonable time as specified in the contract documents, the owner may do so and charge the costs incurred, including direct and indirect costs, to the contractor.

(e) Before the Contractor has received notification of substantial completion, the owner/engineer may submit a request to the contractor to use a functional portion of the work if:

1. Such use does not significantly interfere with construction on any portion of remaining work to be completed, and

2. The conditions of such use shall be identified in the Certificate of Substantial Completion when issued by the owner/engineer.

(f) Final completion shall be that point at which the contract is completed, defective work corrected and clean up work accomplished. Unless a Certificate of Substantial Completion has been issued, the guarantee period shall begin upon certification of final completion by the engineer.

Subchapters 3 through 7. (RESERVED)

EXHIBIT NO. 10

NJSA 2A:44-143, 144

2A:44-143. Additional bond for payment of claims for labor, material, etc.; waiver, surety's obligation

2A:44-143. a. (1) When public buildings or other public works or improvements are about to be constructed, erected, altered or repaired under contract, at the expense of the State or any contracting unit, as defined in section 2 of P.L.1971, c.198 (C.40A:11-2), or school district, the board, officer or agent contracting on behalf of the State, contracting unit or school district, shall require delivery of the payment and performance bond issued in accordance with N.J.S.2A:44-147 and otherwise, as provided for by law, with an obligation for the performance of the contract and for the payment by the contractor for all labor performed or materials, provisions, provender or other supplies, teams, fuels, oils, implements or machinery used or consumed in, upon, for or about the construction, erection, alteration or repair of such buildings, works or improvements provided by subcontractors or material suppliers in contract with the contractor, or subcontractors or material suppliers in contract with a subcontractor to the contractor, which class of persons shall be the beneficiaries of the payment and performance bond. The board, officer or agent shall also require that all payment and performance bonds be issued by a surety which meets the following standards:

(a) The surety shall have the minimum surplus and capital stock or net cash assets required by R.S.17:17-6 or R.S.17:17-7, whichever is appropriate, at the time the invitation to bid is issued; and

(b) With respect to all payment and performance bonds in the amount of $850,000 or more, (i) if the amount of the bond is at least $850,000 but not more than $3.5 million, the surety shall hold a current certificate of authority, issued by the United States Secretary of the Treasury pursuant to 31 U.S.C. 9305, that is valid in the State of New Jersey as listed annually in the United States Treasury Circular 570, except that if the surety has been operational for a period in excess of five years, the surety shall be deemed to meet the requirements of this subsubparagraph if it is rated in one of the three highest categories by an independent, nationally recognized United States rating company that determines the financial stability of insurance companies, which rating company or companies shall be determined pursuant to standards promulgated by the Commissioner of Insurance by regulation adopted pursuant to the "Administrative Procedure Act," P.L.1968, c.410 (C.52:14B-1 et seq.), and (ii) if the amount of the bond is more than $3.5 million, then the surety shall hold a current certificate of authority, issued by the United States Secretary of the Treasury pursuant to 31 U.S.C. 9305, that is valid in the State of New Jersey as listed annually in the United States Treasury Circular 570 and, if the surety has been operational for a period in excess of five years, shall be rated in one of the three highest categories by an independent, nationally recognized United States rating company that determines the financial stability of insurance companies, which rating company or companies shall be determined pursuant to standards promulgated by the Commissioner of Insurance by regulation adopted pursuant to the "Administrative Procedure Act," P.L.1968, c.410 (C.52:14B-1 et seq.). A surety subject to the provisions of subsubparagraph (ii) of this subparagraph which does not hold a certificate of authority issued by the United States Secretary of the Treasury shall be exempt from the requirement to hold such a certificate if the surety meets an equivalent set of standards developed by the Commissioner of Insurance through regulation which at least equal, and may exceed, the general criteria required for issuance of a certificate of authority by the United States Secretary of the Treasury pursuant to 31 U.S.C. 9305. A surety company seeking such an exemption shall, not later than the 180th day following the effective date of P.L.1995, c.384, certify to the appropriate contracting unit that it meets that equivalent set of standards set forth by the commissioner as promulgated.

(2) When such contract is to be performed at the expense of the State and is entered into by the Director of the Division of Building and Construction or State departments designated by the Director of the Division of Building and Construction, the director or the State departments may: (a) establish for that contract the amount of the bond at any percentage, not exceeding 100%, of the amount bid, based upon the director's or department's assessment of the risk presented to the State by the type of contract, and other relevant factors, and (b) waive the bond requirement of this section entirely if the contract is for a sum not exceeding $200,000.

(3) When such a contract is to be performed at the expense of a contracting unit or school district, the board, officer or agent contracting on behalf of the contracting unit or school district may: (a) establish for that contract the amount of the bond at any percentage, not exceeding 100%, of the amount bid, based upon the board's, officer's or agent's assessment of the risk presented to the contracting unit or school district by the type of contract and other relevant factors, and (b) waive the bond requirement of this section entirely if the contract is for a sum not exceeding $100,000.

b. A surety's obligation shall not extend to any claim for damages based upon alleged negligence that resulted in personal injury, wrongful death, or damage to real or personal property, and no bond shall in any way be construed as a liability insurance policy. Nothing herein shall relieve the surety's obligation to guarantee the contractor's performance of all conditions of the contract, including the maintenance of liability insurance if and as required by the contract. Only the obligee named on the bond, and any subcontractor performing labor or any subcontractor or materialman providing materials for the construction, erection, alteration or repair of the public building, work or improvement for which the bond is required pursuant to this section, shall have any claim against the surety under the bond.

c. A board, officer or agent contracting on behalf of the State, contracting unit or school district shall not accept more than one payment and performance bond to cover a single construction contract. The board, officer or agent may accept a single bond executed by more than one surety to cover a single construction contract only if the combined underwriting limitations of all the named sureties, as set forth in the most current annual revision of United States Treasury Circular 570, or as determined by the Commissioner of Insurance pursuant to R.S.17:18-9, meet or exceed the amount of the contract to be performed.

d. A board, officer or agent contracting on behalf of the State, contracting unit or school district shall not accept a payment or performance bond unless there is attached thereto a Surety Disclosure Statement and Certification to which each surety executing the bond shall have subscribed. This statement and certification shall be complete in all respects and duly acknowledged according to law, and shall have substantially the following form:

SURETY DISCLOSURE STATEMENT AND CERTIFICATION

....., surety(ies) on the attached bond, hereby certifies(y) the following:

(1) The surety meets the applicable capital and surplus requirements of R.S.17:17-6 or R.S.17:17-7 as of the surety's most current annual filing with the New Jersey Department of Insurance.

(2) The capital (where applicable) and surplus, as determined in accordance with the applicable laws of this State, of the surety(ies) participating in the issuance of the attached bond is (are) in the following amount(s) as of the calendar year ended December 31, ... (most recent calendar year for which capital and surplus amounts are available), which amounts have been certified as indicated by certified public accountants (indicating separately for each surety that surety's capital and surplus amounts, together with the name and address of the firm of certified public accounts that shall have certified those amounts):

.....

.....

.....

(3) (a) With respect to each surety participating in the issuance of the attached bond that has received from the United States Secretary of the Treasury a certificate of authority pursuant to 31 U.S.C. 9305, the underwriting limitation established therein and the date as of which that limitation was effective is as follows (indicating for each such surety that surety's underwriting limitation and the effective date thereof):

.....

.....

.....

(b) With respect to each surety participating in the issuance of the attached bond that has not received such a certificate of authority from the United States Secretary of the Treasury, the underwriting limitation of that surety as established pursuant to R.S.17:18-9 as of (date on which such limitation was so established) is as follows (indicating for each such surety that surety's underwriting limitation and the date on which that limitation was established):

.....

.....

.....

(4) The amount of the bond to which this statement and certification is attached is $ ..... .

(5) If, by virtue of one or more contracts of reinsurance, the amount of the bond indicated under item (4) above exceeds the total underwriting limitation of all sureties on the bond as set forth in items (3)(a) or (3)(b) above, or both, then for each such contract of reinsurance:

(a) The name and address of each such reinsurer under that contract and the amount of that reinsurer's participation in the contract is as follows:.....

.....

.....

.....; and

(b) Each surety that is party to any such contract of reinsurance certifies that each reinsurer listed under item (5)(a) satisfies the credit for reinsurance requirement established under P.L.1993, c.243 (C.17:51B-1 et seq.) and any applicable regulations in effect as of the date on which the bond to which this statement and certification is attached shall have been filed with the appropriate public agency.

CERTIFICATE

(to be completed by an authorized certifying agent

for each surety on the bond)

I ..... (name of agent), as ..... (title of agent) for ..... (name of surety), a corporation/mutual insurance company/other (indicating type of business organization) (circle one) domiciled in ..... (state of domicile), DO HEREBY CERTIFY that, to the best of my knowledge, the foregoing statements made by me are true, and ACKNOWLEDGE that, if any of those statements are false, this bond is VOIDABLE.

.....

(Signature of certifying agent)

.....

(Printed name of certifying agent)

.....

(Title of certifying agent)

L.1951 (1st SS), c.344; amended 1979, c.408; 1989, c.316; 1991, c.454; 1995, c.38, s.2; 1995, c.384, s.1; 1996, c.81, s.2.

2A:44-144. Sureties on and amount of bond; condition for payment of claims; bond deposited, held for use of interested parties

2A:44-144. The bond required by this article shall be executed by the contractor with such sureties in accordance with N.J.S.2A:44-147 as shall be approved by the board, officer or agent acting on behalf of the State, contracting unit or school district, in an amount equal to 100 per cent of the contract price. The payment bond shall be conditioned for the payment by the contractor of all indebtedness which may accrue to any person, firm or corporation designated as a "beneficiary" pursuant to N.J.S.2A:44-143, in an amount not exceeding the sum specified in the bond, on account of any labor performed or materials, provisions, provender or other supplies, or teams, fuels, oils, implements or machinery used or consumed in, upon, for or about the construction, erection, alteration or repair of the public building or public work or improvement.

The payment bond shall be deposited with and be held by the board, officer or agent acting on behalf of the State, contracting unit or school district, for the use of any beneficiary thereof.

L.1951 (1st SS), c.344; amended 1995, c.384, s.2; 1996, c.81, s.3.

EXHIBIT 11

IMPLEMENTATION OF AMERICAN IRON AND STEEL PROVISIONS OF P.L. 113-76, CONSOLIDATED APPROPRIATIONS ACT, 2014

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

MAR 20 2014

OFFICE OF WATER

MEMORANDUM

SUBJECT: Implementation of American Iron and Steel provisions of P.L. 113-76, Consolidated Appropriations Act, 2014

FROM: For Andrew D. Sawyers, Director
Office of Wastewater Management (4201M)

Peter C. Grevatt, Director
Office of Ground Water and Drinking Water (4601M)

TO: Water Management Division Directors
Regions I - X

P.L. 113-76, Consolidated Appropriations Act, 2014 (Act), includes an "American Iron and Steel (AIS)" requirement in section 436 that requires Clean Water State Revolving Loan Fund (CWSRF) and Drinking Water State Revolving Loan Fund (DWSRF) assistance recipients to use iron and steel products that are produced in the United States for projects for the construction, alteration, maintenance, or repair of a public water system or treatment works if the project is funded through an assistance agreement executed beginning January 17, 2014 (enactment of the Act), through the end of Federal Fiscal Year 2014.

Section 436 also sets forth certain circumstances under which EPA may waive the AIS requirement. Furthermore, the Act specifically exempts projects where engineering plans and specifications were approved by a State agency prior to January 17, 2014.

The approach described below explains how EPA will implement the AIS requirement. The first section is in the form of questions and answers that address the types of projects that must comply with the AIS requirement, the types of products covered by the AIS requirement, and compliance. The second section is a step-by-step process for requesting waivers and the circumstances under which waivers may be granted.

Implementation

The Act states:

Sec. 436. (a)(1) None of the funds made available by a State water pollution control revolving fund as authorized by title VI of the Federal Water Pollution Control Act (33 U.S.C. 1381 et seq.) or made available by a drinking water treatment revolving loan fund as authorized by section 1452 of the Safe Drinking Water Act (42 U.S.C. 300j–12) shall be used for a project for the construction, alteration, maintenance, or repair of a public water system or treatment works unless all of the iron and steel products used in the project are produced in the United States.

(2) In this section, the term ''iron and steel products'' means the following products made primarily of iron or steel: lined or unlined pipes and fittings, manhole covers and other municipal castings, hydrants, tanks, flanges, pipe clamps and restraints, valves, structural steel, reinforced precast concrete, and construction materials.

(b) Subsection (a) shall not apply in any case or category of cases in which the Administrator of the Environmental Protection Agency (in this section referred to as the ''Administrator'') finds that—

(1) applying subsection (a) would be inconsistent with the public interest;

(2) iron and steel products are not produced in the United States in sufficient and reasonably available quantities and of a satisfactory quality; or

(3) inclusion of iron and steel products produced in the United States will increase the cost of the overall project by more than 25 percent.

(c) If the Administrator receives a request for a waiver under this section, the Administrator shall make available to the public on an informal basis a copy of the request and information available to the Administrator concerning the request, and shall allow for informal public input on the request for at least 15 days prior to making a finding based on the request. The Administrator shall make the request and accompanying information available by electronic means, including on the official public Internet Web site of the Environmental Protection Agency.

(d) This section shall be applied in a manner consistent with United States obligations under international agreements.

(e) The Administrator may retain up to 0.25 percent of the funds appropriated in this Act for the Clean and Drinking Water State Revolving Funds for carrying out

the provisions described in subsection (a)(1) for management and oversight of the requirements of this section.

(f) This section does not apply with respect to a project if a State agency approves the engineering plans and specifications for the project, in that agency's capacity to approve such plans and specifications prior to a project requesting bids, prior to the date of the enactment of this Act.

The following questions and answers provide guidance for implementing and complying with the AIS requirements:

Project Coverage

1) What classes of projects are covered by the AIS requirement?

All treatment works projects funded by a CWSRF assistance agreement, and all public water system projects funded by a DWSRF assistance agreement, from the date of enactment through the end of Federal Fiscal Year 2014, are covered. The AIS requirements apply to the entirety of the project, no matter when construction begins or ends. Additionally, the AIS requirements apply to all parts of the project, no matter the source of funding.

2) Does the AIS requirement apply to nonpoint source projects or national estuary projects?

No. Congress did not include an AIS requirement for nonpoint source and national estuary projects unless the project can also be classified as a 'treatment works' as defined by section 212 of the Clean Water Act.

3) Are any projects for the construction, alteration, maintenance, or repair of a public water system or treatment works excluded from the AIS requirement?

Any project, whether a treatment works project or a public water system project, for which engineering plans and specifications were approved by the responsible state agency prior to January 17, 2014, is excluded from the AIS requirements.

4) What if the project does not have approved engineering plans and specifications but has signed an assistance agreement with a CWSRF or DWSRF program prior to January 17, 2014?

The AIS requirements do not apply to any project for which an assistance agreement was signed prior to January 17, 2014.

5) What if the project does not have approved engineering plans and specifications, but bids were advertised prior to January 17, 2014 and an assistance agreement was signed after January 17, 2014?

If the project does not require approved engineering plans and specifications, the bid advertisement date will count in lieu of the approval date for purposes of the exemption in section 436(f).

6) What if the assistance agreement that was signed prior to January 17, 2014, only funded a part of the overall project, where the remainder of the project will be funded later with another SRF loan?

If the original assistance agreement funded any construction of the project, the date of the original assistance agreement counts for purposes of the exemption. If the original assistance agreement was only for planning and design, the date of that assistance agreement will count for purposes of the exemption only if there is a written commitment or expectation on the part of the assistance recipient to fund the remainder of the project with SRF funds.

7) What if the assistance agreement that was signed prior to January 17, 2014, funded the first phase of a multi-phase project, where the remaining phases will be funded by SRF assistance in the future?

In such a case, the phases of the project will be considered a single project if all construction necessary to complete the building or work, regardless of the number of contracts or assistance agreements involved, are closely related in purpose, time and place. However, there are many situations in which major construction activities are clearly undertaken in phases that are distinct in purpose, time, or place. In the case of distinct phases, projects with engineering plans and specifications approval or assistance agreements signed prior to January 17, 2014 would be excluded from AIS requirements while those approved/signed on January 17, 2014, or later would be covered by the AIS requirements.

8) What if a project has split funding from a non-SRF source?

Many States intend to fund projects with "split" funding, from the SRF program and from State or other programs. Based on the Act language in section 436, which requires that American iron and steel products be used in any project for the construction, alteration, maintenance, or repair of a public water system or treatment works receiving SRF funding between and including January 17, 2014 and September 30, 2014, any project that is funded in whole or in part with such funds must comply with the AIS requirement. A "project" consists of all construction necessary to complete the building or work regardless of the number of contracts or assistance agreements involved so long as all contracts and assistance agreements awarded are closely related in purpose, time and place. This precludes the intentional splitting of SRF projects into separate and smaller contracts or assistance agreements to avoid AIS coverage on some portion of a larger

project, particularly where the activities are integrally and proximately related to the whole. However, there are many situations in which major construction activities are clearly undertaken in separate phases that are distinct in purpose, time, or place, in which case, separate contracts or assistance agreement for SRF and State or other funding would carry separate requirements.

9) What about refinancing?

If a project began construction, financed from a non-SRF source, prior to January 17, 2014, but is refinanced through an SRF assistance agreement executed on or after January 17, 2014 and prior to October 1, 2014, AIS requirements will apply to all construction that occurs on or after January 17, 2014, through completion of construction, unless, as is likely, engineering plans and specifications were approved by a responsible state agency prior to January 17, 2014. There is no retroactive application of the AIS requirements where a refinancing occurs for a project that has completed construction prior to January 17, 2014.

10) Do the AIS requirements apply to any other EPA programs, besides the SRF program, such as the Tribal Set-aside grants or grants to the Territories and DC?

No, the AIS requirement only applies to funds made available by a State water pollution control revolving fund as authorized by title VI of the Federal Water Pollution Control Act (33 U.S.C. 1381 et seq.) or made available by a drinking water treatment revolving loan fund as authorized by section 1452 of the Safe Drinking Water Act (42 U.S.C. 300j–12)

Covered Iron and Steel Products

11) What is an iron or steel product?

For purposes of the CWSRF and DWSRF projects that must comply with the AIS requirement, an iron or steel product is one of the following made primarily of iron or steel that is permanently incorporated into the public water system or treatment works:

Lined or unlined pipes or fittings;
Manhole Covers;
Municipal Castings (defined in more detail below);
Hydrants;
Tanks;
Flanges;
Pipe clamps and restraints;
Valves;
Structural steel (defined in more detail below);
Reinforced precast concrete; and
Construction materials (defined in more detail below).

12) What does the term 'primarily iron or steel' mean?

'Primarily iron or steel' places constraints on the list of products above. For one of the listed products to be considered subject to the AIS requirements, it must be made of greater than 50% iron or steel, measured by cost. The cost should be based on the material costs.

13) Can you provide an example of how to perform a cost determination?

For example, the iron portion of a fire hydrant would likely be the bonnet, body and shoe, and the cost then would include the pouring and casting to create those components. The other material costs would include non-iron and steel internal workings of the fire hydrant (i.e., stem, coupling, valve, seals, etc). However, the assembly of the internal workings into the hydrant body would not be included in this cost calculation. If one of the listed products is not made primarily of iron or steel, United States (US) provenance is not required. An exception to this definition is reinforced precast concrete, which is addressed in a later question.

14) If a product is composed of more than 50% iron or steel, but is not listed in the above list of items, must the item be produced in the US? Alternatively, must the iron or steel in such a product be produced in the US?

The answer to both question is no. Only items on the above list must be produced in the US. Additionally, the iron or steel in a non-listed item can be sourced from outside the US.

15) What is the definition of steel?

Steel means an alloy that includes at least 50 percent iron, between .02 and 2 percent carbon, and may include other elements. Metallic elements such as chromium, nickel, molybdenum, manganese, and silicon may be added during the melting of steel for the purpose of enhancing properties such as corrosion resistance, hardness, or strength. The definition of steel covers carbon steel, alloy steel, stainless steel, tool steel and other specialty steels.

16) What does 'produced in the United States' mean?

Production in the United States of the iron or steel products used in the project requires that all manufacturing processes, including application of coatings, must take place in the United States, with the exception of metallurgical processes involving refinement of steel additives. All manufacturing processes includes processes such as melting, refining, forming, rolling, drawing, finishing, fabricating and coating. Further, if a domestic iron and steel product is taken out of the US for any part of the manufacturing process, it becomes foreign source material. However, raw materials such as iron ore, limestone and iron and steel scrap are not covered by the AIS requirement, and the

material(s), if any, being applied as a coating are similarly not covered. Non-iron or steel components of an iron and steel product may come from non-US sources. For example, for products such as valves and hydrants, the individual non-iron and steel components do not have to be of domestic origin.

17) Are the raw materials used in the production of iron or steel required to come from US sources?

No. Raw materials, such as iron ore, limestone, scrap iron, and scrap steel, can come from non-US sources.

18) If an above listed item is primarily made of iron or steel, but is only at the construction site temporarily, must such an item be produced in the US?

No. Only the above listed products made primarily of iron or steel, permanently incorporated into the project must be produced in the US. For example trench boxes, scaffolding or equipment, which are removed from the project site upon completion of the project, are not required to be made of U.S. Iron or Steel.

19) What is the definition of 'municipal castings'?

Municipal castings are cast iron or steel infrastructure products that are melted and cast. They typically provide access, protection, or housing for components incorporated into utility owned drinking water, storm water, wastewater, and surface infrastructure. They are typically made of grey or ductile iron, or steel. Examples of municipal castings are:

Access Hatches;
Ballast Screen;
Benches (Iron or Steel);
Bollards;
Cast Bases;
Cast Iron Hinged Hatches, Square and Rectangular;
Cast Iron Riser Rings;
Catch Basin Inlet;
Cleanout/Monument Boxes;
Construction Covers and Frames;
Curb and Corner Guards;
Curb Openings;
Detectable Warning Plates;
Downspout Shoes (Boot, Inlet);
Drainage Grates, Frames and Curb Inlets;
Inlets;
Junction Boxes;
Lampposts;
Manhole Covers, Rings and Frames, Risers;

Meter Boxes;
Service Boxes;
Steel Hinged Hatches, Square and Rectangular;
Steel Riser Rings;
Trash receptacles;
Tree Grates;
Tree Guards;
Trench Grates; and
Valve Boxes, Covers and Risers.

20) What is 'structural steel'?

Structural steel is rolled flanged shapes, having at least one dimension of their cross-section three inches or greater, which are used in the construction of bridges, buildings, ships, railroad rolling stock, and for numerous other constructional purposes. Such shapes are designated as wide-flange shapes, standard I-beams, channels, angles, tees and zees. Other shapes include H-piles, sheet piling, tie plates, cross ties, and those for other special purposes.

21) What is a 'construction material' for purposes of the AIS requirement?

Construction materials are those articles, materials, or supplies made primarily of iron and steel, that are permanently incorporated into the project, not including mechanical and/or electrical components, equipment and systems. Some of these products may overlap with what is also considered "structural steel". This includes, but is not limited to, the following products: wire rod, bar, angles, concrete reinforcing bar, wire, wire cloth, wire rope and cables, tubing, framing, joists, trusses, fasteners (i.e., nuts and bolts), welding rods, decking, grating, railings, stairs, access ramps, fire escapes, ladders, wall panels, dome structures, roofing, ductwork, surface drains, cable hanging systems, manhole steps, fencing and fence tubing, guardrails, doors, and stationary screens.

22) What is not considered a 'construction material' for purposes of the AIS requirement?

Mechanical and electrical components, equipment and systems are not considered construction materials. Mechanical equipment is typically that which has motorized parts and/or is powered by a motor. Electrical equipment is typically any machine powered by electricity and includes components that are part of the electrical distribution system.

The following examples (including their appurtenances necessary for their intended use and operation) are NOT considered construction materials: pumps, motors, gear reducers, drives (including variable frequency drives (VFDs)), electric/pneumatic/manual accessories used to operate valves (such as electric valve actuators), mixers, gates, motorized screens (such as traveling screens), blowers/aeration equipment, compressors, meters, sensors, controls and switches, supervisory control and

data acquisition (SCADA), membrane bioreactor systems, membrane filtration systems, filters, clarifiers and clarifier mechanisms, rakes, grinders, disinfection systems, presses (including belt presses), conveyors, cranes, HVAC (excluding ductwork), water heaters, heat exchangers, generators, cabinetry and housings (such as electrical boxes/enclosures), lighting fixtures, electrical conduit, emergency life systems, metal office furniture, shelving, laboratory equipment, analytical instrumentation, and dewatering equipment.

23) If the iron or steel is produced in the US, may other steps in the manufacturing process take place outside of the US, such as assembly?

No. Production in the US of the iron or steel used in a listed product requires that all manufacturing processes must take place in the United States, except metallurgical processes involving refinement of steel additives.

24) What processes must occur in the US to be compliant with the AIS requirement for reinforced precast concrete?

While reinforced precast concrete may not be at least 50% iron or steel, in this particular case, the reinforcing bar and wire must be produced in the US and meet the same standards as for any other iron or steel product. Additionally, the casting of the concrete product must take place in the US. The cement and other raw materials used in concrete production are not required to be of domestic origin.

If the reinforced concrete is cast at the construction site, the reinforcing bar and wire are considered to be a construction material and must be produced in the US.

Compliance

25) How should an assistance recipient document compliance with the AIS requirement?

In order to ensure compliance with the AIS requirement, specific AIS contract language must be included in each contract, starting with the assistance agreement, all the way down to the purchase agreements. Sample language for assistance agreements and contracts can be found in Appendix 3 and 4.

EPA recommends the use of a step certification process, similar to one used by the Federal Highway Administration. The step certification process is a method to ensure that producers adhere to the AIS requirement and assistance recipients can verify that products comply with the AIS requirement. The process also establishes accountability and better enables States to take enforcement actions against violators.

Step certification creates a paper trail which documents the location of the manufacturing process involved with the production of steel and iron materials. A step certification is a process under which each handler (supplier, fabricator, manufacturer,

processor, etc) of the iron and steel products certifies that their step in the process was domestically performed. Each time a step in the manufacturing process takes place, the manufacturer delivers its work along with a certification of its origin. A certification can be quite simple. Typically, it includes the name of the manufacturer, the location of the manufacturing facility where the product or process took place (not its headquarters), a description of the product or item being delivered, and a signature by a manufacturer's responsible party. Attached, as Appendix 5, are sample certifications. These certifications should be collected and maintained by assistance recipients.

Alternatively, the final manufacturer that delivers the iron or steel product to the worksite, vendor, or contractor, may provide a certification asserting that all manufacturing processes occurred in the US. While this type of certification may be acceptable, it may not provide the same degree of assurance. Additional documentation may be needed if the certification is lacking important information. Step certification is the best practice.

26) How should a State ensure assistance recipients are complying with the AIS requirement?

In order to ensure compliance with the AIS requirement, States SRF programs must include specific AIS contract language in the assistance agreement. Sample language for assistance agreements can be found in Appendix 3.

States should also, as a best practice, conduct site visits of projects during construction and review documentation demonstrating proof of compliance which the assistance recipient has gathered.

27) What happens if a State or EPA finds a non-compliant iron and/or steel product permanently incorporated in the project?

If a potentially non-compliant product is identified, the State should notify the assistance recipient of the apparent unauthorized use of the non-domestic component, including a proposed corrective action, and should be given the opportunity to reply. If unauthorized use is confirmed, the State can take one or more of the following actions: request a waiver where appropriate; require the removal of the non-domestic item; or withhold payment for all or part of the project. Only EPA can issue waivers to authorize the use of a non-domestic item. EPA may use remedies available to it under the Clean Water Act, the Safe Drinking Water Act, and 40 CFR part 31 grant regulations, in the event of a violation of a grant term and condition.

It is recommended that the State work collaboratively with EPA to determine the appropriate corrective action, especially in cases where the State is the one who identifies the item in noncompliance or there is a disagreement with the assistance recipient.

If fraud, waste, abuse, or any violation of the law is suspected, the Office of Inspector General (OIG) should be contacted immediately. The OIG can be reached at 1-

888-546-8740 or OIG_Hotline@epa.gov. More information can be found at this website: http://www.epa.gov/oig/hotline.htm.

28) How do international trade agreements affect the implementation of the AIS requirements?

The AIS provision applies in a manner consistent with United States obligations under international agreements. Typically, these obligations only apply to direct procurement by the entities that are signatories to such agreements. In general, SRF assistance recipients are not signatories to such agreements, so these agreements have no impact on this AIS provision. In the few instances where such an agreement applies to a municipality, that municipality is under the obligation to determine its applicability and requirements and document the actions taken to comply for the State.

Waiver Process

The statute permits EPA to issue waivers for a case or category of cases where EPA finds (1) that applying these requirements would be inconsistent with the public interest; (2) iron and steel products are not produced in the US in sufficient and reasonably available quantities and of a satisfactory quality; or (3) inclusion of iron and steel products produced in the US will increase the cost of the overall project by more than 25 percent.

In order to implement the AIS requirements, EPA has developed an approach to allow for effective and efficient implementation of the waiver process to allow projects to proceed in a timely manner. The framework described below will allow States, on behalf of the assistance recipients, to apply for waivers of the AIS requirement directly to EPA Headquarters. Only waiver requests received from states will be considered. Pursuant to the Act, EPA has the responsibility to make findings as to the issuance of waivers to the AIS requirements.

Definitions

The following terms are critical to the interpretation and implementation of the AIS requirements and apply to the process described in this memorandum:

Reasonably Available Quantity: The quantity of iron or steel products is available or will be available at the time needed and place needed, and in the proper form or specification as specified in the project plans and design.

Satisfactory Quality: The quality of iron or steel products, as specified in the project plans and designs.

Assistance Recipient: A borrower or grantee that receives funding from a State CWSRF or DWSRF program.

Step-By-Step Waiver Process

Application by Assistance Recipient

Each local entity that receives SRF water infrastructure financial assistance is required by section 436 of the Act to use American made iron and steel products in the construction of its project. However, the recipient may request a waiver. Until a waiver is granted by EPA, the AIS requirement stands, except as noted above with respect to municipalities covered by international agreements.

The waiver process begins with the SRF assistance recipient. In order to fulfill the AIS requirement, the assistance recipient must in good faith design the project (where applicable) and solicit bids for construction with American made iron and steel products. It is essential that the assistance recipient include the AIS terms in any request for proposals or solicitations for bids, and in all contracts (see Appendix 3 for sample construction contract language). The assistance recipient may receive a waiver at any point before, during, or after the bid process, if one or more of three conditions is met:

1. Applying the American Iron and Steel requirements of the Act would be inconsistent with the public interest;
2. Iron and steel products are not produced in the United States in sufficient and reasonably available quantities and of a satisfactory quality; or
3. Inclusion of iron and steel products produced in the United States will increase the cost of the overall project by more than 25 percent.

Proper and sufficient documentation must be provided by the assistance recipient. A checklist detailing the types of information required for a waiver to be processed is attached as Appendix 1.

Additionally, it is strongly encouraged that assistance recipients hold pre-bid conferences with potential bidders. A pre-bid conference can help to identify iron and steel products needed to complete the project as described in the plans and specifications that may not be available from domestic sources. It may also identify the need to seek a waiver prior to bid, and can help inform the recipient on compliance options.

In order to apply for a project waiver, the assistance recipient should email the request in the form of a Word document (.doc) to the State SRF program. It is strongly recommended that the State designate a single person for all AIS communications. The State SRF designee will review the application for the waiver and determine whether the necessary information has been included. Once the waiver application is complete, the State designee will forward the application to either of two email addresses. For CWSRF waiver requests, please send the application to: cwsrfwaiver@epa.gov. For DWSRF waiver requests, please send the application to: dwsrfwaiver@epa.gov.

Evaluation by EPA

After receiving an application for waiver of the AIS requirements, EPA Headquarters will publish the request on its website for 15 days and receive informal comment. EPA Headquarters will then use the checklist in Appendix 2 to determine whether the application properly and adequately documents and justifies the statutory basis cited for the waiver – that it is quantitatively and qualitatively sufficient – and to determine whether or not to grant the waiver.

In the event that EPA finds that adequate documentation and justification has been submitted, the Administrator may grant a waiver to the assistance recipient. EPA will notify the State designee that a waiver request has been approved or denied as soon as such a decision has been made. Granting such a waiver is a three-step process:

1. Posting – After receiving an application for a waiver, EPA is required to publish the application and all material submitted with the application on EPA's website for 15 days. During that period, the public will have the opportunity to review the request and provide informal comment to EPA. The website can be found at: http://water.epa.gov/grants_funding/aisrequirement.cfm

2. Evaluation – After receiving an application for waiver of the AIS requirements, EPA Headquarters will use the checklist in Appendix 2 to determine whether the application properly and adequately documents and justifies the statutory basis cited for the waiver – that it is quantitatively and qualitatively sufficient – and to determine whether or not to grant the waiver.

3. Signature of waiver approval by the Administrator or another agency official with delegated authority – As soon as the waiver is signed and dated, EPA will notify the State SRF program, and post the signed waiver on our website. The assistance recipient should keep a copy of the signed waiver in its project files.

Public Interest Waivers

EPA has the authority to issue public interest waivers. Evaluation of a public interest waiver request may be more complicated than that of other waiver requests so they may take more time than other waiver requests for a decision to be made. An example of a public interest waiver that might be issued could be for a community that has standardized on a particular type or manufacturer of a valve because of its performance to meet their specifications. Switching to an alternative valve may require staff to be trained on the new equipment and additional spare parts would need to be purchased and stocked, existing valves may need to be unnecessarily replaced, and portions of the system may need to be redesigned. Therefore, requiring the community to install an alternative valve would be inconsistent with public interest.

EPA also has the authority to issue a public interest waiver that covers categories of products that might apply to all projects.

EPA reserves the right to issue national waivers that may apply to particular classes of assistance recipients, particular classes of projects, or particular categories of iron or steel products. EPA may develop national or (US geographic) regional categorical waivers through the identification of similar circumstances in the detailed justifications presented to EPA in a waiver request or requests. EPA may issue a national waiver based on policy decisions regarding the public's interest or a determination that a particular item is not produced domestically in reasonably available quantities or of a sufficient quality. In such cases, EPA may determine it is necessary to issue a national waiver.

If you have any questions concerning the contents of this memorandum, you may contact us, or have your staff contact Jordan Dorfman, Attorney-Advisor, State Revolving Fund Branch, Municipal Support Division, at dorfman.jordan@epa.gov or (202) 564-0614 or Kiri Anderer, Environmental Engineer, Infrastructure Branch, Drinking Water Protection Division, at anderer.kirsten@epa.gov or (202) 564-3134.

Attachments

Appendix 1: Information Checklist for Waiver Request

The purpose of this checklist is to help ensure that all appropriate and necessary information is submitted to EPA. EPA recommends that States review this checklist carefully and provide all appropriate information to EPA. This checklist is for informational purposes only and does not need to be included as part of a waiver application.

Items	✓	Notes
General • Waiver request includes the following information: — Description of the foreign and domestic construction materials — Unit of measure — Quantity — Price — Time of delivery or availability — Location of the construction project — Name and address of the proposed supplier — A detailed justification for the use of foreign construction materials • Waiver request was submitted according to the instructions in the memorandum • Assistance recipient made a good faith effort to solicit bids for domestic iron and steel products, as demonstrated by language in requests for proposals, contracts, and communications with the prime contractor		
Cost Waiver Requests • Waiver request includes the following information: — Comparison of overall cost of project with domestic iron and steel products to overall cost of project with foreign iron and steel products — Relevant excerpts from the bid documents used by the contractors to complete the comparison — Supporting documentation indicating that the contractor made a reasonable survey of the market, such as a description of the process for identifying suppliers and a list of contacted suppliers		
Availability Waiver Requests • Waiver request includes the following supporting documentation necessary to demonstrate the availability, quantity, and/or quality of the materials for which the waiver is requested: — Supplier information or pricing information from a reasonable number of domestic suppliers indicating availability/delivery date for construction materials — Documentation of the assistance recipient's efforts to find available domestic sources, such as a description of the process for identifying suppliers and a list of contacted suppliers. — Project schedule — Relevant excerpts from project plans, specifications, and permits indicating the required quantity and quality of construction materials • Waiver request includes a statement from the prime contractor and/or supplier confirming the non-availability of the domestic construction materials for which the waiver is sought • Has the State received other waiver requests for the materials described in this waiver request, for comparable projects?		

Appendix 2: HQ Review Checklist for Waiver Request

Instructions: To be completed by EPA. Review all waiver requests using the questions in the checklist, and mark the appropriate box as Yes, No or N/A. Marks that fall inside the shaded boxes may be grounds for denying the waiver. If none of your review markings fall into a shaded box, the waiver is eligible for approval if it indicates that one or more of the following conditions applies to the domestic product for which the waiver is sought:

1. The iron and/or steel products are not produced in the United States in sufficient and reasonably available quantities and of a satisfactory quality.
2. The inclusion of iron and/or steel products produced in the United States will increase the cost of the overall project by more than 25 percent.

Review Items	Yes	No	N/A	Comments
Cost Waiver Requests				
• Does the waiver request include the following information?				
— Comparison of overall cost of project with domestic iron and steel products to overall cost of project with foreign iron and steel products				
— Relevant excerpts from the bid documents used by the contractors to complete the comparison				
— A sufficient number of bid documents or pricing information from domestic sources to constitute a reasonable survey of the market				
• Does the Total Domestic Project exceed the Total Foreign Project Cost by more than 25%?				
Availability Waiver Requests				
• Does the waiver request include supporting documentation sufficient to show the availability, quantity, and/or quality of the iron and/or steel product for which the waiver is requested?				
— Supplier information or other documentation indicating availability/delivery date for materials				
— Project schedule				
— Relevant excerpts from project plans, specifications, and permits indicating the required quantity and quality of materials				
• Does supporting documentation provide sufficient evidence that the contractors made a reasonable effort to locate domestic suppliers of materials, such as a description of the process for identifying suppliers and a list of contacted suppliers?				
• Based on the materials delivery/availability date indicated in the supporting documentation, will the materials be unavailable when they are needed according to the project schedule? (By item, list schedule date and domestic delivery quote date or other relevant information)				
• Is EPA aware of any other evidence indicating the non-availability of the materials for which the waiver is requested? Examples include:				
— Multiple waiver requests for the materials described in this waiver request, for comparable projects in the same State				
— Multiple waiver requests for the materials described in this waiver request, for comparable projects in other States				
— Correspondence with construction trade associations indicating the non-availability of the materials				
• Are the available domestic materials indicated in the bid documents of inadequate quality compared those required by the project plans, specifications, and/or permits?				

Appendix 3: Example Loan Agreement Language

ALL ASSISTANCE AGREEMENT MUST HAVE A CLAUSE REQUIRING COMPLIANCE WITH THE AIS REQUIREMENT. THIS IS AN EXAMPLE OF WHAT COULD BE INCLUDED IN SRF ASSISTANCE AGREEMENTS. EPA MAKES NO CLAIMS REGARDING THE LEGALITY OF THIS CLAUSE WITH RESPECT TO STATE LAW:

Comply with all federal requirements applicable to the Loan (including those imposed by the 2014 Appropriations Act and related SRF Policy Guidelines) which the Participant understands includes, among other, requirements that all of the iron and steel products used in the Project are to be produced in the United States ("American Iron and Steel Requirement") unless (i) the Participant has requested and obtained a waiver from the Agency pertaining to the Project or (ii) the Finance Authority has otherwise advised the Participant in writing that the American Iron and Steel Requirement is not applicable to the Project.

Comply with all record keeping and reporting requirements under the Clean Water Act/Safe Drinking Water Act, including any reports required by a Federal agency or the Finance Authority such as performance indicators of program deliverables, information on costs and project progress. The Participant understands that (i) each contract and subcontract related to the Project is subject to audit by appropriate federal and state entities and (ii) failure to comply with the Clean Water Act/Safe Drinking Water Act and this Agreement may be a default hereunder that results in a repayment of the Loan in advance of the maturity of the Bonds and/or other remedial actions.

Appendix 4: Sample Construction Contract Language

ALL CONTRACTS MUST HAVE A CLAUSE REQUIRING COMPLIANCE WITH THE AIS REQUIREMENT. THIS IS AN EXAMPLE OF WHAT COULD BE INCLUDED IN ALL CONTRACTS IN PROJECTS THAT USE SRF FUNDS. EPA MAKES NO CLAIMS REGARDING THE LEGALITY OF THIS CLAUSE WITH RESPECT TO STATE OR LOCAL LAW:

The Contractor acknowledges to and for the benefit of the City of _____ ("Purchaser") and the _____ (the "State") that it understands the goods and services under this Agreement are being funded with monies made available by the Clean Water State Revolving Fund and/or Drinking Water State Revolving Fund that have statutory requirements commonly known as "American Iron and Steel;" that requires all of the iron and steel products used in the project to be produced in the United States ("American Iron and Steel Requirement") including iron and steel products provided by the Contactor pursuant to this Agreement. The Contractor hereby represents and warrants to and for the benefit of the Purchaser and the State that (a) the Contractor has reviewed and understands the American Iron and Steel Requirement, (b) all of the iron and steel products used in the project will be and/or have been produced in the United States in a manner that complies with the American Iron and Steel Requirement, unless a waiver of the requirement is approved, and (c) the Contractor will provide any further verified information, certification or assurance of compliance with this paragraph, or information necessary to support a waiver of the American Iron and Steel Requirement, as may be requested by the Purchaser or the State. Notwithstanding any other provision of this Agreement, any failure to comply with this paragraph by the Contractor shall permit the Purchaser or State to recover as damages against the Contractor any loss, expense, or cost (including without limitation attorney's fees) incurred by the Purchaser or State resulting from any such failure (including without limitation any impairment or loss of funding, whether in whole or in part, from the State or any damages owed to the State by the Purchaser). While the Contractor has no direct contractual privity with the State, as a lender to the Purchaser for the funding of its project, the Purchaser and the Contractor agree that the State is a third-party beneficiary and neither this paragraph (nor any other provision of this Agreement necessary to give this paragraph force or effect) shall be amended or waived without the prior written consent of the State.

Appendix 5: Sample Certifications

The following information is provided as a sample letter of **step** certification for AIS compliance. Documentation must be provided on company letterhead.

Date

Company Name

Company Address

City, State Zip

Subject: American Iron and Steel Step Certification for Project (XXXXXXXXXX)

I, (company representative), certify that the (melting, bending, coating, galvanizing, cutting, etc.) process for (manufacturing or fabricating) the following products and/or materials shipped or provided for the subject project is in full compliance with the American Iron and Steel requirement as mandated in EPA's State Revolving Fund Programs.

Item, Products and/or Materials:

1. Xxxx
2. Xxxx
3. Xxxx

Such process took place at the following location:

_____

If any of the above compliance statements change while providing material to this project we will immediately notify the prime contractor and the engineer.

Signed by company representative

The following information is provided as a sample letter of certification for AIS compliance. Documentation must be provided on company letterhead.

Date

Company Name

Company Address

City, State Zip

Subject: American Iron and Steel Certification for Project (XXXXXXXXXX)

I, (company representative), certify that the following products and/or materials shipped/provided to the subject project are in full compliance with the American Iron and Steel requirement as mandated in EPA's State Revolving Fund Programs.

Item, Products and/or Materials:

1. Xxxx
2. Xxxx
3. Xxxx

Such process took place at the following location:

_____

If any of the above compliance statements change while providing material to this project we will immediately notify the prime contractor and the engineer.

Signed by company representative

EXHIBIT NO. 12

LIST OF DRAWINGS

PASSAIC VALLEY SEWERAGE COMMISSION
600 WILSON AVENUE
NEWARK, NEW JERSEY 07105

ADMINISTRATION BUILDING REHABILITATION

CONTRACT NO. A920

Index of Drawings

Index of Drawings
(Continued)

Index of Drawings
(Continued)

Index of Drawings
(Continued)

SECTION 00900

SCOPE OF CONTRACT

CONTRACT NO. A920
ADMINISTRATION BUILDING REHABILITATION

General

In general, the work shall include the site investigation, site preparation, concrete and masonry work, general building construction, piping, mechanical process work, painting, testing, manufacturers' services, and final cleanup. Work related to structural steel and ornamental iron, plumbing, heating and ventilating and electrical work shall be included as part of this single overall contract.

During the course of construction, all subcontractors shall cooperate regarding the use of available facilities and undertake the work within their contract areas of responsibility so as to facilitate the work of other subcontracts. The scheduling of work shall be coordinated by the General Contractor with the review of the Engineer. Time scheduling shall be arranged to enable all subcontractors to work at the same time as far as may be practical. The Contractor shall be responsible for overall construction operations at the site and other subcontractors shall work through him and the Engineer in all matters involving the coordination of the various items of work. Regularly scheduled job meetings shall be held at least twice per month to resolve differences relating to coordination of the various phases of the work. Site cleanup shall be the responsibility of the Contractor and he shall have the cooperation of all subcontractors on the site in this regard.

All existing electrical, heat, gas, water, telephone, or other utility services to the existing facilities shall be kept in operation at all times during the construction period.

Brief general descriptions of the various components of the work are set forth in the sections which follow. All work included on the Drawings and in the Specifications shall be completed in full without further compensation than is provided for in the Lump Sum Price regardless of whether or not such work is specifically mentioned in the Scope of Contract Items as follows.

Although the contract is a single overall construction contract, the Specifications describe construction operations in various standard broad work categories. The general construction work shall include in general, site excavation and backfill, environmental protection and restoration, concrete and masonry work, general building construction, and final clean-up.

All coordination between the various trades shall be the Contractor's responsibility and he shall provide services of competent professionals to provide this coordination function to the extent of preparing necessary coordination drawings which interrelate with the approved shop drawings.

The following outlines the general scope of work to be considered and included in the bid price as proposed for this project:

SC1.00 Work Included in Base Bid Item 1.00 Mobilization

For the lump sum price bid under this item the contractor shall furnish all labor, materials and equipment for mobilization, complete.

Mobilization shall consist of the cost of initiating the contract. It shall include all the bonds, insurance, facilities and services needed before work on the other items of work on the contract can begin. Payment for mobilization will be made at the lump sum price bid for this item, which price shall include all the costs of initiating the contract. The provision for payment of this item shall supersede any provision elsewhere in the specifications or including the costs of these initial services and facilities in the prices bid for the various items in the proposal.

The lump sum price bid for this item is limited in accordance with N.J.A.C. 7:14-2.9 to the following maximum amounts:

Original Contract Bid Amount (Including Mobilization)		**Maximum Amount for** Mobilization
From	To	
$0	$100,000	$3,000
$100,000	$500,000	$15,000
$500,000	$1,000,000	$30,000
$1,000,000	$2,000,000	$60,000
$2,000,000	$3,000,000	$90,000
$3,000,000	$4,000,000	$120,000
$4,000,000	$5,000,000	$125,000
$5,000,000	$6,000,000	$150,000
$6,000,000	$7,000,000	$175,000
$7,000,000	$10,000,000	$200,000
$10,000,000	-----	2.5% of the bid amount

The lump sum price bid for mobilization shall be payable to the Contractor whenever he shall have completed 10 percent of the work of the Contract. For the purposes of this item, 10 percent of the work shall be considered completed when the total payment earned, exclusive of the amount bid for this item, as shown the monthly certificates of the approximate quantities of work done, shall exceed10 percent of the total price bid for the Contract

SC2.00 Work Included in Base Bid Item 2.00, Rehabilitation of Administration Building

For the lump sum price bid on this Contract, the Contractor shall furnish all costs, labor, materials, equipment, services, and resources as required or needed to complete the rehabilitation of the Administration Building as detailed and/or specified in the Contract Plans and Specifications and as noted below. The lump sum price bid shall include any and all anticipated costs as needed to provide for a completely functional building as intended and detailed in the Contract Documents.

Following award of the Contract the Contractor shall provide PVSC with a breakdown of the lump sum fee in accordance with the following:

i. Demolition - Work shall include, but is not limited to site clearing, demolition work associated with the building interior, existing plumbing, existing HVAC, existing electrical and fire suppression systems as needed or required including the cost of removal and disposal of same in accordance with all applicable laws and regulations.

ii. Site Improvements - Site improvements shall include, but is not limited to the installation of site piping, construction/restoration of paved areas, excavation, grading, subgrade preparation; concrete curbs, walks, landscaping and other site work. Work shall also include installation of an automatic non potable water filter in the Influent Pump Station, installation of sump pumps and drainage trenches in the Administration Building, realigning the ejector pumps discharge piping, and all other work as needed or required.

iii. Roof Penthouse Addition - shall include, but is not limited to construction of the new penthouse addition, modifications to the existing building structural components, and roofing and structural modifications/repair as needed or required.

iv. Building Envelope Modifications - shall include, but is not limited to work associated with the modifications/replacement of the roof, new railings, new window panels, wall modifications, and areaway modifications as needed or required.

v. Interior Construction - shall include, but is not limited to work associated with partitions and framing, soffits and chase construction, interior/exterior doors and hardware, storefront framing and subfloor preparation and repair as needed or required.

vi. Finishes - shall include, but is not limited to work associated with the ceilings, various floor coverings, wall coverings, stone and veneer paneling, painting, and carpentry trim and finishes as needed or required.

vii. Furniture - shall include, but is not limited to work and costs associated with removal, relocation, and if needed storage of all 2nd floor furniture as necessary to perform their work, and the reinstallation of the same as directed by PVSC. PVSC is purchasing new equipment for the first floor under a separate contract. The Contractor shall coordinate and undertake the interconnection of all furniture within building with the mechanical, electrical, and communication/audio visual components as installed under this contract.

viii. Special Construction - shall include, but is not limited to work associated with fabrication and construction of various casework, the Commissioner's Room platform, and the furnishing and installation of appliances as needed or required.

ix. . Electrical System - shall include, but is not limited to modifications/reconstruction of the existing building electrical equipment, buried conduits and duct banks, distribution switchboards, feeders, panels, motor control centers, transformers, lighting fixtures, branch circuits, devices, controls, wiring and connections as needed or required.

x. Fire Suppression System - shall include, but is not limited to fire alarm panel modifications, and construction of new smoke detectors, strobes, horn/strobes, manual pull stations, cables, conduits and miscellaneous construction as needed or required.

xi. Plumbing System – shall include, but is not limited to modifications/reconstruction of piping systems and fixtures including roof and floor drainage, sanitary drainage, potable hot and cold water lines, pipe hangers, flashing items, valves, vents, blowoffs, traps, cleanouts, lavatories, slop sinks, urinals, water closets, fire suppression systems, all with associated fittings, water coolers, fixture carriers, eye wash units, appurtenances, and accessories. Work also includes connections to existing systems, testing and disinfection as needed or required.

xii. HVAC - shall include, but is not limited to heating and ventilating systems, hot water boilers, exhaust systems, fresh air intake systems, supply air systems including registers, grilles, diffusers, fire dampers, duct work, access doors, insulation, hangers, piping, valves and specialties, and appurtenances and accessories as needed or required. Work also includes testing and balancing, controls and start-up.

SC3.00 Work Included in Base Bid Item 3.00, Audio/Visual Allowance

Under this allowance item, and amount provided, the Contractor shall retain an audio/visual specialist to work with PVSC personnel in the selection, design, and installation of audio/visual equipment and components as selected by PVSC for various locations within the building including, but not limited to the Entrance, Executive Director's Conference Room, the Commissioner's Conference Room, and the General Public Meeting Room.

SC4.00 Work Included in Base Bid Item 4.00, Sign Allowance

Under this allowance item, and amount provided, the Contractor shall provide any and all signage as required under the New Jersey Environmental Infrastructure Trust as detailed within the specifications.

SC5.00 Work Included in Base Bid Item 5.00, Painting, Wall Finishes & Flooring Allowance

Under this allowance item, and amount provided, the Contractor shall provide painting, wall finishes & flooring for segments of the 2nd floor of the building as directed and approved by PVSC. Painting, wall finishes & flooring on the 1st floor of the building, and/or as noted on the plans, shall be included in the lump sum under Base Bid Item 1.00.

SC6.00 Work Included in Base Bid Item 6.00, Allowance for Additional Authorized Work

Under this Allowance Item, and amount has been provided for additional work clearly outside the scope of work as shown on the contract drawings and describe in the specifications. In general, this allowance is reserved for additional work items approved by the Owner identified during this Contract that are clearly outside the scope of the bid items, including major unforeseen conditions that were not identified in the contract documents. Should the Contractor determine such conditions exist he shall immediately notify the Engineer and Owner in writing and also provide the same a breakdown of the Contractor's price to make use of the allowance. Once the Engineer and Owner have provided authorization for the Contractor, the amount will be applied towards this Allowance. All items that are applied to the Allowance are payable in the final payment of this contract.

SECTION 01010

SUMMARY OF WORK

PART 1 GENERAL

1.01 LOCATION OF WORK

A. The Passaic Valley Sewerage Commission (PVSC) intends on having improvements made under Contract A920. The work to be completed under this Contract is located at Passaic Valley Sewerage Commission Facility, 600 Wilson Avenue, New Jersey 07105.

1.02 SCOPE OF WORK

A. Furnish all labor, materials, equipment and incidentals required to complete the Administration Building Rehabilitation in its entirety as shown on the Drawings and as specified herein.

B. Refer to Section 00900 for the general description of the work included under this contract.

1.03 WORK SEQUENCE

A. Contractor shall accommodate Owner's occupancy during the construction period and ensure completion of the Work in the Contract Time. Completion dates of the various stages shall be in accordance with the approved construction schedule submitted by the Contractor.

1.04 CONTRACTOR'S USE OF PREMISES

A. Contractor shall limit the use of the premises for his/her Work and for storage to allow for Owner occupancy and use.

B. Coordinate use of premises with Owner or Engineer.

C. Contractor shall assume full responsibility for security of all his/her and his/her subcontractors' materials and equipment stored on the site. Equipment storage areas and staging area are shown on the Drawings.

D. If directed by the Owner or Engineer, move any stored items, which interfere with operations of Owner or other contractors.

E. Obtain and pay for use of additional storage or work areas if needed to perform the Work.

1.05 OWNER OCCUPANCY

A. Owner will occupy premises during performance of the work to conduct his/her normal operations. Coordinate all construction operations with Owner or Engineer to minimize conflict and to facilitate Owner usage.

END OF SECTION

SECTION 01025

MEASUREMENT AND PAYMENT

PART 1: GENERAL

1.01 SCOPE OF WORK

A. The Work shall include furnishing all labor, materials, equipment and incidentals required to complete the work specified herein and shown on the Contract Drawings and all addenda. The Bid Proposal for this Contract is a combination of lump sum costs, unit prices and allowance items.

1.02 MOBILIZATION (Bid Item No. 1)

A. Measurement and Payment

For the lump sum price bid under this item the contractor shall furnish all labor, materials and equipment for mobilization, complete.

Mobilization shall consist of the cost of initiating the contract. It shall include all the bonds, insurance, facilities and services needed before work on the other items of work on the contract can begin. Payment for mobilization will be made at the lump sum price bid for this item, which price shall include all the costs of initiating the contract. The lump sum price bid for this item is limited to the maximum amounts provided in N.J.A.C. 7:14-2.9.

1.03 REHABILITATION OF ADMINISTRATION BUILDING (Bid Item No. 2)

A. Measurement and Payment

For the lump sum price bid on this Contract, the Contractor shall furnish all costs, labor, materials, equipment, services, and resources as required or needed to complete the rehabilitation of the Administration Building as detailed and/or specified in the Contract Plans and Specifications and as noted below. The lump sum price bid shall include any and all anticipated costs as needed to provide for a completely functional building as intended and detailed in the Contract Documents.

1.04 ALLOWANCE AUDIO VISUAL DESIGN & IMPLEMENTATION (Bid Item No. 3)

A. Measurement and Payment

This allowance is reserved as a means of payment for the selection, design, and installation of audio/visual equipment and components as selected by the Commission and provided by the Contractor.

1.05 ALLOWANCE FOR SIGNS (Bid Item No. 4)

A. Measurement and Payment

This allowance is reserved as a means of payment for any and all signage as required by the New

Jersey Environmental Infrastructure Trust and provided by the Contractor.

1.06 ALLOWANCE FOR PAINTING, WALL FINISHES & FLOORING ON 2ND FLOOR (Bid Item No. 5)

A. Measurement and Payment

This allowance is reserved as a means of payment for painting, wall finishes & flooring for segments of the 2nd floor of the building as directed and approved by the Commission and provided by the Contractor.

1.07 ALLOWANCE ADDITIONAL AUTHORIZED WORK (Bid Item No. 6)

A. Measurement and Payment

1. Measurement for the Allowance for Additional Authorized Work shall be on an as needed basis.

2. Payment for the work shall be made at a price agreed upon by the Owner and shall provide full compensation for furnishing all labor, materials, equipment, and incidentals required to complete the work as necessary. The Allowance for Additional Authorized Work is intended to provide for work that may later be determined to be necessary for the completion of the project but is not covered in the bid specifications. Written authorization by the OWNER for utilization of any part of the allowances for any such work shall be required.

1.08 EXTRA WORK AND ALLOWANCES

A. Extra work, if any and allowances as authorized by the Owner will be performed in accordance with Articles 10, 11 and 12 of the General Conditions of the Contract and will be paid for in accordance with the provisions of those Articles and Article.

PART 2: PRODUCTS

(NOT USED)

PART 3: EXECUTION

(NOT USED)

END OF SECTION

SECTION 01046

CONTROL OF WORK

PART 1: GENERAL

1.01 CONSTRUCTION EQUIPMENT

A. Furnish equipment that will be efficient, appropriate and large enough to secure a satisfactory quality of work and a rate of progress that will insure the completion of the work within the Contract Time. If at any time it appears to the Engineer to be inefficient, inappropriate or insufficient for securing the quality of work required or for producing the rate of progress aforesaid, he/she may order the Contractor to increase the efficiency, change the character or increase the plant equipment and the Contractor shall conform to such order. Failure of the Engineer to give such order shall in no way relieve the Contractor of his/her obligations to secure the quality of the work and rate of progress required.

1.02 PIPE LOCATIONS

A. Pipe locations shall be located substantially as indicated on the Drawings, but the Engineer reserves the right to make such modifications in locations as may be found desirable to avoid interference with existing structures or for other reasons. Where fittings are noted on the Drawings, such notation is for the Contractor's convenience and does not relieve him/her from laying and jointing different or additional items where required.

1.03 CARE AND PROTECTION OF PROPERTY

A. The Contractor shall be responsible for the preservation of all public and private property and shall use every precaution necessary to prevent damage thereto. If any direct or indirect damage is done to public or private property by or on account of any act, omission, neglect, or misconduct in the execution of the work on the part of the Contractor, such property shall be restored by the Contractor, at his/her expense, to a condition similar or equal to that existing before the damage was done, or he/she shall make good the damage in other manner acceptable to the Engineer.

1.04 PROTECTION AND RELOCATION OF EXISTING STRUCTURES AND UTILITIES

A. The Contractor shall assume full responsibility for the protection of all buildings, structures, and utilities, public or private, including signs, services to buildings, utilities, gas pipes, water pipes, hydrants, sewers, drains and electric and telephone cables, whether or not they are shown on the Drawings. The Contractor shall carefully support and protect all such structures and utilities from injury of any kind. Any damage resulting from the Contractor's operations shall be repaired by him/her at his/her expense.

B. Protection and temporary removal and replacement of existing utilities and structures as described in this Section shall be a part of the work under the Contract and all costs in connection therewith shall be included in the Price Bid in the Bid Form.

C. If, in the opinion of the Engineer, permanent relocation of a utility, other than those indicated on the Drawings, is required, he/she may direct the Contractor, in writing, to perform the work. Work so ordered will be paid for at the Contract unit prices, if applicable, or as extra work under Article 6 of the General Conditions. If relocation of a privately owned utility is required, the Owner will

notify the Utility to perform the work as expeditiously as possible. The Contractor shall fully cooperate with the Owner and Utility and shall have no claim for delay due to such relocation.

1.05 CLEANUP AND DISPOSAL OF EXCESS MATERIAL

A. During the course of the work, the Contractor shall keep the site of his/her operations in as clean and neat a condition as is possible. He/she shall dispose of all residues resulting from the construction work and, at the conclusion of the work, he/she shall remove and haul away any surplus excavation, broken pavement, lumber, equipment, temporary structures and any other refuse remaining from the construction operations and shall leave the entire site of the work in a neat and orderly condition.

B. In order to prevent environmental pollution arising from the construction activities related to the performance of this Contract, the Contractor and his/her subcontractors shall comply with all applicable Federal, State and local laws and regulations concerning waste material disposal, as well as the specific requirements stated in this Section and elsewhere in the Specifications.

END OF SECTION

SECTION 01170

SPECIAL PROVISIONS

PART 1 GENERAL

1.01 SLEEVES AND OPENINGS

A. Provide all openings, channels, chases, etc and install anchor bolts and other items to be embedded in concrete, as required to complete the work under this Contract, together with those required by subcontractors and perform all cutting and patching, excepting cutting and patching of materials of a specified trade and as stated otherwise in the following paragraph.

B. Subcontractors shall furnish all sleeves, inserts, hangers, anchor bolts, etc, required for the execution of their work. It shall be their responsibility before the work of the Contractor is begun to furnish him with the above items and with templates, drawings or written information covering chases, openings, etc, which they require and to follow up the work of the Contractor as it progresses, making sure that their drawings and written instructions are carried out. Failing to do this, they shall be responsible for the cost of any corrective measures which may be required to provide necessary openings, etc. If the Contractor fails to carry out the directions given him, covering details and locations of openings, etc, he shall be responsible for any cutting and refinishing required to make the necessary corrections. In no case shall beams, lintels, or other structural members be cut without the approval of the Engineer.

1.03 IDENTIFICATION

A. The Contractor shall prepare an identification system as required by Section 01340.

1.04 SPARE PARTS

A. Furnish all spare parts recommended by the manufacturer or system supplier for one year of service. In addition, furnish all spare parts itemized in each Section.

B. Collect and store all spare parts in an area to be designated by the Engineer. Furnish the Engineer with an inventory listing all spare parts, the equipment they are associated with, the name and address of the supplier and the delivered cost of each item. Copies of actual invoices for each item shall be furnished with the inventory to substantiate the delivery cost.

C. Spare parts shall be packed in cartons, properly labeled with indelible markings with complete descriptive information including manufacturer, part number, part name and equipment for which the part is to be used and shall be properly treated for one year of storage.

D. A Spare Parts Turnover Form shall be completed for each piece of equipment provided for this project. The Form to be completed is appended to this section.

END OF SECTION

SECTION 01172

PIPE PENETRATIONS

PART 1 GENERAL

1.01 SCOPE OF WORK

A. Furnish all labor, materials, equipment and incidentals required and install pipe penetration assemblies where indicated. This Section covers materials for the various pipe penetration configurations.

1.02 RELATED WORK

A. Piping materials and systems are included in Division 15.

1.03 SUBMITTALS

A. Submit manufacturers' literature, installation instructions, and where applicable, fire rating and certified test results of the various components on all items to be furnished in accordance with Section 01300.

PART 2 PRODUCTS

2.01 PIPE SLEEVES

A. Unless otherwise shown all pipe sleeves shall be Schedule 40 galvanized steel pipe conforming to ASTM A53. Where indicated, provide a 2-in minimum circumferential water stop welded to exterior of sleeve at its midpoint. Ends of sleeves shall be cut and ground smooth and shall be flush with the wall or ceiling and extend 2-in above finished floors. Sleeves to be sealed with mechanical seals shall be sized in accordance with the seal manufacturer's recommendations. Sleeves to be sealed by caulking and sleeves for insulated piping shall be sized as required.

2.02 SEALING MATERIALS

A. Mechanical seals for pipe penetrations shall be modular, adjustable, bolted, mechanical type consisting of interlocking synthetic rubber links shaped to continuously fill the annular space between the pipe and sleeve. The seal shall be rated by the manufacturer for 40-ft of head or 20 psig. A single seal shall be provided for all sleeve and cores in walls up to 14" thick; dual sleeves shall be provided in larger walls. Bolts and hardware shall be carbon steel, zinc plated. Pressure plates shall be corrosion-resistant acetal resin. Mechanical seals shall be Link-Seal LS-300-M, LS-400-M, or LS-500-M, depending on pipe size, by Thunderline Corp., Wayne, MI or equal.

B. Sealant shall be a two part foamed silicone elastomer by Dow Corning Co., Product No. 3-6548 silicone R.T.V.; 3M brand fire barrier products caulk C.P. 25 and 3M brand putty 303; or Flame-Safe fire stop systems Fig. No. FS-500 by Thomas & Betts Corp. Sealant bead configuration, depth and width shall be in accordance with manufacturer's recommendations.

2.03 MISCELLANEOUS MATERIALS

A. Bonding compound shall be Sikadur Hi-Mod epoxy by Sika Corp.; Euclid Chemical Corp.; Master Builders Company or equal.

B. Non-shrink grout shall be Masterflow 713 by Master Builders Co.; Euco N-S by Euclid Chemical Co.; Five Star Grout by U.S. Grout Corp. or equal.

PART 3 EXECUTION

3.01 INSTALLATION

A. Assemble and install components of pipe penetration assemblies per manufacturers recommendations.

END OF SECTION

SECTION 01300

SUBMITTALS

PART 1 - GENERAL

1.01 Description of Requirements:

A. This section specifies the general methods and requirements of submissions applicable to the following work-related submittals: Shop Drawings, Product Data, Samples, Maintenance and Lubrication Schedule/Survey, Certified Shop test Reports, Equipment Manufacturers certification and Mock-Ups. Additional general submission requirements are contained in paragraphs 6.17 of the General Conditions. Detailed submittal requirements will be specified in the technical specification sections.

B. All submittals shall be clearly identified by reference to Specification Section, Paragraph, Drawing No. or Detail as applicable. Submittals shall be clear and legible and of sufficient size for sufficient presentation of data.

1.02 Shop Drawings, Product Data, Samples:

A. Shop Drawings

1. Shop drawings, as defined in the General Conditions, and as specified in individual work sections include, but are not necessarily limited to, custom-prepared data such as fabrication and erection/installation (working) drawings, scheduled information, setting diagrams, actual shopwork manufacturing instructions, custom templates, special wiring diagrams, coordination drawings, individual system or equipment inspection and test reports including performance curves and certifications, as applicable to the Work.

2. All shop drawings submitted by subcontractors for approval shall be sent directly to the Contractor for checking. The Contractor shall be responsible for their submission at the proper time so as to prevent delays in delivery of materials.

3. The Contractor shall check all subcontractor's shop drawings regarding measurements, size of members, materials, and details to satisfy himself that they conform to the intent of the Drawings and Specifications. Shop drawings found to be inaccurate or otherwise in error shall be returned to the subcontractors for correction before submission thereof.

4. All details on shop drawings submitted for approval shall show clearly the relation of the various parts to the main members and lines of the structure, and where correct

fabrication of the work depends upon field measurements, such measurements shall be made and noted on the drawings before being submitted for approval.

B. Product Data

1. Product data as specified in individual Sections, include, but are not necessarily limited to, standard prepared data for manufactured products (sometimes referred to as catalog data), such as the manufacturer's product specification and installation instructions, availability of colors and patterns, manufacturer's printed statements of compliances and applicability, roughing-in diagrams and templates, catalog cuts, product photographs, standard wiring diagrams, printed performance curves and operational-range diagrams, production or quality control inspection and test reports and certifications, mill reports, product operating and maintenance instructions and recommended spare-parts listing and printed product warranties, as applicable to the work.

C. Samples

1. Samples specified in individual Sections, include, but are not necessarily limited to, physical examples of the work such as sections of manufactured or fabricated work, small cuts or containers of materials, complete units of repetitively-used products, color/texture/pattern swatches and range sets, specimens for coordination of visual effect, graphic symbols and units of work to be used by the Engineer or Owner for independent inspection and testing, as applicable to the work.

1.03 Contractor's Responsibilities

A. The Contractor shall review shop drawings, product data and samples, including those by subcontractors, prior to submission to determine and verify the following:

1. Field measurements.

2. Field construction criteria.

3. Catalog numbers and similar data.

4. Conformance with the Specifications.

B. All submittals, including shop drawings prepared by or under the direction of the Contractor, shall be thoroughly checked by the Contractor for accuracy and conformance to the intent of the Contract Documents before being submitted to the Engineer and shall bear the Contractor's certification with signature of approval certifying that they have been so checked. Submittals without the Contractor's certification with signature of approval, will not be reviewed by the Engineer and will be returned to the Contractor stamped "Rejected."

Before submitting them to the Engineer, all submittals shall be bound, properly labeled and consecutively numbered and bear the certification statement, listed below, on the cover sheet for sheets 11" x 17" and smaller or in a clear space above the title block for drawings.

PASSAIC VALLEY SEWERAGE COMMISSION
NAME OF PROJECT: ADMINISTRATION BUILDING REHABILITATION
Date:
Contract No.: A920
Name of Equipment:
Contract Drawing No.:
Specification Section:
I hereby represent that I have determined and verified all field measurements, field construction criteria, materials, dimensions, catalog numbers and similar data and I have checked and coordinated each item with other applicable approved shop drawings and all Contract requirements and they are hereby approved. The information contained herein has been coordinated with all involved Contractor's.
Contractor:
Signed:

Provide to the Resident Project Representative a copy of each submittal transmittal sheet for shop drawings, product data and samples at the time of submittal of said drawings, product data and samples to the Engineer.

C. The Contractor shall utilize a 10-character submittal identification numbering system in the following manner:

1. The first character shall be a D, S, P, M, or R, which represents Shop/Working Drawing and other Product Data (D), Sample (S), Preliminary Submittal (P), Operating/Maintenance Manual (M), or Request for Information (R).

2. The next five digits shall be the applicable Specification Section Number.

3. The next three digits shall be the number 001-999 to sequentially number each initial separate item or drawing submitted under each specific Section number.

4. The last character shall be a letter, A-Z, indicating the submission, or resubmission of the same Drawing, i.e., "A=1st submission, B=2nd submission, C=3rd submission, etc. A typical submittal number would be as follows:

Contract No. – **A920 D-03300-008-B**

D	=	Shop Drawing
03300	=	Specification Section for Concrete
008	=	The eighth initial submittal under this specification section.
B	=	The second submission (first resubmission) of that particular shop drawing.

D. Notify the Engineer in writing, at the time of submittal, of any deviations in the submittals from the requirements of the Contract Documents.

E. The review and approval of shop drawings, samples or product data by the Engineer shall not relieve the Contractor from his/her responsibility with regard to the fulfillment of the terms of the Contract. All risks of error and omission are assumed by the Contractor and the Engineer will have no responsibility therefor.

F. No portion of the work requiring a shop drawing, sample, or product data shall be started nor shall any materials be fabricated or installed prior to the approval or qualified approval of such item. Fabrication performed, materials purchased or on-site construction accomplished which does not conform to approved shop drawings and data shall be at the Contractor's risk. The Owner will not be liable for any expense or delay due to corrections or remedies required to accomplish conformity.

G. Project work, materials, fabrication, and installation shall conform with approved shop drawings, applicable samples, and product data.

1.04 Submission Requirements:

A. Make submittals promptly in accordance with approved schedule, and in such sequence as to cause no delay in the work or in the work of any other contractor.

B. Each submittal, appropriately coded, will be returned within **21 working days** following receipt of submittal by the Engineer.

C. Number of submittals required:

1. Shop Drawings as defined in Paragraph 1.02 A: Ten (10) copies.

2. Product Data as defined in Paragraph 1.02 B: Ten (10) copies.

3. Samples: Submit the number stated in the respective Specifications Sections.

D. Submittals shall conform:

1. The date of submission and the dates of any previous submissions.

2. The project title and number.

3. Contractor identification.

4. The name of:

a. Contractor

b. Supplier

c. Manufacturer

5. Identification of the product, with the specification section number, page and paragraph(s).

6. Field dimensions, clearly identified as such.

7. Relation to adjacent or critical features of the work or materials.

8. Applicable standards, such as ASTM or Federal Specification numbers.

9. Distinct identification of any deviations from Contract Documents.

10. Identification of revisions or resubmittals.

11. An 8" x 3" blank space for Contractor and Engineer stamps.

E. All markings to identify model number, part number, dimension, capacity, etc., shall be reproducible. Highlight markings are unacceptable.

1.05 Review of Shop Drawings, Product Data, Working Drawings and Samples:

A. The review of shop drawings, data, and samples will be for general conformance with the design concept and Contract Documents. They shall not be construed.

1. As permitting any departure from the contract requirements;

2. As relieving the Contractor of responsibility for any errors, including details, dimensions, and materials.

3. As approving departures from details furnished by the Engineer, except as otherwise provided herein.

B. The Contractor remains responsible for details and accuracy, for coordinating the work with all other associated work and trades, for selecting fabrication processes, for techniques of assembly, and for performing work in a safe manner.

C. If the shop drawings, data or samples as submitted describe variations and show a departure from the contract requirements which the Engineer finds to be in the interest of the Owner and to be so minor as not to involve a change in Contract Price or time for performance, the Engineer may return the revised drawings without noting an exception.

D. Submittals will be returned to the Contractor under one of the following codes:

Code 1 - "APPROVED" is assigned when there are no notations or comments on the submittal. When returned under this code the Contractor may release the equipment and/or material for manufacture.

Code 2 - "APPROVED AS NOTED" This code is assigned when a confirmation of the notations and comments IS NOT required by the Contractor. The Contractor may release the equipment or material for manufacture; however, all notations and comments must be incorporated into the final product.

Code 3 - "APPROVED AS NOTED/CONFIRM" This combination of codes is assigned when a confirmation of the notations and comments is required by the Contractor. The Contractor may release the equipment or material for manufacture; however, all notations and comments must be incorporated into the final product. This confirmation shall specifically address each omission and nonconforming item that was noted. Confirmation is to be received by the Engineer within 15 calendar days of the date of the Engineer's transmittal requiring the confirmation.

Code 4 - "APPROVED AS NOTED/RESUBMIT" This combination of codes is assigned when notations and comments are extensive enough to require a resubmittal of the package. The Contractor may release the equipment or material for manufacture; however, all notations and comments must be incorporated into the final product. This resubmittal is to address all comments, omissions and non-conforming items that were noted. Resubmittal is to be received by the Engineer within fifteen (15) calendar days of the date of the Engineer's transmittal requiring the resubmittal.

Code 5 - "NOT APPROVED" is assigned when the submittal does not meet the

intent of the Contract Documents. The Contractor must resubmit the entire package revised to bring the submittal into conformance. It may be necessary to resubmit using a different manufacturer/vendor to meet the Contract Documents.

Code 6 - "COMMENTS ATTACHED" is assigned where there are comments attached to the returned submittal which provide additional data to aid the Contractor.

Codes 1 through 5 designate the status of the reviewed submittal with Code 6 showing there has been an attachment of additional data.

E. Resubmittals will be handled in the same manner as first submittals. On resubmittals the Contractor shall direct specific attention, in writing on the letter of transmittal and on resubmitted shop drawings by use of revision triangles or other similar methods, to revisions other than the corrections requested by the Engineer, on previous submissions. Any such revisions which are not clearly identified shall be made at the risk of the Contractor. The Contractor shall make corrections to any work done because of this type revision that is not in accordance to the Contract Documents as may be required by the Engineer.

F. Partial submittals may not be reviewed. The Engineer will be the only judge as to the completeness of a submittal. Submittals not complete will be returned to the Contractor, and will be considered "Not Approved" until resubmitted. The Engineer may at his/her option provide a list or mark the submittal directing the Contractor to the areas that are incomplete.

G. Repetitive Review

1. Shop drawings and other submittals will be reviewed no more than twice at the Owner's expense. All subsequent reviews will be performed at times convenient to the Engineer and at the Contractor's expense, based on the Engineer's then prevailing rates. The Contractor shall reimburse the Owner for all such fees invoiced to the Owner by the Engineer. Submittals are required until approved.

2. Any need for more than one resubmission, or any other delay in obtaining Engineer's review of submittals, will not entitle Contractor to extension of the Contract Time.

H. If the Contractor considers any correction indicated on the shop drawings to constitute a change to the Contract Documents, the Contractor shall give written notice thereof to the Engineer at least seven working days prior to release for manufacture.

I. When the shop drawings have been completed to the satisfaction of the Engineer, the Contractor shall carry out the construction in accordance therewith and shall make no further changes therein except upon written instructions from the Engineer.

1.06 Distribution:

A. Distribute reproductions of approved shop drawings and copies of approved product data and samples, where required, to the job site file and elsewhere as directed by the Engineer. Number of copies shall be as directed by the Engineer but shall not exceed six.

1.07 Mock-Ups:

A. Mock-up units as specified in individual Sections, include but are not necessarily limited to, complete units of the standard of acceptance for that type of work to be used on the project. Remove at the completion of the work or when directed.

1.08 Maintenance and Lubrication Schedule/Survey

For all items of equipment furnished, the Contractor shall provide a list including the equipment name, and address and telephone number of the manufacturer's representative and service company so that service and/or spare parts can be readily obtained. In addition, a maintenance and lubrication schedule for each piece of equipment shall be submitted with the shop drawings. Submission shall be in ten (10) copies. The schedules shall be in the form indicated below:

Typical Maintenance Schedule

Item	Action	Frequency	Remarks
Motors	Check cleanliness	As required	Motor exterior to be kept clean. Keep air intake openings free of foreign material and do not block air outlet.
	Removal of accumulated moisture	As required	Remove plug in motor frame to drain moisture.
	Check insulation resistance	Annually	See manufacturer operation and maintenance manual for method.

Typical Lubrication Schedule

Item	Action	Frequency	Remarks
Motor Bearings	6 Months	Grease lubricant, Gulf-crown Grease #2 for operating temperatures from 15°F to 300°F	Add grease to inlet, replace inlet plugs, run motor for ½ hour, before replacing drain plug.

* See manufacturer's instructional manual for initial operation instructions (important).

The Contractor shall furnish lubricants for all equipment supplied under this Contract in one

delivery consisting of a minimum number of products, reflecting the results of the lubrication survey, as hereinafter specified.

A lubrication survey, made by an independent consultant, subject to the approval of the Engineer shall be provided by the Contractor. A representative of a lubrication supply firm is not acceptable. The lubrication survey shall list all manufacturer's lubrication recommendations and an interchangeable lubricants tabulation standardizing and consolidating lubricants whenever possible. Ten (10) copies of the approved Lubrication Survey shall be furnished prior to final acceptance. All costs for lubricants and lubrication survey shall be included in the lump sum price bid of this Contract.

1.09 Certified Shop Test Reports

Certified shop test data, for equipment not requiring witness shop tests, shall be furnished by the Contractor in accordance with the requirements of the General Conditions. Where witness shop tests are required, the Contractor shall give written notice of the tests and furnish witness shop test reports in accordance with the requirements of the General Conditions. No equipment or material shall be shipped to the Project until the Engineer notifies the Contractor, in writing, that the shop test data or reports are acceptable.

1.10 Manufacturers Certification Form

The Contractor shall submit a certificate, in the form attached to this section, from each equipment manufacturer, certifying that the equipment as installed and tested meets all the requirements of the Contract Documents that it is fully suitable and will function properly for the use intended and within the system called for by the Contract Documents, and that the guarantees as required by this Contract will be in full force and effect.

When the specifications call for "supervision, installation, adjustment, start-up," and words of similar intent, by the manufacturer's factory employed technicians or manufacturer's representatives, the Contractor shall provide a certificate co-signed by the manufacturer as to compliance with the stipulated requirements.

The final acceptance of any equipment will be withheld, appropriate amount of money will be retained by the Owner, and the warranty will not commence until such certifications are supplied.

1.11 Professional Engineer (P.E.) Certification Form:

A. If specifically required in other Sections of these Specifications, the Contractor shall submit a P.E. Certification for each item required, in the form attached to this Section, completed filled in and stamped.

1.12 General Procedures for Submittals:

A. Coordination of Submittal Times: Prepare and transmit each submittal sufficiently in advance of performing the related work or other applicable activities, or within the time specified in the individual work sections, of the Specifications, so that the installation will not be delayed by processing times including disapproval and resubmittal (if required), coordination with other submittals, testing, purchasing, fabrication, delivery and similar sequenced activities. No extension of time will be authorized because of the Contractor's failure to transmit submittals sufficiently in advance of the work..

P.E. CERTIFICATION FORM

The undersigned hereby certifies that he/she is a Professional Engineer registered in the State of New Jersey and that he/she has been employed by (Name of Contractor)_____

_____

_____ to design _____

_____ in accordance with Specification Section _____ for

Contract No. A920, ADMINISTRATION BUILDING REHABILITATION.

(Contract No.) (Contract Title)

The undersigned further certifies that he/she has performed the design of the _____, that said design is in conformance with all applicable local, state and federal codes, rules and regulations, and that his/her signature and P.E. stamp have been affixed to all calculations and drawings used in, and resulting from, the design.

The undersigned hereby agrees to make all original design drawings and calculations available to the Passaic Valley Sewage Commission or their representative with seven days following written request therefore by the Owner.

_____

P.E. Name

_____

Signature

_____

Address

_____

Contractor's Name

_____

Signature

_____

Title

_____

EQUIPMENT MANUFACTURER'S CERTIFICATION

Owner: Passaic Valley Sewerage Commission

Project: ADMINISTRATION BUILDING REHABILITATION.
(PROJECT TITLE)

Contract No.: A920

EQUIPMENT SPECIFICATION SECTION: _____

EQUIPMENT DESCRIPTION: _____

I _____, authorized representative of
(Print Name)

_____
(Print Manufacturer's Name)

hereby CERTIFY that

_____
(Print Equipment Name & Model with Serial Number)

has been installed in complete accordance with the contract documents and manufacturers instructions and is satisfactory to _____. The
(Manufacturer)

equipment as installed has been fully tested, operates in accordance with the contract and manufacturer's specifications, is suitable for its intended use, and is ready for permanent use by the Owner.

CERTIFIED BY: _____ _____
(Signature of Manufacturer) **(Date)**

_____
(Print Name and Title)

*** END OF SECTION ***

SECTION 01311

CONSTRUCTION SCHEDULING

PART 1 GENERAL

1.01 PROGRAM DESCRIPTION

A. A Critical Path Method (CPM) construction schedule shall be used to control the work of this Contract and to provide a definitive basis for determining job progress. The construction schedule shall be prepared by the Contractor. Updating will be performed by the Contractor with input from the Engineer. All work shall be done in accordance with the established CPM schedule and the Contractor and his/her subcontractors shall be responsible for cooperating fully with the Engineer and the Owner in effectively utilizing the CPM schedule.

B. The CPM schedule to be prepared and submitted by the Contractor shall consist of a CPM network (diagram of activities) and a computer-generated schedule (print-out) using Microsoft Project ®, Primavera Project Planner ® or Engineer approved equal as specified herein. The format shall be the activity-on-node precedence network as indicated on the Preliminary Guideline CPM Schedule.

1.02 QUALIFICATIONS

A. Have the capability of preparing and utilizing the specified CPM scheduling technique. A statement of CPM capability shall be submitted in writing to the Engineer within 15 days after the award of the Contract and will verify that either the Contractor's organization has in-house capability qualified to use the technique or that the Contractor employs a consultant who is so qualified. Capability shall be verified by description of the construction projects to which the Contractor or his/her consultant has successfully applied the CPM scheduling technique and which were controlled throughout the duration of the project by means of systematic use and updating of a computer-based CPM schedule. The submittal shall include the name of the individual on the Contractor's staff who will be responsible for the CPM schedule and for providing the required updating information.

1.03 NETWORK REQUIREMENTS

A. The network shall show the order and inter-dependence of activities and the sequence in which the work is to be accomplished as planned by the Contractor. The basic concept of a network analysis diagram shall be followed to show how the start of a given activity is dependent on the completion of preceding activities and its completion restricts the start of following activities.

B. Detailed network activities shall include: construction activities, major submittals, milestones or deliverables. Break the work into activities with durations no longer than 20 working days each, except as to non-construction activities (such as procurement of significant materials or equipment and delivery of equipment) and any other activities for which the Engineer may approve the showing of longer duration. To the extent feasible, activities related to a specific physical area of the work shall be grouped on the network for ease of understanding and simplification.

C. Separate activities shall be provided for each significant identifiable function in each trade area in each facility. Activities shall be so identified that there will be no reasonable doubt as to how

much work remains on each. Specific activities which shall be included are: all subcontract work, all interface work between subcontractors and between the Contractor and subcontractors, leakage tests of structures, tanks and pipelines, electrical connections to each item of equipment, supplier and manufacturer technical assistance, mechanical connections to each item of equipment, all tests, concrete finishing, each item of site work, (including restraints on other activities) and all utilities, fuels and chemicals.

D. Each activity on the network shall have the following:

1. A single duration (i.e., the single best estimate of time considering the scope of the work involved in the activity and the resources planned for accomplishing the activity) expressed in working days.

2. A five character (or less) code indicative of the party (Contractor/Subcontractor) responsible for accomplishing the activity. Additional codes for phasing, site area, and schedule of values shall be identified and included on the network.

3. A cost estimate for each activity which, when accumulated with the cost of all activities, equals the total contract cost. Estimated overhead and profit shall be prorated throughout all activities. Materials costs shall be assigned to delivery activities. Front loading of costs shall not be allowed.

4. A brief description of the activity.

E. The selection and number of activities shall be subject to the Engineer's approval. The detailed network must be time scaled showing work by week.

F. To the extent that the network or any revision thereof shows anything not jointly agreed upon or fails to show anything jointly agreed upon, it shall not be deemed to meet the specification requirements. Failure to include on a network any element of work required for the performance of this Contract shall not excuse the Contractor from completing all work required within any applicable completion date, notwithstanding the review of the network by the Engineer.

G. Except where earlier completions are specified, CPM schedules which show completion of all work prior to the contract completion date may be approved by the Engineer but in no event shall they be acceptable as a basis for claim for delay against the Owner by the Contractor.

1.04 COMPUTER-GENERATED SCHEDULE REQUIREMENTS

A. Each computer-generated schedule submittal from the CPM activity network shall include the following tabulations: a list of activities in numerical order, a list of activity precedences, a schedule sequenced by Early Start Date and a schedule sequenced by Total Float. Each schedule shall include the following minimum items:

1. Activity numbers

2. Estimated duration

3. Activity description

4. Early start date (calendar dated)

5. Early finish date (calendar dated)

6. Latest allowable start date (calendar dated)

7. Latest allowable finish date (calendar dated)

8. Status (whether critical)

9. Estimated cost of the activity

10. Total float and free float

11. Physical percent complete

12. Remaining duration

B. In addition, each schedule shall be prefaced with the following summary data:

1. Contract name and number

2. Contractor's Name

3. Contract duration

4. Contract schedule

5. The effective or starting date of the schedule (the date indicated in the Notice to Proceed).

C. The work day to calendar date correlation shall be based on an 8-hour day and 40-hour week with adequate allowance for holidays, adverse weather and all other special requirements of the work.

1.05 INITIAL CONFERENCE

A. Within 15 days following the receipt of the Notice to Proceed, meet with the Engineer to discuss and agree on the proposed standards for the CPM schedule. At this conference submit to the Engineer a preliminary network defining the planned operations during the first 60 calendar days after Notice to Proceed. The general approach for the balance of the project shall be indicated. Cost of activities expected to be completed or partially completed before submission and approval of the complete network shall be included.

1.06 APPROVED CPM SCHEDULE

A. Within 45 days following the receipt of the Notice to Proceed, submit two prints of the proposed CPM activity network and a computer-generated schedule to the Engineer. Following a two week review by the Engineer, the Contractor shall finalize the network and submit five prints and two reproducible of the revised network and two copies of the computer-generated schedule. This final submittal shall be delivered to the Engineer within 65 days after the Notice to Proceed. Once this final submittal is deemed in accordance with the specifications by the Engineer, the CPM schedule shall be used for planning, organizing and directing the work, and reporting progress.

B. CPM schedules which contain activities showing negative float or which extend beyond the contract completion date in the computer- generated schedule will not be approved.

C. Review of the CPM activity network by the Engineer is advisory only and shall not relieve the Contractor of responsibility for accomplishing the work within the contract completion date. Omissions and errors in the approved CPM schedule shall not excuse performance less than that required by the Contract. Review by the Engineer in no way makes the Engineer an insurer of the CPM schedule's success or liable for time or cost overruns flowing from its shortcomings. The Owner hereby disclaims any obligation or liability by reason of review by its agent, the Engineer, of the CPM schedule.

E. The CPM activity network shall be submitted on sheets 24-in by 36-in and may be divided into as many separate sheets as required.

1.07 PROGRESS REPORTING

A. Progress under the approved CPM schedule shall be evaluated monthly by the Contractor and the Engineer. Not less than 7 days prior to each monthly progress meeting, they shall meet at the jobsite and jointly evaluate the status of each activity on which work has started or is due to start, based on the preceding CPM schedule; to show actual progress, to identify those activities started and those completed during the previous period, to show the estimated time required to complete or the physical percent complete of each activity started but not yet completed and to reflect any changes indicated for the network. Activities shall not be considered to be complete until they are, in fact, 100 percent complete.

B. Within two weeks following each monthly progress meeting, submit a narrative report based on the CPM schedule evaluation described above, in a format agreed upon by the Contractor and the Engineer. The report shall include a description of the progress during the previous period in terms of completed activities, an explanation of each activity which is showing a delay, a description of problem areas, current and anticipated delaying factors and their estimated impact on performance of other activities and completion dates and an explanation of corrective action taken or proposed. The Contractor shall include costs to date for the period during which the meeting takes place. This report, as well as the CPM Status Report, will be discussed at each progress meeting.

C. Provide an updated schedule based on the results of the monthly progress meeting.

1.08 RESPONSIBILITY FOR SCHEDULE COMPLIANCE

A. Whenever it becomes apparent from the current CPM schedule and CPM Status Report that delays to the critical path have resulted and the contract completion date will not be met, or when so directed by the Engineer, take some or all of the following actions at no additional cost to the Owner. Submit to the Engineer, a written statement of the steps intended to take to remove or arrest the delay to the critical path in the approved schedule.

1. Increase construction manpower in such quantities and crafts as will substantially eliminate the backlog of work.

2. Increase the number of working hours per shift, shifts per day, working days per week, the amount of construction equipment, or any combination of the foregoing, sufficiently to substantially eliminate the backlog of work.

3. Reschedule activities to achieve maximum practical concurrence of accomplishment of activities and comply with the revised schedule.

B. If when so requested by the Engineer, failure to submit a written statement of the steps intended to take or should fail to take such steps, the Engineer may direct the Contractor to increase the level of effort in man-power (trades), equipment and work schedule (overtime, weekend and holiday work, etc) to be employed by the Contractor in order to remove or arrest the delay to the critical path in the approved schedule and the Contractor shall promptly provide such level of effort at no additional cost to the Owner.

1.09 ADJUSTMENT OF CONTRACT SCHEDULE AND COMPLETION TIME

A. If the Contractor desires to make changes in his/her method of operating which affect the approved CPM schedule, he/she shall notify the Engineer in writing stating what changes are proposed and the reason for the change. If the Engineer reviews these changes, the Contractor shall revise and submit, without additional cost to the Owner, all of the affected portions of the CPM network. The CPM schedule shall be adjusted by the Contractor only after prior review of his/her proposed changes by the Engineer. Adjustments may consist of changing portions of the activity sequence, activity durations, division of approved activities, or other adjustments as may be approved by the Engineer. The addition of extraneous, non-working activities and activities which add unapproved restraints to the CPM schedule shall not be allowed.

B. If the completion of any activity, whether or not critical, falls more than 100 percent behind its duration, submit for review a schedule adjustment showing each such activity divided into two activities reflecting completed versus uncompleted work.

C. The contract completion time will be adjusted only for causes specified in this Contract. In the event the Contractor requests an extension of any contract completion date, he/she shall furnish such justification and supporting evidence as the Engineer may deem necessary to determine whether the Contractor is entitled to an extension of time under the provisions of this Contract. The Engineer will, after receipt of such justification and supporting evidence, make findings of fact and will advise the Contractor in writing thereof. If the Engineer finds that the Contractor is entitled to any extension of any contract completion date, the Engineer's determination as to the total number of days extension shall be based upon the currently accepted CPM schedule and on all data relevant to the extension. Such data shall be included in the next updating of the schedule. Actual delays in activities which, according to the CPM schedule, do not affect any contract completion date shown by the critical path in the network will not be the basis for a change therein.

D. Each request for change in any contract completion date shall be submitted by the Contractor to the Engineer within 30 days after the beginning of the delay for which a time extension is requested but before the date of final payment under this Contract. No time extension will be granted for requests which are not submitted within the foregoing time limit.

1. From time to time it may be necessary for the contract schedule or completion time to be adjusted by the Owner to reflect the effects of job conditions, weather, technical difficulties, strikes, unavoidable delays on the part of the Owner or its representatives and other

unforeseeable conditions which may indicate schedule adjustments or completion time extensions. Under such conditions, the Engineer will direct the Contractor to reschedule the work or contract completion time to reflect the changed conditions and the Contractor shall revise his/her schedule accordingly. No additional compensation will be made to the Contractor for such schedule changes except for unavoidable overall contract time extensions beyond the actual completion of all unaffected work, in which case the Contractor shall take all possible action to minimize any time extension and any additional cost to the Owner. Available float time in the CPM schedule may be used by the Owner as defined by the Engineer, as well as by the Contractor.

E. The Owner controls the float time in the approved CPM network and, therefore, without obligation to extend either the overall completion date or any intermediate completion dates set out in the CPM network, the Owner may initiate changes to the work that absorb float time only. Owner initiated changes that affect the critical path on the approved CPM network shall be the sole grounds for extending (or contracting) said completion dates. Contractor-initiated changes that encroach on the float time identified in the approved CPM network may be accomplished with the Owner's concurrence. Such changes, however, shall give way to Owner-initiated changes competing for the same float time.

1.10 COORDINATING SCHEDULES WITH OTHER CONTRACT SCHEDULES

A. Where work is to be performed under this Contract concurrently with or contingent upon work performed on the same facilities or area under other contracts, the Contractor's CPM Schedule shall be coordinated with the schedules of the other contracts. Obtain the schedules of the other appropriate contracts from the Owner for the preparation and updating of the CPM schedule and make the required changes in the schedule when indicated by changes in corresponding schedules.

B. In case of interference between the operations of different contractors, the Owner will determine the work priority of each contractor and the sequence of work necessary to expedite the completion of the entire project. In all such cases, the decision of the Owner shall be accepted as final. The temporary delay of the Contractor's work due to such circumstances shall not be considered as justification for claims for additional compensation.

END OF SECTION

SECTION 01330

OPERATION AND MAINTENANCE MANUALS

PART 1 – GENERAL

1.01 Description of Requirements

This section specifies the general methods and requirements of submissions applicable to Operation and Maintenance Manuals. Operation and Maintenance Manuals shall be provided for all equipment and process systems supplied under this Contract. The Contractor shall submit a list of all Operation and Maintenance Manuals to be supplied for the Engineer's review and approval. Additional general submission requirements are contained in Section 01300 – Submittals and individual technical specification sections.

1.02 Operation and Maintenance Manuals

A. Operation and maintenance manuals include, but are not necessarily limited to, a separate document for each piece of equipment and process system which cover only the specific equipment or process installed with the following specific requirements:

a. Contents:

Title page

Copy of complete specifications for equipment installed, including model, serial number and all other nameplate data.

Brief description of each system (process, mechanical, electrical, etc.) components and flow diagrams.

Exploded views of equipment.

Pre startup procedures.

Starting and stopping procedures (both normal and emergency).

Special operating instructions, including abnormal operating conditions and procedures to return to normal operating conditions.

Routine maintenance procedures and trouble shooting procedures.

Routine and special lubrication procedures and instructions, and a list of all required lubricants by commercial name.

Safety considerations.

Emergency procedures.

Description of potential leak or discharge conditions, including control and mitigation procedures.

Description of leak monitoring and containment equipment.

Inspection procedures.

Operational logs and checklists.

Manufacturer's printed operating and maintenance instructions, parts lists, illustrations, and diagrams.

Instrumentation drawings per ISA-S5.4, Schematics per JIC, EGP and EI, latest revisions.

One (1) copy each of wiring diagram.

Electric motor data including bearing data.

One (1) approved copy of each shop drawing and each Contractor's coordination and layout drawing.

List of recommended spare parts, manufacturer's price, and recommended quantity.

List of all required special tools (or statement that none are required).

All markings on catalog cuts, drawings, etc., shall be reproducible. "Highlighter" markings are not acceptable.

Name, address and telephone numbers of local service representatives.

b. Material:

Loose leaf punched paper.

Page size, 8-1/2" by 11".

Diagrams and illustrations, attached foldouts as required of original quality, reproducible by dry copy method.

Drafting shall be in accordance with current ANSI Drafting Manual.

Covers: oil, moisture and wear resistant 9" x 12" size.

c. Submittals to the Engineer:

1. Five (5) preliminary copies of manuals shall be submitted with form attached to this section. The Contractor is to provide information and initial each item on check list. The Engineer will initial form as part of the review. Manuals not

accompanied by this form will be returned without being reviewed. These preliminary copies must be submitted no later than **fifteen (15) days** following approval of the shop drawings for each piece of equipment or system and six (6) final copies of complete manuals prior to Engineer's tests and acceptance for beneficial use.

2. Not more than forty percent (40%) of the cost of the equipment, installed in place, (based on the Contractor's lump sum breakdown) will be paid until the preliminary copies of the operation and maintenance manuals have been approved by the Engineer.

3. Each manufacturer's operation and maintenance manual(s) shall have printed on the cover of the manual A920 – ADMINSTRATION BUILDING REHABILITATION, Operation and Maintenance Manual, Product/Process System Identification, the specification section with item number and specific equipment's plant location.

4. Where existing systems or equipment are being modified, Contractor shall furnish such information needed to fully update and revise the existing manufacturer's manuals. The information shall be in such form as to be easily inserted in the existing manufacturer's manuals. Where electrical or control modifications are being made, Contractor shall furnish as-built electrical power, control, and ladder diagram drawings for all work performed.

PASSAIC VALLEY SEWERAGE COMMISSION

CONTRACT NO. A920

ADMINISTRATION BUILDING REHABILITATION

(Contract Title)

OPERATION AND MAINTENANCE MANUAL - MINIMUM CHECK LIST

Submittal No. _____

	Cont	Eng.
Five (5) preliminary and six (6) final complete sets of operation and maintenance instructions	☐	☐

The manuals for each piece of equipment and process system shall be a separate document and cover only the specific equipment or process system installed with the following specific requirements:

Contents:

Title Page	☐	☐
Copy of complete specifications for equipment installed, including model, serial number and all other nameplate data.	☐	☐
Brief description of each system (process, mechanical, electrical, etc.), components and flow diagrams.	☐	☐
Exploded views of equipment	☐	☐
Pre startup procedures	☐	☐
Starting and stopping procedures (both normal and emergency).	☐	☐
Special operation instructions, including abnormal operating conditions and purchases to return to normal operating conditions.	☐	☐
Routine maintenance procedures and trouble shooting procedures.	☐	☐
Routine and special lubrication procedures and instructions, and a list of all required lubricants by commercial name.	☐	☐
Safety considerations.	☐	☐
Emergency procedures.	☐	☐
Description of potential leak or discharge conditions, including control and mitigation procedures.	☐	☐
Description of leak monitoring and containment equipment.	☐	☐

	Cont	Eng.
Inspection procedures.	☐	☐
Operational logs and checklists.	☐	☐
Manufacturer's printed operating and maintenance instructions, parts	☐	☐

lists, illustrations, and diagrams.	☐	☐
Instrumentation drawings per ISA-S5.4, Schematics per JIC, EGP and EI, latest revisions.	☐	☐
One copy of each wiring diagram.	☐	☐
Electric motor data including bearing data.	☐	☐
One (1) approved copy of each shop drawing and each Contractor's coordination and layout drawing.	☐	☐
List of recommended spare parts, manufacturer's price, and recommended quantity.	☐	☐
List of all required special tools (or statement that none are required).	☐	☐
All markings on catalog cuts, drawings, etc., shall be reproducible. "Highlighter" markings are not acceptable.	☐	☐
Name, address and telephone numbers of local service representatives.	☐	☐

Material:

Loose leaf punch paper.	☐	☐
Page size, 8-1/2" by 11".	☐	☐
Diagrams and illustrations, attached fold outs as required for original quality, reproducible by dry copy method.	☐	☐
Drafting shall be in accordance with current ANSI Drafting Manual.	☐	☐
Covers: oil, moisture and wear resistant 9" x 12" size.	☐	☐
Each manufacturer's Operating and Maintenance Manual(s) shall have printed on the cover of the manual Contract No. _____ - _____ (Contract Title) _____, "Operation and Maintenance Manual", Product/Process System Identification, the specification section with item number and specific equipment's plant location.	☐	☐

*** END OF SECTION ***

SECTION 01340

IDENTIFICATION

PART 1 – GENERAL

1.01 Scope of Work

1. The Contractor shall furnish and install all components of the system for identification of piping, ducts, conduits, panels, disconnect switches, junction boxes, and equipment as specified hereinafter. A master equipment list shall be furnished along with drawings indicating location and Owners 15-digit asset I.D. numbers for equipment, valves and appurtenances. The system shall include the placing of acrylic plastic identification signs and direction-of-flow arrows on all visible plant piping, the placing of brass valve identification tags, and the fastening of engraved plastic nameplates on plant equipment. In addition, each pressure and temperature gauge shall be furnished with identifying tags noting the gauge operational range. The Contractor shall paint the equipment and piping in the colors herein specified and in accordance with the requirements of Division 9 – Painting. The Contractor shall furnish and install underground pipeline markers for all buried piping installed as part of their contract. The underground pipeline markers shall be installed such that a continuous pipeline demarcation is formed. Additional and supplemental requirements are specified in Divisions 22, 23 and 26.

2. All submissions under this section shall be in accordance with the requirements of Section 01300- Submittals.

1.02 Identification Signs

A. General

Lettering shall be carefully made in capital block letters so as to produce a clear, legible sign. No lettering, symbol or markings containing the name of the manufacturer will be permitted to be placed on the signs. Fabrication of signs and nameplates shall be performed in a sound workmanlike manner. Samples of the lettering to be used for Pipe Identification Signs, and Equipment Nameplates shall be submitted to the Engineer for approval before manufacturing begins. Such samples shall show the height, width and spacing of letters and numbers for any three (3) legends of ten or more letters and spaces as listed herein.

B. Pipe Identification Signs

1. Pipe identification signs shall be fabricated of acrylic plastic suitable for outdoor installation. Signs shall be resistant to corrosive chemicals or color fading from exposure to heat or sunlight.

2. Pipe identification signs shall conform to the requirements of ANSI A13.1-1981 for overall size, lettering size and length of color field. Legends and colors shall be as specified. All signs shall incorporate direction of flow arrows and pipe sizes (i.e. 6-inch). The service abbreviation shall be shown on the signs.

3. Pipe identification signs shall be "Setmark" pipe markers as manufactured by Seton Nameplate Corp., or equal.

4. All underground pipeline markers shall consist of 6" wide brightly colored tape consisting of 4 mil thick plastic, vinyl, or other non-biodegradable material and shall be resistant to chemical attack. Underground pipeline markers shall be Carlton SMART TAPE, or equal.

5. Underground pipeline markers shall also have the words "CAUTION" and "Buried Pipeline Below" added. Markers shall be installed face-up in two (2) continuous layers over the pipeline they are intended to mark. The first layer shall be installed three to six inches directly over the top of the piping. The second layer shall be installed 24-30 inches directly over the top of the piping. In no case shall the underground pipeline marker interfere with the installation of other pipelines, structures, roadways, valves, valve boxes, hydrants, etc.

6. Pipeline signs, and finish coats of paint for pipelines and equipment shall be coded as in the attached Schedule 01340-1. All pipelines and equipment shall be painted in conformity with the requirements of Division 9 – Painting. The color of the final coats of paint shall be color coded. Where aluminum or stainless steel is specified for pipe, duct work or insulated jackets the exterior shall not be painted. Pipes flanges, flexible couplings, valves and fittings for such jacketed lines shall be painted with the foregoing color code. Vents and drains shall be in the same color combination as the contents of tanks and equipment vented and drained.

7. Identification signs for piping shall be located along straight line runs at intervals not to exceed 30 feet and near valves, branches and junction points and where pipes pass through walls or ceilings. Direction-of-flow arrows shall be located at intervals not to exceed 15 feet and near valves, branches, junction points and changes in direction or where required for clarity. All piping identification signs shall be placed so as to be easily visible from operating locations.

8. Identification signs and arrows on piping shall be mounted parallel and tangent to the pipe and valves by fastening with screws, plastic or fiber washers, threaded brackets and banding straps and seals. Screws and brackets shall be stainless steel with 5/16 –

18 American Standard Coarse Threads; bands shall be 25 gage stainless steel, ¾ inch wide spring type retainers or straps shall not be permitted. All attachment and bolting devices shall be of type 304 stainless steel. Where pipe is insulated, the Contractor shall use care in mounting the signs so as to prevent the banding straps from crushing the insulation.

The mounting assembly shall be Steelbinder No. 0011-SS-4 strapping unit as manufactured by A.J. Gerrard & Co., Melrose Park, Ill.; Independent Metal Strap Co., Inc., Roslyn, N.Y., or equal.

C. Equipment, Valves and Appurtenance Identification

The Contractor shall be responsible for furnishing and installing tags and nameplates for all equipment, valves and appurtenances required on this project. Tags and nameplates shall have on them the information specified herein as part of the Owners fifteen (15) digit asset I.D. numbering system. The fifteen (15) digit asset I.D. number differs from the number on the contract drawing. The Contractor shall furnish a Master Equipment List (MEL) which indicates the following information:

15-digit asset I.D. Number
Functional description or process identification
Location of Installation
Service
Size / Capacity / Type
Drawing I.D. Number
Manufacturers Name
Model Number (if applicable)
Serial Number (if applicable)
Vendor / Supplier name and address
Vendor / Supplier phone and fax numbers

The MEL shall be developed in a Microsoft Excel or Access spreadsheet and submitted preliminarily (five [5] hard copies and electronic format) for review and approval by the Engineer and Owner.

Upon completion of equipment installation the Contractor and Engineer shall jointly review the MEL in the field before asset I.D. numbers are provided by the Owner. The Contractor shall make the necessary changes and submit a final MEL (five [5] hard copies and electronic format) for review and approval by the Engineer and the Owner.

The Owner will issue to the Engineer all the asset I.D. numbering for the project, which the Contractor shall use to print the valve tags, equipment nameplates and appurtenance identification as specified herein.

1. Valve Identification Tags

Valve tags shall be non-corrosive brass, 2" in diameter, minimum 19 gauge thick with a 1/8" diameter punched hole. The 1/8" diameter hole shall be filled with a stainless steel grommet for attachment to the valve with a stainless steel chain or strapping. Valve tags shall carry one (1) line of engraving which contains the owners fifteen (15) digit asset number. Engraving shall be centered on the tag. Valve tags shall be located on or adjacent to the valves bonnet or flange bolts. Attachment of tags to handwheel of valve will not be permitted. All underground valves shall carry three (3) lines of engraving which contains the name of service, valve size and the fifteen (15) digit asset I.D. number. Underground valve tags shall be secured by approved (grouted) methods to concrete encasement or floor by the valve box.

2. Equipment Nameplates

Nameplates for equipment shall be engraved plastic nameplates made from 1/16-inch thick laminated non-flammable phenolic engraving stock, black surface over white letters. Lettering shall be ¾-inch high standard block lettering "Helvetica" style. Engraving through the durable black surface color, exposing the contrasting white core color shall produce permanent lettering. Nameplates shall carry two (2) lines of engraving. The equipment's name shall be centered on the top line of lettering and it's fifteen (15) digit asset I.D. number shall be centered below the name. Equipment names are as shown on the Contract Drawings. Nameplates shall be secured with stainless steel rivets or screws, not to cause damage to the equipment. Nameplates shall be located on equipment bases and on structures at readily visible levels in such positions relative to the equipment and structures as to prevent damage to the nameplate.

3. Drawings

The Contractor shall be responsible for furnishing three (3) preliminary sets of plans, which indicate location with asset I.D. numbers for all valves, equipment and appurtenances required on the project, for review and approval by the Engineer. After final approval furnish six (6) sets of plans indicating location with asset I.D. numbers. In addition provide one (1) electronic format (AutoCAD Rel. 14) and one(1) Mylar reproducible drawing for the Owner.

SCHEDULE 01340-1
SYMBOL AND COLOR CODES

Ref. Line	Service	Symbol	Color	Banding	Val Spar & TNEMEC Color No.	Remarks
1	Bldg. Roof Leaders	BRL	Mist Gray		F-39	
2	Bldg. Storm Drain	BSD			2052	
3	Bldg. Sanitary and	BSA	No. 61 Gray	6" White @ 30" O.C.	F-34	
4	Bldg. Floor Drainage	BFD			2053	
5	Chlorine Gas	GCL	Bright Yellow	2" Orange @ 24" O.C.	Y-111 2026	
6	Chlorine Liquid	LCL	Bright Yellow	2" Red @ 30" O.C.	Y-111 2026	
7	Chlorine Solution	CLS	Bright Yellow	2" Gray @ 30" O.C.	Y-111 2026	
8	Chlorine Solution Diffuser	CLD	Bright Yellow	2" Gray @ 30" O.C.	Y-111 2026	All pipes except RL & RC pipe appurtenances
9	Chlorinator Water (NPW)	CW	Light Gray	6" Red @ 30" O.C.	F-42 2050	
10	Combustion Air	CA	Powder Blue	3" Red @ 72" O.C.	B-121 2040	
11	City Water	W	Safety Blue		B-5 2045	
12	Conduit Drains	CD	Safety Blue	2" Black @ 30" O.C.	B-5 2045	
13	Cooling Water	CW	Azure	6" Green @ 72" O.C.	B-8 2044	
14	Cooling Water Supply	CWS	Azure	6" White @ 72" O.C.	B-8 2044	
15	Cooling Water Return	CWR	Azure	6" Red @ 72" O.C.	B-8 2044	

SCHEDULE 01340-1
SYMBOL AND COLOR CODES

Ref. Line	Service	Symbol	Color	Banding	Val Spar & TNEMEC Color No.	Remarks
16	Dewatering	DW	*	6" Green @ 72" O.C.		Note 2
17	Dilution Water	DL; DLW	Azure		B-8 2044	All piping and appurt. from pump suction flange including pump and motor
18	Drains (Piping drains and sidewalk door drains)	DR	Mist Gray	2" Black @ 30" O.C.	F-39 2052	Steel pipe and appurt.
19	Effluent Water (Final Clar. Effl.)	EW	No. 61 Gray		F-34 2053	All piping appurt. to pump suction flange
20	Electrolyte Cooling Water Supply	ECS	Light Gray	3" Orange @ 24" O.C.	F-42 2050	Note 2
21	Electrolyte Cooling Water Return	ECR	Light Gray	3" Orange @ 24" O.C.	F-42 2050	
22	Final Clarifier Influent	FCI	Mist Gray	2" White @ 30" O.C.	F-39 2052	Note 2
23	Fire Stand Piping	FSP	Safety Red		R-9 2008	
24	Fuel Oil Supply	FOS	Black	6" White @ 30" O.C.	J-5 2009	
25	Fuel Oil Return	FOR	Black	6" Red @ 30" O.C.	J-5 2009	
26	Heat Treatment Plant Supernatant Return	HTPSR	International Orange		Y-3 2017	See Note 1
27	Heating Water Supply	HS	Powder Blue	2" Red @ 30" O.C.	B-121 2040	
28	Heating Water Return	HR	Powder Blue	2" Red @ 30" O.C.	B-121 2040	

SCHEDULE 01340-1
SYMBOL AND COLOR CODES

Ref. Line	Service	Symbol	Color	Banding	Val Spar & TNEMEC Color No.	Remarks
29	Hot Water Domestic	HWD	Safety Blue	6" Red @ 30" O.C.	B-5 2045	
30	Influent (Sewage Screened, Degritted and Degreased)	ISP	No. 61 Gray		F-34 2053	Top bearing, gear box, motor, etc., in operating room.
31	City Gas	GAS	Safety Red	2" Yellow @ 24" O.C.	R-9 2008	Note 2
32	Lawn Sprinkling	LSP	Light Gray	2" Red @ 24" O.C.	F-42 2050	
33	Lubrication Oil	LO	Black	2" White @ 24" O.C.	J-5 2009	
34	Waste Mixed Liquor	WML	Cinnamon		D-106 2003	Name of Service Stencil
35	Mixed Liquors	ML	Cinnamon			
36	Non-Potable Water	NPW	Light Gray		F-42 2050	All piping & appurt. from pump suction flange including pump & motor
37	Non-Potable Water By-Pass	NPW-BYPASS	No. 61 Gray	2" Blue @ 30" O.C.	F-34 2053	
38	Non-Potable Water Hose Bibb	HB	No. 61 Gray			Paint Engire Hose Bibb
39	Oxygenation Tanks – Influent (Mixed Liquor)	OX1	Cinnamon		D-106 2003	Note 2
40	Oxygenation Mixers	OXM	Bright Yellow		Y-111 2026	Entire Equip. Package
41	Oxygen (Stainless Steel)	O	Not Painted			Stencils Only
42	Oxygen (Steel)	0	White		W-3 2000	Stencils

SCHEDULE 01340-1
SYMBOL AND COLOR CODES

Ref. Line	Service	Symbol	Color	Banding	Val Spar & TNEMEC Color No.	Remarks
43	Plant Air	PLA	Powder Blue	2" White @ 24" O.C.	B-121 2040	Note 1
44	Plant Air Hose Valve	HV	Powder Blue		B-121 2040	Paint Engire Air Hose Valve
45	Plant Effluent Discharge	PED	Mist Gray	2" Black @ 30" O.C.	F-39 2052	
46	Plant Effluent Well Vents	PEWV	Outdoor Steel Protective Coat & Fin. Color			As directed by the Engineer
47	Primary Sludge	PS	Antique Brown		D-14 2006	Note 2
48	Process Air	PRA	Powder Blue		B-121 2040	
49	Reclaim Piping	RP	Safety Blue	2" Yellow @ 30" O.C.	B-5 2045	
50	Return Sludge	RS	Cypress Green		G-12 2032	Screw Pump/Outdoor motor, gear box, etc. in operating room
51	Scum	SC	Cinnamon	2" White @ 24" O.C.	D-106 2003	Note 1
52	Scum Lines	SCE	Cinnamon	2" White @ 24" O.C.	D-106 2003	Note 1
53	Seed Sludge	SSL	Cinnamon	2" Brown @ 30" O.C.	D-106 2003	8" pipe in utility tunnel from return & waste sludge p.s. to supernatant treatment plant
54	Sludge Withdrawal	SLW	Palm Green	2" Yellow @ 30" O.C.	G-33 2033	Note 2
55	Sludge Thickeners Supernatant Return	STSR	Safety Orange	6" White @ 30" O.C.	Y-15 2016	

SCHEDULE 01340-1
SYMBOL AND COLOR CODES

Ref. Line	Service	Symbol	Color	Banding	Val Spar & TNEMEC Color No.	Remarks
56	Strainer Backwash	SWB	No. 61 Gray	2" Black @ 30" O.C.	F-34 2053	Note 2
57	Sump Pumps Discharge	SP	*			
58	Supernatant Treatment Plant Effluent	STPE	Safety Orange	6" White @ 72" O.C.	Y-15 2016	
59	Tanks Drains	TD	*			Note 2
60	Underground Tank Vents	UTV	Black		J-5 2009	
61	Vent (Dewatering Wells)	V	Mist Gray	2" Black @ 24" O.C.	F-39 2052	Vent post finish as approved by Engineer
62	Waste Oil	WO	Black	2-2" White @ 24" O.C.	J-5 2009	Note 1
63	Crank Case Oil	CO	Black	2" Orange @ 24" O.C.	J-5 2009	Note 1
64	Waste Sludge	WS; WSL	Palm Green	6" White @ 30" O.C.	G-33 2033	Note 1
65	Waste Sludge & Chemical Sludge	WS & CSL	Palm Green	2" White @ 24" O.C.	G-33 2033	Chemical sludge – No banding name service/stencil
66	Instrument & Purge Air	I + PA	Powder Blue	2" Brown @ 24" O.C.	B-121 2040	Name of Service stencil and Note 1
67	Instrument Air	IA	Powder Blue	2" Brown @ 24" O.C.		
68	Brine	B	Light Gray	2" Yellow @ 24" O.C.	F-42 2050	
69	Polymer Solution	PMS	Powder Blue	2" Red @ 24" O.C.	B-121 2040	Name of service stencil and Note 1
70	Polymer	P	Powder Blue	2" Red @ 24" O.C.	B-12 2040	Name of service stencil and Note 1

SCHEDULE 01340-1
SYMBOL AND COLOR CODES

Ref. Line	Service	Symbol	Color	Banding	Val Spar & TNEMEC Color No.	Remarks
71	Seal Water	SW; SEW	Safety Blue	6" White @ 30" O.C.	B-5 2045	Note 1
72	Soft Water	SOW	Safety Blue	2" Green @ 24" O.C.	B-5 2045	Note 1 Service & Symbol by Stencil
73	Softened Water	SFW	Safety Blue	2" Green @ 24" O.C.		
74	Thickened Sludge	TSL	Antique Brown	6" White @ 72" O.C.	D-14 2006	Note 1
75	Grit	G	Black	2" Red @ 24" O.C.	J-5 2009	
76	Sludge Stor. Tank, Supernatant Ret.	SSR; SLS; TSR	Safety Orange	2" White @ 24" O.C.	Y-15 2016	
77	Oxidized Sludge & Vapor	OSL & V	Cinnamon	2" Yellow @ 72" O.C.	D-106 2003	
78	Oxidized Sludge	OSL	Cinnamon	2" Red @ 72" O.C.		
79	Vapor	V; VA	Safety Green	6" Brown @ 72" O.C.	G-11 2036	
80	Scrubbed Vapor	SVA	Cypress Green	2" Brown @ 24" O.C.	G-11 2032	
81	Scrubbed Water	SW	Light Gray	2" Green @ 24" O.C.	F-42 2050	
82	Propane	P	Safety Red	2" Gray @ 24" O.C.	R-9 2008	Note 1
83	Decant Sludge	DSL	International Orange	6" Black @ 72" O.C.	Y-3 2017	
84	Steam	STM	Safety Orange		Y-15 2016	
85	Lime Slurry	LS	Powder Blue	6" Yellow @ 30" O.C.	B-121 2040	Note 1

SCHEDULE 01340-1
SYMBOL AND COLOR CODES

Ref. Line	Service	Symbol	Color	Banding	Val Spar & TNEMEC Color No.	Remarks
86	Thickener Influent	TI	Antique Brown	2" Yellow @ 30" O.C.	D-14 2006	Note 2
87	Propane Gas	PG	Safety Red	2" Orange @ 30" O.C.	R-9 2008	Note 1
88	Thickener Scum	TSC	Cinnamon	2" White @ 24" O.C.	D-106 2003	Note 1
89	Supernatant (Recirculating)	S	Safety Orange	2" Brown @ 24" O.C.	Y-15 2016	
90	Nitric Acid	NA	Bright Yellow	2" Brown @ 30" O.C.	Y-111 2025	Stencil Only (Nitric Acid Fill/NAF)
91	Nitric Acid	NA	Bright Yellow	2" Brown @ 30" O.C.	Y-111 2025	Stencil Only (Nitric Acid Vent/V) No Banding
92	Not Used					
93	Not Used					
94	Sludge & Air (High Pressure Sludge)	S&A SL&A	Antique Brown	6" Red @ 30" O.C.	D-14 2006	Note 1
95	Settling Tank Effluent Sludge	STE	Palm Green	2" Red @ 24" O.C.	G-33 2033	Note 2
96	Sludge	SL	Palm Green	2" Red @ 24" O.C.	G-33 2033	Note 2
97	Transformer Oil	TRO	Black	2" Green @ 30" O.C.	J-5 2009	Note 1
98	Solvent	SOV; SOL	Safety Yellow	2" Brown @ 24" O.C.	Y-15 2025	Name of Service, Stencil
99	Solvent Drain	SOL; SOL-DE	Safety Yellow	2" Brown @ 24" O.C.		
100	Solvent Return	SOL-R	Safety Yellow	2" Brown @ 24" O.C.		

SCHEDULE 01340-1
SYMBOL AND COLOR CODES

Ref. Line	Service	Symbol	Color	Banding	Val Spar & TNEMEC Color No.	Remarks
101	Solvent Supply	SOL-S	Safety Yellow	2" Brown @ 24" O.C.		
102	Chemical (Sodium Sulfite)	CHEM	Purple		TNEMEC B-17	Use 2045 Tnemec + Red to match Mobil purple
103	Cooling Water (Oxygenation)	CWO	Azure	6" Green @ 72" O.C.	B-8 2044	
104	Spray Water-Foam Control	SW-FC	Azure	3" Yellow @ 24" O.C.	B-8 2044	
105	Vacuum	VA	Powder Blue	2" Gray @ 24" O.C.	B-121 2040	
106	Spray Water	SPW	Azure	6" Yellow @ 30" O.C.	B-18 2044	Note 1
107	Not Used					
108	Not Used					
109	Not Used					
110	Recirculated Spray Water (Vapor Scrubber)	RSP	Light Gray	2" Green @ 24" O.C.	F-42 2050	Note 1
111	Primary Clarifier Influent	PCI	Stoneridge		F-38 2023	Note 2
112	Primary Clarifier Dewatering	PCD	Stoneridge	6" Red @ 72" O.C.		
113	Heated Non-Potable Water	HNPW	Light Gray	6" Yellow @ 72" O.C.	F-42 2050	Note 1
114	Sludge Feed & Dewatering Sludge	SF	Cinnamon	6" Yellow @ 72" O.C.	D-106 2003	Note 1
115	Sludge Drain	SD	*			Note 2
116	Filtrate Collection	FC	(All) International Orange	(All) 6" Brown @ 72" O.C.	Y-3 2017	Name of Service Stencil

SCHEDULE 01340-1
SYMBOL AND COLOR CODES

Ref. Line	Service	Symbol	Color	Banding	Val Spar & TNEMEC Color No.	Remarks
117	Filtrate	F	(All) International Orange	(All) 6" Brown @ 72" O.C.	Y-3 2017	Name of Service Stencil
118	Filtrate Discharge	FD	(All) International Orange	(All) 6" Brown @ 72" O.C.	Y-3 2017	Name of Service Stencil
119	Filtrate Vent	FV	*			Note 2
120	Core Blow	CB	Cinnamon	6" Black @ 72" O.C.	D-106 2003	
121	Compressed Air	COA	Powder Blue	2" Green @ 36" O.C.	B-121 2040	Note 2
122	Filter Plate Washwater (N.P.W.)	FPW	Light Gray	2" Red @ 36" O.C.	F-42 2050	
123	Drains (Equipment)	DE	*			
124	Filtered Water (Fountain)	FW	Safety Blue	2" Green @ 30" O.C.	B-5 2045	Note 1
125	Backwash (Filter)	BW	Safety Blue	2" Brown @ 24" O.C.	B-5 2045	
126	Not Used					
127	Not Used					
128	Hydraulic Oil	HO	Black	2" Yellow @ 24" O.C.	J-5 2009	Note 1
129	Overflow (Grit)	OF	Light Gray	2" Black @ 30" O.C.	F-42 2050	Note 1
130	Air	A	Powder Blue	2-2" Green @ 36" O.C.		Note 1
131	Chemical Solution	CHS	Bright Yellow	2" Black @ 24" O.C.	Y-111 2026	Note 1
132	Dewatering (Sumps)	DW(S)	Cinnamon	6" Green @ 72" O.C.	D-106 2003	Note 1

SCHEDULE 01340-1
SYMBOL AND COLOR CODES

Ref. Line	Service	Symbol	Color	Banding	Val Spar & TNEMEC Color No.	Remarks
133	Liquid Nitrogen	LIN	White	2" Yellow @ 72" O.C.	W-9 2000	
134	Nitrogen Gas	NG	White	2" Red @ 72" O.C.	W-9 2000	
135	Nitrogen + Oxygen	N + O	White	2" Blue @ 72" O.C.	W-9 2000	

Legend:

Note 1 - All piping and appurtenances including pumps and motors, etc.
Note 2 - All piping and appurtenances including Venturi Meters, etc.
* - Color as per Color Schedule for same service

SECTION 01340-2

CONTRACT NO. _____

_____

(Contract Title)

MASTER EQUIPMENT LIST (MEL)

Asset I.D. No.	Description / Process I.D.	Location	Service	Size / Capacity / Type	Drawing I.D. No.	Manufacturer	Model No.	Serial No.	Vendor Address, Phone, Fax

*** END OF SECTION ***

SECTION 01350

RECORD DOCUMENTS

PART 1 – GENERAL

1.01 General

A. The Owner shall be responsible for the preparation of all record drawings required. This responsibility may be delegated to the Engineer. The Contractor shall assist the Owner/Engineer by providing record information during the progress of the work.

B. Contractor shall maintain and provide the Engineer with record documents as specified below, except where otherwise specified.

C. Maintenance of Documents

1. Maintain in Contractor's field office in clean, dry, legible condition complete sets of the following: Drawings, Specifications, Addenda, approved Shop Drawings, Photographs, Change Orders, other modifications of Contract Documents, Field Orders, and all other documents pertinent to Contractor's Work.

2. Provide files and racks for proper storage and easy access. File in accordance with filing format of Construction Specification Institute (CSI), unless otherwise approved by Engineer.

3. Make documents available at all times for inspection by Engineer and Owner.

4. Record documents shall not be used for any other purpose and shall not be removed from the Contractor's office without Engineer's approval.

D. Marking System: Provide colored pencils or felt tipped pens for marking changes, revisions, additions and deletions, to the record set of Drawings. Use following color code unless otherwise approved by the Engineer.

1. Structural: Red

2. Other Printed Notations: Green

D. Recording

1. Label each document "PROJECT RECORD" in 2-inch high printed letters.

2. Keep record documents current.

3. Do not permanently conceal any work until required information has been recorded.

4. Drawings: Legibly mark to record actual construction including:

a. Field changes of dimensions and details

b. Changes made by Change Order of Field Order.

c. Details not on original Drawings.

5. Specifications and Addenda: Legibly mark up each Section to record:

a. Manufacturer, trade name, catalog number and supplier of each product and item of equipment actually installed or used.

b. Changes made by Change Order or Field Order.

c. Other matters not originally specified.

E. Submittal

1. Upon Substantial Completion of the work, deliver record documents to the Engineer. Final payment will not be made until satisfactory record documents are received and approved by the Engineer.

2. Accompany submittal with transmittal letter containing:

a. Date

b. Project title and number.

d. Contractor's name and address.

c. Title and number of each record document.

e. Certification that each document as submitted is complete and accurate.

f. Signature of Contractor, or his authorized representative.

*** END OF SECTION ***

SECTION 01360

SCHEDULE OF VALUES

PART 1 – GENERAL

1.01 Schedule of Values

A. General

1. The Contractor shall, within two weeks of executing the Contract, submit a Schedule of Values accurately breaking down the contract price into logical categories of work. This Schedule of Values shall be submitted to the Engineer for approval. Any items not acceptable to the Engineer shall be substantiated to the satisfaction of the Engineer or amended to the satisfaction of the Engineer. Upon approval by the Engineer, the Schedule of Values shall serve as the basis for the Contractor's application for payment, which shall be made on **AIA Document G702 Application** and Certification for Payment.

2. Upon request, submit documentation to support the values assigned to the Goods and Special Services. Sum of all values shall equal the Total Contract Price less any Allowances.

3. The following is a list of the minimum categories to be contained in the Schedule of Values. The Contractor may propose additional categories to improve the utility of the Schedule.

4. Each of the following categories shall be broken into subcategories for labor and materials.

1.02 Minimum List of Categories

Title

General Conditions
- Mobilization
- Submittals
- Project Schedule
- Job Supervision
- Record Documents

Demolition
Site Improvements
Roof Penthouse Addition
Building Envelope Addition
Interior Construction
Finishes
Special Construction
Electrical System
Fire Suppression System
Plumbing System
HVAC/Mechanical
Furniture
Additional Authorized Work

*** END OF SECTION ***

SECTION 01500

PROJECT SIGN

PART 1 GENERAL

1.01 PROJECT SIGN

A. The Contractor shall erect one (1) project sign at the project site which shall include Title of Project and Contract Number, Name of Owner, Names and titles of Officials, Name of Contractor and Names of Consulting Engineers. Names and titles of officials to be included will be furnished to the Contractor after award of Contract. The layout of the sign shall be submitted for approval by the Engineer and shall be similar to the sign attached to this section.

B. The sign shall be 4 feet high by 8 feet long and supported on vertical posts. The sign panels shall be constructed of ¾-inch minimum thickness marine grade plywood rabbeted into a 2" x 4" frame with vertical intermediate supports, 24-inches on center, maximum. Each plywood panel shall be resin impregnated on both sides. All fasteners used in the construction of the sign shall be of a rust proof nature. The colors for the Project Sign shall be a selected by the Engineer. All supports, trims and the back of the sign panels shall be painted with at least two coats of the same paint used for the sign face. All paint used shall be exterior grade paint, suitable for use on wood signs. The supports, framing and sign surfaces shall be able to withstand winds of 100 miles per hour.

C. The sign shall be furnished, erected and maintained by the Contractor in a prominent location at each publicly visible project site and facility as designated by the Engineer.

END OF SECTION

ENVIRONMENTAL INFRASTRUCTURE PROJECT SIGN DETAILS

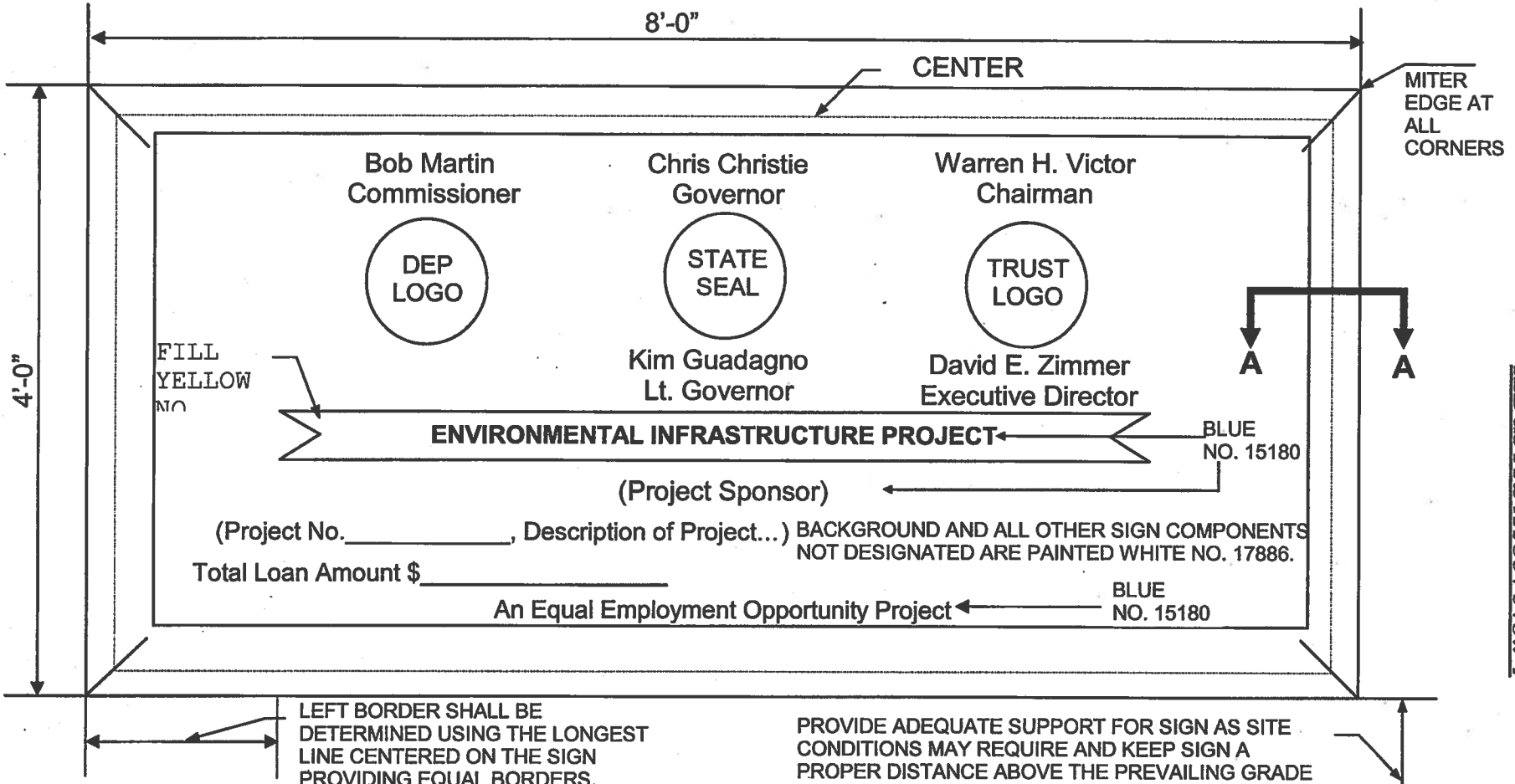
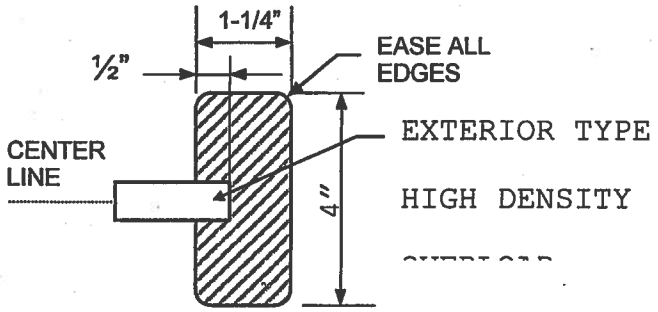


ILLUSTRATION NO.: 1



SECTION A---A

NOTE:
COLOR NUMBERS REFER TO FEDERAL COLOR STANDARD NO. 595A (1-68) WHICH ARE AVAILABLE FROM GSA SUPPLIER. LETTERING PAINTED BLACK NO. 17038 (UNLESS OTHERWISE SPECIFIED). DECALS FOR THE LOGOS AND SEAL SHALL BE AVAILABLE FROM NJDEP CONSTRUCTION CONTROL ENGINEER AT THE PRE-CONSTRUCTION CONFERENCE. FIRST NUMBER INDICATES 1=GLOSS, 2=SEMIGLOSS, 3=MATT AND SECOND NUMBER INDICATES THE COLOR TYPE AND LAST THREE NUMBERS INDICATES INTENSITY. HIGHER NUMBER (LAST 3 DIGITS) MEANS MORE DARKNESS. LETTERING SHOULD BE SIZED ACCORDINGLY TO BE LEGIBLE FOR PUBLIC VIEWING.

SECTION 01600

MATERIAL AND EQUIPMENT

PART 1: GENERAL

1.01 REQUIREMENTS INCLUDED

A. Material and equipment incorporated into the Work:

1. Conform to applicable specifications and standards.

2. Comply with size, make, type and quality specified, or as specifically approved in writing by the Engineer.

3. Manufactured and Fabricated Products:

a. Design, fabricate and assemble in accord with the best engineering and shop practices.

b. Manufacture like parts of duplicate units to standard sizes and gauges, to be interchangeable.

c. Two or more items of the same kind shall be identical, by the same manufacturer.

d. Products shall be suitable for service conditions.

e. Equipment capacities, sizes and dimensions shown or specified shall be adhered to unless variations are specially approved in writing.

4. Do not use material or equipment for any purpose other than that for which it is designed or is specified.

1.02 RELATED WORK

A. Conditions of the Contract

B. Summary of Work is included in Section 01010.

C. Shop Drawings, Working Drawings, Product Data and Samples are included in Section 01300.

E. Operating and Maintenance Data is included in Section 01330.

F. Warranties and Bonds are included in Section 01740.

1.03 APPROVAL OF MATERIALS

A. Only new materials and equipment shall be incorporated in the work. All materials and equipment furnished by the Contractor shall be subject to the inspection and approval of the Engineer. No material shall be delivered to the work without prior approval of the Engineer.

B. Within 30 days after the Effective Date of the Agreement, the Contractor shall submit to the Engineer, data relating to materials and equipment he proposes to furnish for the work. Such data shall be insufficient detail to enable the Engineer to identify the particular product and to form an opinion as to its conformity to the specifications. The data shall comply with Paragraph 1.06 of this Section.

C. Facilities and labor for handling and inspection of all materials and equipment shall be furnished by the Contractor. If the Engineer requires, either prior to beginning or during the progress of the work, the Contractor shall submit samples of materials for such special tests as may be necessary to demonstrate that they conform to the specifications. Such samples shall be furnished, stored, packed, and shipped as directed at the Contractor's expense. Except as otherwise noted, the Owner will make arrangements for and pay for the tests.

D. The Contractor shall submit data and samples sufficiently early to permit consideration and approval before materials are necessary for incorporation in the work. Any delay of approval resulting from the Contractor's failure to submit samples or data promptly shall not be used as a basis of claim against the Owner or the Engineer.

E. The materials and equipment used on the work shall correspond to the approved samples or other data.

1.04 MANUFACTURER'S INSTRUCTIONS FOR INSTALLATION

A. When Contract Documents require that installation of work shall comply with manufacturer's printed instructions, obtain and distribute copies of such instructions to parties involved in the installation, including five copies to the Engineer.

1. Maintain one set of complete instructions at the job site during installation and until completion.

B. Handle, install, connect, clean, condition and adjust products in strict accordance with such instructions and in conformity with specified requirements.

1. Should job conditions or specified requirements conflict with manufacturer's instructions, consult with Engineer for further requirements.

2. Do not proceed with work without clear instructions.

C. Perform work in accordance with manufacturer's instructions. Do not omit any preparatory step or installation procedure unless specifically modified or exempted by Contract Documents.

1.05 TRANSPORTATION AND HANDLING

A. Arrange deliveries of Products in accord with construction schedules coordinate to avoid conflict with work and conditions at the site.

1. Deliver Products in undamaged condition, in manufacturer's original containers or packaging, with identifying labels intact and legible.

2. Immediately on delivery, inspect shipments to assure compliance with requirements of Contract Documents and approved submittals, and that Products are properly protected and undamaged.

B. Provide equipment and personnel to handle Products by methods to prevent soiling or damage to Products or packaging.

1.06 STORAGE AND PROTECTION

A. Storage of equipment shall be in strict accordance with the "instructions for storage" of each equipment supplier and manufacturer including connection of heaters, placing of storage lubricants in equipment, etc. Furnish a copy of the manufacturer's instructions for storage to the Engineer prior to storage of all equipment and materials. Corroded, damaged or deteriorated equipment and parts shall be replaced before acceptance of the project. Equipment and materials not properly stored will not be included in a payment estimate. The location for the storage of equipment shall be as directed by the Engineer and Owner.

B. Store Products in accord with manufacturer's instructions, with seals and labels intact and legible.

1. Store products subject to damage by the elements in weathertight enclosures.

2. Maintain temperature and humidity within the ranges required by manufacturer's instructions.

3. Store fabricated products above the ground, on blocking or skids, prevent soiling or staining. Cover products which are subject to deterioration with impervious sheet coverings, provide adequate ventilation to avoid condensation.

C. All materials to be incorporated in the work shall be handled and stored by the Contractor before, during, and after shipment in a manner to prevent warping, twisting, bending, breaking, chipping, rusting, and any injury, theft or damage of any kind whatsoever to the material or equipment.

E. All materials which, in the opinion of the Engineer, have become so damaged as to be unfit for the use intended or specified shall be promptly removed from the site of the work, and the Contractor shall receive no compensation for the damaged material or its removal.

F. Arrange storage in a manner to provide easy access for inspection. Make periodic inspections of stored Products to assure that Products are maintained under specified conditions, and free from damage or deterioration.

G. Protection After Installation:

1. Provide substantial coverings as necessary to protect installed products from damage from traffic and subsequent construction operations. Remove covering when no longer needed.

H. The Contractor shall be responsible for all material and supplies sold and delivered to the Owner under this Contract until final inspection of the work and acceptance thereof by the Owner. In the event any such material and supplies are lost, stolen, damaged, or destroyed prior to final inspection and acceptance, the Contractor shall replace same without additional cost to the Owner.

I. Should the Contractor fail to take proper action on storage and handling of material supplied under this Contract within seven days after written notice to do so has been given, the Owner retains the right to correct all deficiencies noted in previously transmitted written notice and deduct the cost associated with these corrections from the Contractor's Contract. These costs may be comprised of expenditures of labor, equipment usage, administrative, clerical, engineering and any other costs associated with making the necessary conditions.

1.07 SPECIAL TOOLS

A. Manufacturers of material shall furnish any special tools required for normal adjustment, operations and maintenance, together with instructions for their use. The Contractor shall preserve and deliver to the Owner these tools and instructions in good order prior to completion of the Contract.

1.08 STORAGE AND HANDLING OF EQUIPMENT ON SITE

A. Because of the long period allowed for construction, special attention shall be given to the storage and handling of equipment on site. As a minimum, the procedure outlined below shall be followed.

1. Equipment shall not be shipped until approved by the Engineer. The intent of this requirement is to reduce on-site storage time prior to installation and/or operation. Under no circumstances shall equipment be delivered to the site more than one month prior to installation without written authorization from the Engineer. Operation and Maintenance data as described in Section 01730 shall be submitted to the Engineer for review prior to shipment of equipment.

2. All equipment having moving parts such as gears, electric motors, etc, and/or instruments shall be stored in a temperature and humidity controlled building approved by the Engineer, until such time as the equipment is to be installed.

3. All equipment shall be stored fully lubricated with oil, grease, etc, unless otherwise instructed by the manufacturer.

4. A copy of the manufacturer's storage instructions shall be given to the Engineer and shall be carefully studied by the Contractor and reviewed with the Engineer by him. These instructions shall be carefully followed and a written record of this kept by the Contractor.

5. Moving parts shall be rotated a minimum of once weekly to insure proper lubrication and to avoid metal-to-metal "welding". Upon installation of the equipment, start the equipment, at least half load, once weekly for an adequate period of time to ensure that the equipment does not deteriorate from lack of use.

6. Lubricants shall be changed upon completion of installation and as frequently as required thereafter during the period between installation and acceptance. Mechanical equipment to be used in the work, if stored for longer than ninety days, shall have the bearings cleaned, flushed and lubricated prior to testing and startup, at no extra cost to the Owner.

7. Prior to acceptance of the equipment, have the manufacturer inspect the equipment and certify that its condition has not been detrimentally affected by the long storage period. Such certifications by the manufacturer shall be deemed to mean that the equipment is

judged by the manufacturer to be in a condition equal to that of equipment that has been shipped, installed, tested and accepted in a minimum time period. As such, the manufacturer will guarantee the equipment equally in both instances. If such a certification is not given, the equipment shall be judged to be defective. It shall be removed and replaced at the Contractor's expense.

1.09 SPARE PARTS

A. Spare parts for certain equipment provided under Divisions 15 and 16 have been specified in the pertinent Sections. Collect and store all spare parts as required by the manufacturer. In addition, furnish to the Engineer an inventory listing all spare parts, the equipment they are associated with, the name and address of the supplier and the delivered cost of each item. Copies of actual invoices for each item shall be furnished with the inventory to substantiate the delivered cost. Deliver the spare parts to the Owner not later than 10 days prior to plant start-up.

PART 2: PRODUCTS (NOT USED)

PART 3: EXECUTION (NOT USED)

END OF SECTION

SECTION 01700

CONTRACT CLOSEOUT

PART 1 GENERAL

1.01 SCOPE OF WORK

A. This Section specifies administrative and procedural requirements for project closeout, including but not limited to:

1. Closeout procedures.

2. Final cleaning.

3. Adjusting.

4. Project record documents.

5. Spare parts and maintenance materials.

1.02 RELATED WORK

A. Operation and Maintenance Data are included in Section 01330.

B. Warranties and Bonds are included in Section 01740.

C. Additional closeout procedures are included in Sections 00700.

1.03 RECORD DOCUMENTS

A. Record Documents shall be maintained in accordance with Section 01350.

1.04 CLOSEOUT PROCEDURES

A. Submit in accordance with Article 14 of the Conditions of the Contract written certification that Contract Documents have been reviewed, work has been inspected and that work is complete in accordance with Contract Documents and ready for Engineer's inspection.

B. Provide submittals to Engineer that are required by governing or other authorities.

C. Submit Application for Final Payment identifying total adjusted Contract Sum, previous payments and sum remaining due.

1.05 SUBSTANTIAL COMPLETION

A. When the Contractor considers the Work to be Substantially Complete, he shall submit to the Engineer:

1. A written notice that the Work, or designated portion thereof, is substantially complete.

2. A list of items to be completed or corrected.

B. Within a reasonable time after receipt of such notice, the Engineer will make an inspection to determine the status of completion.

C. Should the Engineer determine that the Work is not Substantially Complete:

1. The Engineer will notify the Contractor in writing, giving the reasons therefore.

2. Contractor shall remedy the deficiencies in the Work, and send a second written notice of substantial completion to the Engineer.

3. The Engineer will reinspect the Work.

1.06 FINAL INSPECTION

A. When Contractor considers the Work is complete, he shall submit written certification that:

1. Contract Documents have been reviewed.

2. Work has been inspected for compliance with Contract Documents.

3. Work has been completed in accordance with Contract Documents.

4. Equipment and systems have been successfully tested in the presence of Owner=s representatives and are operational.

5. Work is completed and ready for final inspection.

B. The Engineer will make an inspection to verify the status of completion with reasonable promptness after receipt of such certification.

C. Should the Engineer consider that the Work is incomplete or defective:

1. The Engineer will promptly notify the Contractor in writing, listing the incomplete or defective work.

2. Contractor shall take immediate steps to remedy the stated deficiencies, and send a second written certification to the Engineer that the Work is complete.

3. The Engineer will reinspect the Work.

D. When the Engineer finds that the Work is acceptable under the Contract Documents, he shall request the Contractor to make closeout submittal.

1.07 REINSPECTION FEES

A. Should the Engineer perform reinspections due to failure of the Work to comply with the claims of status of completion made by the Contractor:

1. Owner will compensate the Engineer for such additional services.

2. Owner will deduct the amount of such compensation from the final payment to the Contractor.

1.08 CONTRACTOR'S CLOSEOUT SUBMITTALS TO ENGINEER

A. Evidence of compliance with requirements of governing authorities.

B. Project Record Documents.

C. Operation and Maintenance Data, and Care and Cleaning Instruction: In accordance with requirements of Section 01330.

D. Warranties and Bonds: In accordance with requirements of the General Conditions and Section 01740.

E. Tools, Spare Parts and Maintenance Material: To requirements of Section 01170.

F. Evidence of Payment and Release of Liens: To requirements of General and Supplementary Conditions.

1.09 FINAL CLEANING

A. Complete the following cleaning operations before requesting inspection for Certification of Substantial Completion.

1. Remove labels that are not permanent labels.

2. Clean exposed exterior and interior hard-surfaced finishes to a dust-free condition, free of stains, films and similar foreign substances

3. Wipe surface of mechanical and electrical equipment. Remove excess lubrication and other substances.

1.10 FINAL ADJUSTMENT OF ACCOUNTS

A. Submit a final statement of accounting to the Engineer.

B. Statement shall reflect all adjustments to the Contract Sum:

1. The original Contract Sum.

2. Additions and deductions resulting from:

a. Previous Change Orders.

b. Allowances.

c. Unit Prices.

d. Deductions for uncorrected Work.

e. Deductions for reinspection payments.

f. Other adjustments.

3. Total Contract Sum, as adjusted.

4. Previous payments.

5. Sum remaining due.

C. Engineer will prepare a final Change Order, reflecting approved adjustments to the Contract Sum which were not previously made by Change Orders.

1.11 FINAL APPLICATION FOR PAYMENT

A. Contractor shall submit the final Application for Payment in accordance with procedures and requirements stated in the General Conditions. Costs for reinspections due to failure of the Work to comply with Contractor's representations of status of completion shall be deducted from amounts due and payable to Contractor.

END OF SECTION

SECTION 01740

WARRANTIES AND BONDS

PART 1 GENERAL

1.01 SCOPE OF WORK

A. This Section specifies general administrative and procedural requirements for warranties and bonds required by the Contract Documents, including manufacturers standard warranties on products and special warranties.

1.02 RELATED WORK

A. Refer to Conditions of Contract for the general requirements relating to warranties and bonds.

B. General closeout requirements are included in Section 01700 Project Closeout.

C. Specific requirements for warranties for the work and products and installations that are specified to be warranted, are included in the individual Sections of Division 2 through 16.

1.03 SUBMITTALS

A. Submit written warranties to the Owner prior to the date fixed by the Engineer for Substantial Completion. If the Certificate of Substantial Completion designates a commencement date for 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 Owner.

B. When a designated portion of the work is completed and occupied or used by the Owner, by separate agreement with the Contractor during the construction period, submit properly executed warranties to the Owner within 15 days of completion of that designated portion of the Work.

C. When a special warranty is required to be executed by the Contractor, or the Contractor and a subcontractor, 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 for approval prior to final execution.

D. Refer to individual Sections of Divisions 2 through 33 for specific content requirements, and particular requirements for submittal of special warranties.

1.04 WARRANTY REQUIREMENT

A. All equipment warranties will have a minimum duration of coverage not less than 12 complete months starting on the date of final acceptance of the equipment by the Owner unless otherwise stated in individual Sections of Division 2 through 16.

B. Related Damages and Losses: When correcting warranted work that has failed, remove and replace other 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.

F. Rejection of Warranties: The Owner reserves the right to reject warranties and to limit selections to products with warranties not in conflict with requirements of the Contract Documents.

G. The Owner reserves the right to refuse to accept work for the project where a special warranty, certification, or similar commitment is required on such work or part of the work, until evidence is presented that entities required to countersign such commitments are willing to do so.

H. 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, nor does it relieve suppliers, manufacturers and subcontractors required to countersign special warranties with the Contractor.

1.05 DEFINITIONS

A. Standard Product Warranties are preprinted written warranties published by individual manufacturers for particular products and are specifically endorsed by the manufacturer to the Owner.

B. Special Warranties are written warranties required by or incorporated in the Contract Documents, either to extend time limits provided by standard warranties or to provide greater rights for the Owner.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 01750

MAINTENANCE OF PLANT OPERATIONS DURING CONSTRUCTION

PART 1: GENERAL

1.01 GENERAL REQUIREMENTS

A. The existing wastewater treatment plant facilities, both process and non-process, will be maintained in continuous operation by the Owner during the entire construction period. Work under the contract shall be so scheduled and conducted by the Contractor such that work will not impede any treatment process, create potential hazards to operation or equipment, reduce the quality of the effluent or cause odor or other nuisance. In performing the work shown as specified, the Contractor shall plan and schedule the work to meet the operating requirements and additional constraints outlined in this Section.

B. The Contractor has the option of providing additional temporary facilities that can eliminate a constraint, provided it is done without cost to the Authority, and provided that all requirements of these specifications are fulfilled. Work not specifically covered in the following paragraphs may, in general, be done at any time during the contract period, subject to the operating requirements outlined hereinafter. All references to days in this Section are to be construed as consecutive calendar days, and all references to "continuous" in this section are to be construed as uninterrupted until completed.

C. The intent of this section is to have the Contractor perform the work in such a manner that continuous, uninterrupted treatment and all essential services and facilities are maintained operational throughout the construction period.

D. The Contractor is hereby advised that he/she shall not shut off or disconnect any operating system of the existing wastewater treatment plant facilities. All equipment shutdowns shall be executed by the Owner.

E. For brevity the Contractor is advised that this Section of the Specifications contains several references to equipment, piping, material and appurtenances to be removed or reinstalled. The Contractor shall refer to other specification sections and the Contract Drawings for definition of the equipment, piping, material and appurtenances to be removed from the site by the Contractor.

F. The descriptions of work herein are complementary and supplementary to the Contract Drawings and Specifications, and do not negate any work required by either, and do not purport to represent every element or detail of work to be performed or every operational or construction constraint which may be required.

G. All work described herein shall be performed by the Contractor unless otherwise noted.

H. Any Contractor's activities during the period of 4:15 P.M. to 7:45 A.M. must have prior approval of the Owner.

I. The costs for all temporary facilities, maintenance of services, and all other work specified in these specifications shall be borne by the Contractor unless specifically stated otherwise. The costs for all the aforementioned work is deemed included in the lump sum bid price.

1.02 GENERAL CONSTRAINTS

In this Section, the recommended sequence and shutdown of units, which are to be taken out-of-service, are presented. The operational status of new or existing units other than the designated units shall not be interrupted by the General Contractor or Subcontractors during the specified time periods. New units may only be used after the specified testing and acceptance of the new units.

The following constraints shall be applied to all equipment, treatment units and appurtenant utility systems on the project site.

A. Access to Project Site

An unobstructed traffic route at the entrance must be maintained at all times. Vehicular access to all treatment units and buildings must be maintained at all times. Any work requiring the temporary closing of a road to traffic must be coordinated with the Owner.

B. Vehicular Access

Except as otherwise permitted, vehicular access to all portions of the buildings and utility tunnels must be maintained at all times.

C. Personnel Access

Treatment Plant Personnel must have safe access to all areas remaining in operation throughout the construction period. Construction site and staging areas shall be maintained in a neat and workmanlike condition. This includes but is not limited to rubbish removal, cutting grass and removing weeds on a regular basis, grading to eliminate potholes, ponding, ruts, etc., as well as dust control and proper material and equipment storage.

The Contractor is informed that Plant Personnel utilize the utility tunnels to transport equipment and materials between buildings and that this access should be maintained throughout the construction period.

D. Plant Utility Systems

1. The existing potable and non-potable water systems shall be kept in operation at all times. All connections to the plant potable and non-potable water systems shall be approved by the Owner prior to installation. All potable water system connections shall contain protective devices as required by the Health Department or applicable code.

2. Existing fire hydrants within the plant site shall be operational at all times.

3. Storm drainage on the site shall be operational at all times.

4. Electric power, lighting service and communication systems shall be maintained in uninterrupted operation mode in all areas remaining in operation. Temporary power shall be provided where required.

E. Plumbing Facilities

Except as otherwise permitted, all building plumbing systems such as roof and floor drains, sump pumps and other systems shall remain in operation.

F. Special Protection of Machinery and Equipment

The Contractor shall take all protective measures to the satisfaction of the Engineer necessary to insure that inclement weather, or dust and debris from demolition does not enter any of the mechanical or electrical equipment enclosures. Enclosures shall be provided where necessary to prevent contamination of the air. All protective measures shall be furnished, installed, lighted, ventilated, maintained and removed at the Contractor's own cost.

Interior dustproof covers shall be a heavy reinforced polyethylene film curtain, minimum thickness 6 mils, supported by wood framing. All seams and penetrations shall be sealed with duct tape on two sides. Junctions with existing walls, floors and ceilings shall be made with a double fold secured with a backing strip anchored to the existing wall, floor and ceiling.

Exterior weather tight enclosures shall be provided whenever a section of a roof or exterior wall on an existing building is removed or equipment is installed in a new building.

The Contractor shall be responsible for all damage to existing structures, equipment, and facilities caused by his/her construction operation and must repair all such damage when and as ordered at no additional cost to the Owner.

G. Service Interruptions

1. When a construction task requires a suspension of normal operations of an individual treatment unit or an individual equipment system for a period less than twenty-four (24) continuous hours, the suspension shall be considered a service interruption. For each service interruption, the Contractor shall compile an inventory of the labor and materials required to perform the work, an estimate of the time required and a written description of the steps required to complete the task resulting in a service interruption. The inventory, time estimate and written procedure shall be submitted to the Owner for review thirty days prior to the start date of the task. If the proposed procedure submitted by the Contractor is acceptable, the Owner shall authorize in writing, the service interruption pending the verification of materials and labor and the final notification specified herein.

2. No service interruption shall be initiated until the Engineer verifies the list of materials and labor at the site at least one week prior to the proposed start date. After verification of the list of materials and labor, the Contractor shall notify the Engineer of the exact date that he/she wishes to perform the work in writing two normal working days, excluding Saturdays, Sundays and holidays, prior to the proposed date.

3. When the normal operations of a treatment unit are suspended longer than twenty-four hours, then the procedures for a shutdown, specified hereinafter, shall be enforced.

4. Forms included at the end of this section must be used to request shutdowns and service interruptions.

H. Shutdowns

1. Shutdown shall be defined to indicate that the normal operation of a unit has to be suspended or taken out-of-service for more than twenty-four hours in order to perform specified work.

2. For each shutdown the Contractor shall compile an inventory of its labor and materials required to perform the tasks, an estimate of the time required and a written description of the steps required to complete the tasks. The inventory, time estimate and written procedure shall be submitted to the Engineer for review thirty (30) calendar days prior to the start date of the shutdown. The Contractor shall also request in writing, from the Engineer approval for each shutdown a minimum of fourteen (14) calendar days prior to the proposed initiation date. No shutdown shall be initiated until the list of materials, labor and equipment is verified as on site or in the Contractor's secure storage area at least one week prior to the proposed start date.

2. The work specified herein and any other work required at the request of the Owner, which may interrupt the normal operations, shall be accomplished at such times that will be convenient to the Owner.

3. The Contractor shall also have on hand, located in close proximity to the work area(s), all tools, equipment and materials, both temporary and permanent, necessary to complete each work category, without interruption. Where temporary pumping is required, contractor shall have on hand 100% backup for the largest unit installed. Prefabrication of all piping and other assemblies shall be completed to the greatest degree possible, prior to any shutdowns. The Engineer must be satisfied that the Contractor has complied with these requirements, to the fullest extent possible, before any shutdowns will be authorized. Once any shutdown is initiated, work shall be continuous until completed.

4. The Contractor must remove the contents in all cases from any tank, conduit or pipe during a shutdown longer than twenty-four continuous hours.

5. Contractor shall tag out all valves and equipment which are shutdown by the Owner indicating valve/equipment status for the shutdown duration to insure the Owner and Contractor are both fully aware of valve/equipment status during shutdown, and to eliminate an uncoordinated valve/equipment operation.

I. Shutdown of Electrical Systems

For electrical shutdowns, the Contractor shall notify the Engineer of the exact date he wishes to perform the work in writing seven (7) normal working days excluding Saturdays, Sundays and holidays prior to the proposed date.

After the final notification and with the approval of the Owner and Engineer, the Contractor shall lock out and tag existing circuit breakers, motor starters and switches, which shall be operated by the Owner. The Contractor shall check cables and wires to be sure that they are denergized to ground potential before work begins. Upon completion of the work, the Contractor shall notify the Owner and Engineer that the facilities are available for use. With the approval by the Owner and Engineer, the Contractor shall remove the locks and tags from the circuit breakers, motor starters or switches. The Contractor shall not operate any existing electrical equipment without the approval, direction and supervision of the Owner or the Engineer.

J. Overtime

Overtime work by the Contractor necessary to conform to these requirements shall be considered as normal procedure under this Contract, and the Contractor shall make no claims for extra compensation as a result thereof. The Contractor shall be prepared to work around the clock and supply multiple work crews as necessary to complete the work including testing and acceptance as specified, within the specified time frame.

J. Load Limits on Access Roads and Plant Facilities

Existing and new underground facilities such as electrical duct banks, pipelines, etc., in, under, and crossing plant roads have been designed for a maximum wheel load in accordance with AASHTO H-20. Contractor shall not exceed this weight limit.

Contractor shall not load nor permit any part of any structure to be loaded in any manner that will endanger the structure, nor shall Contractor subject any part of the Work or adjacent property to stresses or pressure that will endanger it. For all construction activities that require a crane, heavy machinery, etc., the Contractor shall submit a safe structural loading analysis on the existing facilities. Review of the analysis is required before any work can proceed. The analysis shall require a Professional Engineer's Certification from the State of New Jersey as part of the submittal to the Engineer. Contractor shall take all provisions necessary to distribute concentrated loads due to cranes and heavy machinery.

K. Emergency Repair Crews

In case the Contractor's operations disrupt the treatment process or the minimum operating facilities hereinbefore described, at any time, he/she shall at his/her own expense immediately make all repairs or replacements and do all work necessary to restore the plant to operation to the satisfaction of the Owner.

Such work shall progress continuously to completion on a 24-hour day, seven work-day week basis. The Contractor shall provide the services of emergency repair crews, available on call 24 hours per day.

L. Use of Existing Plant Hoisting Equipment and Tunnel Access Elevators

Use of existing plant hoisting equipment and tunnel access elevators by the Contractor will be permitted at the discretion of the Owner. The Contractor shall inform the Owner of the hoisting equipment and tunnel access elevators the Contractor plans to utilize for approval by the Owner prior to usage. The Contractor shall inspect the hoisting equipment and tunnel access elevators

prior to use, report any existing damage to the Owner and Engineer, and make any necessary repairs as a result of damage caused by the Contractor's use at no additional cost.

1.03 TEMPORARY POWER

A. All work necessary to provide temporary power for maintaining plant operations as described herein below and in Division 26, or as otherwise required, shall be performed by the Contractor. All temporary power facilities shall be furnished in accordance with applicable codes.

B. The Contractor shall submit a plan for providing the temporary plant power source and for all temporary facilities to be provided for the Engineer's review. The plan shall describe the temporary power installation and identify the type and location of component equipment to be provided.

1.04 SEQUENCE OF CONSTRUCTION AND OPERATION

A. In order to maintain continuous operation during construction to the existing wastewater treatment plant facilities, a phased removal and construction sequence shall be required. The Contractor is advised that work may be required to be performed in multiple areas simultaneously in order to complete the entire scope of the Contract within the allotted time.

PART 2: PRODUCTS (NOT USED)

PART 3: EXECUTION (NOT USED)

PASSAIC VALLEY SEWERAGE COMMISSION
CONTROL OF HAZARDOUS ENERGY SOURCES
COMPLIANCE PROGRAM
CONTRACTOR COMPLIANCE FORM

PURCHASE ORDER #/CONTRACT #: Contract No. A920

OTHER: _____

DATE: _____

CONTRACTOR FIRM: _____

CONTRACTOR PRINCIPAL IN CHARGE: _____

PASSAIC VALLEY SEWERAGE COMMISSION
CONTACT PERSON: _____

BUILDING NAME: _____

ROOM NAME OR NO: _____ FLOOR LEVEL: _____

EQUIPMENT TYPE: _____ EQUIP. LOCATION: _____

EQUIPMENT NAME: _____ EQUIPMENT NO: _____

SEQUENTIAL ITEM #: _____ EQUIPMENT ID: _____

ASSOCIATED EQUIPMENT TO BE LOCKED OUT

EQUIPMENT TYPE: _____ EQUIPMENT ID#: _____

EQUIPMENT TYPE: _____ EQUIPMENT ID#: _____

EQUIPMENT TYPE: _____ EQUIPMENT ID#: _____

EQUIPMENT TYPE: _____ EQUIPMENT ID#: _____

CONTRACTOR CERTIFICATION

I UNDERSTAND THE REQUIREMENTS OF N.J.A.C. 12:100-11.1 ET SEQ. AND HAVE BEEN INFORMED OF THE PASSAIC VALLEY SEWERAGE COMMISSION'S PROCEDURES TO CONTROL HAZARDOUS ENERGY SOURCES FOR THE ABOVE EQUIPMENT. I WILL COMPLY WITH THESE REQUIREMENTS AND ENFORCE COMPLIANCE WITH THESE REQUIREMENTS BY EMPLOYEES OF THE CONTRACTOR.

CONTRACTOR SUPERVISOR-IN-CHARGE SIGNATURE: _____

AGREEMENT FOR CONTRACTOR'S TEMPORARY USE
OF OWNER'S EQUIPMENT

_____ ("the Contractor"), currently performing work under Contract No. A920 hereby agrees with the Owner, for and in consideration of Owner's consent to the Contractor's temporary use of Owner's _____ _____ ("the equipment"), to save and hold Owner harmless of, from and against any and all damage and injury to any property or person whatsoever, including but not limited to the property or person of Owner, the Contractor, their employees and third persons, in addition to any incidental or consequential damages arising therefrom, which damage or any injury arises out of, results from or is in any way caused by the Contractor's use of the equipment. The Contractor shall indemnify Owner for any and all claims, liabilities, costs and expenses, including attorney's fees, asserted against or incurred by Owner as a result of or in connection with such damage and injury.

By signing this Agreement, the Contractor acknowledges that the equipment is in good working condition, and agrees to undertake and pay for any and all repairs necessary to return the equipment to Owner in the same working condition after each use by the Contractor, or when deemed necessary by Owner. The Contractor shall reimburse Owner for the cost of any repairs and/or replacements required to be undertaken by Owner when, in the sole judgement of Owner, such repair and/or replacements are needed as a result of Contractors use of the equipment.

The Contractor agrees that temporary use shall be defined as that use of the equipment by the Contractor for construction purposes, at those times as are convenient for and allowed by Owner. Owner's need to utilize said equipment shall at all times take precedence over the Contractors requirements. Any unavailability of this equipment to the Contractor for whatever reason and for whatever length of time shall under no circumstances give rise to any claims by the Contractors for delays to the work. It is expressly understood and agreed that the Contractors temporary use of this equipment is for his benefit only, and is above and beyond any contractual obligations of Owner.

The Contractor agrees to utilize only those personnel who are fully competent to operate the equipment described and to exercise all safety precautions.

The privileges for use of this equipment may be revoked by Owner at any time, at its discretion.

CONTRACTOR SUPERVISOR-IN-CHARGE SIGNATURE: _____

LOCK-OUT/TAG-OUT REQUEST

DESCRIBE EQUIPMENT TO BE LOCKED OUT _____

_____

COMPANY REQUESTING LOCK-OUT: _____

PERSON RESPONSIBLE FOR LOCK-OUT: _____ TITLE: _____

DATE OF REQUEST: _____

DATE LOCK-OUT REQUIRED: _____

TIME PROPOSED: _____

APPROVALS:

CONTRACTOR: _____ DATE: _____

PVSC: _____ DATE: _____

ENGINEER: _____ DATE: _____

COMMENTS: _____

_____

_____

COMPLETE AREA BELOW WHILE PLACING LOCKS ON EQUIPMENT AND RETURN THIS FORM TO CONTRACTOR'S OFFICE.

TAG NO.	LOCK NO.	INSTALLED BY (NAME)	INITIALS	COMPANY	SYSTEMS AFFECTED	ESTIMATED DURATION	DATE ISSUED	DATE RETURNED

RELEASE FROM LOCK-OUT: **(INITIAL EACH & SIGN BELOW)**

Contractor has reviewed the equipment & system which was locked out and has found that all PERSONNEL_____, TOOLS _____, and PARTS _____ have been cleared for removal of locks and equipment can be placed back into service.

SIGNED: _____ DATE: _____

NAME (print): _____ TITLE: _____

LOCKOUT AUTHORIZATION FORM

WORK ORDER #/CONTRACT #: _____

CHECK HERE IF SHIFT CHANGE: _____

TIME LOCKS AND TAGS INSTALLED: _____ DATE: _____

CHECK HERE IF SHIFT CHANGE: _____

TIME LOCKS AND TAGS REMOVED: _____ DATE: _____

BUILDING NAME:

EQUIPMENT NAME:

SEQ. ITEM #:

EQUIPMENT ID #:

VOLTAGE READING: _____

AFFECTED EMPLOYEES NOTIFIED BY: _____

SIGN-OFF FOR LOCK INSTALLATION

OPERATIONS SUPERVISOR SIGNATURE: _____

MAINTENANCE ELECTRICIAN SIGNATURE: _____

MAINTENANCE SUPERVISOR SIGNATURE: _____
(OR HIS AUTHORIZED MAINTENANCE PERSON)

OTHER SIGNATURE: _____

OTHER SIGNATURE: _____

OTHER SIGNATURE: _____

SIGN-OFF FOR LOCK REMOVAL

OPERATIONS SUPERVISOR SIGNATURE: _____

MAINTENANCE ELECTRICIAN SIGNATURE: _____

MAINTENANCE SUPERVISOR SIGNATURE: _____
(OR HIS AUTHORIZED MAINTENANCE PERSON)

OTHER SIGNATURE: _____
OTHER SIGNATURE: _____
OTHER SIGNATURE: _____

The person signing this agreement is authorized to do so on behalf of the Contractor.

_____
(NAME OF CONTRACTOR)

_____
(AUTHORIZED SIGNATURE)

_____
(PRINT NAME)

DATE: _____

State of _____

County of _____ TO WITNESS

on the _____ day of _____ 20 ___ before me personally

came and appeared _____ to me known, who by

me duly sworn, did depose and say that he is the _____ of _____

and that he has the authority to bind the above named firm to the terms and conditions of the foregoing Agreement.

My Commission Expires: _____ By: _____

Printed Name: _____

SECTION 03300 - CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes cast-in-place concrete, including formwork, reinforcement, concrete materials, mixture design, placement procedures, and finishes.

B. Related Sections:

1. Section 03532 CONCRETE FLOOR TOPPING.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. Design Mixtures: For each concrete mixture.

C. Steel Reinforcement Shop Drawings: Placing drawings that detail fabrication, bending, and placement.

D. Formwork Shop Drawings: Prepared by or under the supervision of a qualified professional engineer detailing fabrication, assembly, and support of formwork.

1.3 INFORMATIONAL SUBMITTALS

A. Welding certificates.

B. Material certificates.

C. Material test reports.

D. Floor surface flatness and levelness measurements.

1.4 QUALITY ASSURANCE

A. Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94/C 94M requirements for production facilities and equipment.

1. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities."

B. Testing Agency Qualifications: An independent agency, acceptable to authorities having jurisdiction, qualified according to ASTM C 1077 and ASTM E 329 for testing indicated.

C. Welding Qualifications: Qualify procedures and personnel according to AWS D1.4/D 1.4M, "Structural Welding Code - Reinforcing Steel."

D. ACI Publications: Comply with the following unless modified by requirements in the Contract Documents:
   1. ACI 117, "Specifications for Tolerances for Concrete Construction and Materials."

E. Concrete Testing Service: Engage a qualified independent testing agency to perform material evaluation tests and to design concrete mixtures.

F. Preinstallation Conference: Conduct conference at Project site.

PART 2 - PRODUCTS

2.1 FORM-FACING MATERIALS

A. Smooth-Formed Finished Concrete: Form-facing panels that will provide continuous, true, and smooth concrete surfaces. Furnish in largest practicable sizes to minimize number of joints.

B. Rough-Formed Finished Concrete: Plywood, lumber, metal, or another approved material. Provide lumber dressed on at least two edges and one side for tight fit.

2.2 STEEL REINFORCEMENT

A. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.

B. Galvanized-Steel Welded Wire Reinforcement: ASTM A 185/A 185M, plain, fabricated from galvanized-steel wire into flat sheets.

C. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire reinforcement in place. Manufacture bar supports from steel wire, plastic, or precast concrete according to CRSI's "Manual of Standard Practice.

2.3 CONCRETE MATERIALS

A. Cementitious Material: Use the following cementitious materials, of the same type, brand, and source, throughout Project:

   1. Portland Cement: ASTM C 150, Type I white.

B. Normal-Weight Aggregates: ASTM C 33, graded.

   1. Maximum Coarse-Aggregate Size: 1 inch nominal.
   2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.

C. Water: ASTM C 94/C 94M and potable.

2.4 ADMIXTURES

A. Air-Entraining Admixture: ASTM C 260.

B. Chemical Admixtures: Provide admixtures certified by manufacturer to be compatible with other admixtures and that will not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride.

1. Water-Reducing Admixture: ASTM C 494/C 494M, Type A.
2. Retarding Admixture: ASTM C 494/C 494M, Type B.
3. Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type D.
4. High-Range, Water-Reducing Admixture: ASTM C 494/C 494M, Type F.
5. High-Range, Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type G.
6. Plasticizing and Retarding Admixture: ASTM C 1017/C 1017M, Type II.

2.5 VAPOR RETARDERS

A. Sheet Vapor Retarder: Polyethylene sheet, ASTM D 4397, not less than 10 mils thick.

2.6 CURING MATERIALS

A. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.

2.7 RELATED MATERIALS

A. Expansion- and Isolation-Joint-Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber.

2.8 CONCRETE MIXTURES

A. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both, according to ACI 301.

B. Cementitious Materials: Use fly ash, pozzolan, ground granulated blast-furnace slag, and silica fume as needed to reduce the total amount of portland cement, which would otherwise be used, by not less than 40 percent.

C. Admixtures: Use admixtures according to manufacturer's written instructions.
1. Use water-reducing and retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.

D. Proportion normal-weight concrete mixture as follows:

1. Minimum Compressive Strength: 3000 psi at 28 days.
2. Maximum Water-Cementitious Materials Ratio: 0.45.
3. Slump Limit: 4 inches.

4. Air Content: Do not allow air content of trowel-finished pavement to exceed 3 percent.

2.9 FABRICATING REINFORCEMENT

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

2.10 CONCRETE MIXING

A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94/C 94M, and furnish batch ticket information.

1. When air temperature is between 85 and 90 deg F, reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F, reduce mixing and delivery time to 60 minutes.

PART 3 - EXECUTION

3.1 FORMWORK

A. 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. Chamfer exterior corners and edges of permanently exposed concrete.

D. Reinforced concrete slab to be 4" thick with 6"x6"x10/10 welded wire galvanized mesh. 4'-0" wide x 44'-9" long.

3.2 EMBEDDED ITEMS

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

3.3 VAPOR RETARDERS

A. Sheet Vapor Retarders: Place, protect, and repair sheet vapor retarder according to ASTM E 1643 and manufacturer's written instructions.

1. Lap joints 6 inches and seal with manufacturer's recommended tape.
2. Remove and replace all torn sections with new.

3.4 STEEL REINFORCEMENT

A. General: Comply with CRSI's "Manual of Standard Practice" for placing reinforcement.

1. Do not cut or puncture vapor retarder. Repair damage and reseal vapor retarder before placing concrete. 6"x6"x10/10 W.W.M. on chair supports.

3.5 JOINTS

A. General: Construct joints true to line with faces perpendicular to surface plane of concrete.

B. Construction Joints: Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Architect.

C. Contraction Joints in Slabs-on-Grade: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of concrete thickness as follows:

1. Grooved Joints: Form contraction joints after initial floating by grooving and finishing each edge of joint to a radius of 1/8 inch. Repeat grooving of contraction joints after applying surface finishes. Eliminate groover tool marks on concrete surfaces.
2. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch wide joints into concrete when cutting action will not tear, abrade, or otherwise damage surface and before concrete develops random contraction cracks.

D. Isolation Joints in Slabs-on-Grade: After removing formwork, install joint-filler strips at slab junctions with vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.

E. Waterstops: Install in construction joints and at other joints indicated according to manufacturer's written instructions.

3.6 CONCRETE PLACEMENT

A. Before placing concrete, verify that installation of formwork, reinforcement, and embedded items is complete and that required inspections have been performed.

B. Deposit concrete continuously in one layer or in horizontal layers of such thickness that no new concrete will be placed on concrete that has hardened enough to cause seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as indicated. Deposit concrete to avoid segregation.

1. Consolidate placed concrete with mechanical vibrating equipment according to ACI 301.

C. Cold-Weather Placement: Comply with ACI 306.1.

D. Hot-Weather Placement: Comply with ACI 301.

3.7 FINISHING FORMED SURFACES

3.8 FINISHING CONCRETE SLABS

A. General: Comply with ACI 302.1R recommendations for screeding, restraightening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.

B. Broom Finish: Apply a broom finish to exterior concrete pavement as indicated on construction drawings.

3.9 CONCRETE PROTECTING AND CURING

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and ACI 301 for hot-weather protection during curing.

B. Cure concrete according to ACI 308.1, by one or a combination of the following methods:
1. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches, and sealed by waterproof tape or adhesive. Cure for not less than seven days. Immediately repair any holes or tears during curing period using cover material and waterproof tape.
2. Removal: After curing period has elapsed, remove curing compound without damaging concrete surfaces by method recommended by curing compound manufacturer

3.10 CONCRETE SURFACE REPAIRS

A. Defective Concrete: Repair and patch defective areas when approved by Architect. Remove and replace concrete that cannot be repaired and patched to Architect's approval.

B. Clean all adjacent pavers, landscaping, roadway, and building surfaces. Immediately after work prior to concrete drying. Repeat to remove and dried concrete residue to existing conditions.

3.11 FIELD QUALITY CONTROL

A. Testing and Inspecting: Owner will engage a qualified testing and inspecting agency to perform field tests and inspections and prepare test reports.

END OF SECTION 03300

SECTION 03532 - CONCRETE FLOOR TOPPING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes mineral aggregate concrete floor topping. To be installed in areas as directed by Architect. Based upon evaluation of flooring existing condition at site.

1.2 SUBMITTALS

A. Product Data: For each concrete floor topping indicated.

B. Product certificates.

1.3 QUALITY ASSURANCE

A. Mockups: Cast topping mockups, approximately 100 sq. ft., to demonstrate typical joints, surface finish, bonding, texture, tolerances, and qualities of execution.

1. Build mockups as required by Architect on site.
2. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

B. Preinstallation Conference: Conduct conference at Project site.

1.4 PROJECT CONDITIONS

A. Environmental Limitations: Comply with manufacturer's written instructions for substrate temperature and moisture content, ambient temperature and humidity, ventilation, and other conditions affecting topping performance.

1. Place topping only when ambient temperature and temperature of base slabs are between 50 and 86 deg F.

PART 2 - PRODUCTS

2.1 CONCRETE FLOOR TOPPING

A. Mineral-Aggregate Topping:

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
2. Products: Subject to compliance with requirements, provide one of the following:

    a. Anti-Hydro International, Inc; A-H Emery A-1 Premix.
    b. Dayton Superior Corporation; Emery Tuff Top.
    c. L&M Construction Chemicals, Inc.; Emerytop 400.
    d. Metalcrete Industries; Met-Top E.
    e. Sternson Group; Emeri-Crete Topping.

B. Related Materials:

1. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B, 25 percent solids content, minimum.
2. Epoxy Joint Filler: Two-component, semirigid, 100 percent solids, epoxy resin with a Shore A hardness of 80 percent ASTM D 2240.
3. Joint-Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber.
4. Acrylic-Bonding Agent: ASTM C 1059, Type II, non-redispersible, acrylic emulsion or styrene butadiene.
5. Epoxy Adhesive: ASTM C 881, Type V, two-component epoxy resin, capable of humid curing and bonding to damp surfaces, of class and grade to suit requirements.
6. Bonding Slurry: Mix portland cement with water to a thick paint consistency.
7. Bonding Slurry: Mix 1 part portland cement and 2 parts sand with water and an acrylic-bonding agent according to manufacturer's written instructions to a thick paint consistency.

2.2 MIXING

A. Topping: Mix topping materials and water in appropriate drum-type batch machine mixer or truck mixer according to manufacturer's written instructions.

PART 3 - EXECUTION

3.1 PREPARATION

A. Existing Concrete: Prepare and clean existing base slabs according to topping manufacturer's written instructions. Fill voids, cracks, and cavities in base slabs.

B. Install joint-filler strips where topping abuts vertical surfaces.

3.2 TOPPING APPLICATION

A. Install topping according to manufacturer's written instructions. Start application in presence of manufacturer's technical representative.

B. Monolithic Topping: Place topping while concrete base slab is still plastic.

C. Deferred Topping: Within 72 hours of placing base slabs, mix and scrub bonding slurry into dampened concrete. Place topping while slurry is still tacky.

D. Existing Concrete: Apply epoxy-bonding adhesive, mixed according to manufacturer's written instructions, and scrub into dry base slabs. Place topping while adhesive is still tacky.

E. Screed surface with a straightedge and strike off to correct elevations. Begin initial floating using bull floats to form a uniform and open-textured surface plane free of humps or hollows.

F. Finishing: Consolidate surface with power-driven floats as soon as topping can support equipment and operator. Float and restraighten surface. Apply hard trowel finish, leaving surface smooth and uniform.

G. Begin curing immediately after finishing topping. Apply curing compound uniformly in two coats in continuous operations 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.

H. Install epoxy joint filler full depth of contraction joints according to manufacturer's written instructions. Overfill joint and trim joint filler flush with top of joint after hardening.

I. Repair and patch defective topping areas, including areas that have not bonded to concrete substrate.

END OF SECTION 03532

SECTION 03542- CEMENT-BASED SELF-LEVELING UNDERLAYMENT

PART 1 – GENERAL

1.01 SUMMARY OF WORK

A. The Work of this Section shall include, but not be limited to, installation of hydraulic cement-based self-leveling underlayment (SLU) on slabs to the elevation required to place finish material at the contract elevation. Prepare substrate to receive the SLU and install as per this Section and per manufacturer's recommendations.

B. Provide over all existing Asbestos Floor Tile and existing Mastic Adhesive on all slabs to provide a uniform surface to receive finish. All existing Asbestos Floor Tile and existing Mastic Adhesive is to remain INTACT and to be entrapped by Cement Based Self-Leveling Underlayment.

C. Moisture content of the concrete slabs shall be checked and documented in writing by the Contractor to ensure the moisture content is acceptable for all materials to be placed on the slab (SLU, finish flooring).

1. Slabs shall be tested utilizing the calcium chloride moisture test and, if required by the floor finish manufacturer, using in-situ test probe method for relative humidity.

2. New concrete slabs shall be cured a minimum of twenty-eight (28) days for normal weight concrete and 56 days for lightweight concrete prior to testing.

1.02 RELATED SECTIONS

A. Cast-in-Place Concrete. . . . . Section 03300

B. Resilient Tile Flooring and Wall Base Section 09651

C. Tile Carpeting. . . . . Section 09681

D. Engineered Hardwood Flooring. . . Section 09640

E. Resinous Matrix Terrazzo Flooring . . Section 09662

1.03 REFERENCES

A. American Society for Testing and Materials (ASTM), latest editions.

C31 Standard Testing Method How to Cast the In-Field F_c and F_i Test Cubes

C94 Standard Specification for Ready-Mixed Concrete

C109 Standard Test Method for Compressive Strength of Hydraulic Mortars Using 2-inch or [50mm] Cube Specimens

C157 Standard Test Method for Length Change of Change of Hardened Hydraulic-Cement Mortar and Concrete

C191 Test Using Vicat Needle to Determine Final Setting Time of (SLU) Mix

C596 Standard Test Method to Determine Amount of Water Content in Concrete and Concrete Coatings of Hydraulic Cement Grout (Non-Shrink)

C1583 Test Method Standard for Tensile Strength of Concrete Surfaces and the Bond Strength or Tensile Strength of Concrete Surfaces

F1869 Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride

F2170 Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes

1.04 SUBMITTALS

A. Product Data

Submit manufacturer's technical data for all materials, including repair material, primer, self-leveling underlayment, epoxy, and moisture mitigation membrane.

B. Shop Drawings

Plans indicating substrates, locations, and average depths of cement-based underlayment based on survey of substrate conditions.

C. Quality Control Submittals

1. Test Reports:

a. Submit independent laboratory test reports for the performance criteria specified in Part 2 for the SLU (For products not listed).

b. Moisture testing:

1) Calcium chloride moisture test indicating substrate moisture content is within acceptable limits to receive SLU and finish flooring.

2) Relative Humidity moisture test indicating substrate moisture content is within acceptable limits to receive SLU and finish flooring.

2. Certificates

Furnish single-source Manufacturer's certification that materials meet or exceed Specification requirements.

3. Manufacturer's Instructions: Furnish manufacturer's printed material, specifications, and application instructions for installation of all component materials to complete the Work of this Section.

4. Written Repair Procedure

Submit written copies of procedures of actual process to be utilized to install self-leveling underlayment, including surface preparation and mixing procedures. Procedure is to be signed by manufacturer's representative for locations where drawings require manufacturer's representative to inspect and certify compatibility of manufacturer's product with substrate.

5. Manufacturer's Field Reports

Manufacturer's representative of single-source cement-based self-leveling underlayment shall submit field reports of surface preparation inspection and underlayment placement.

6. Qualifications

Provide proof of Manufacturer and Installer qualifications and experience specified under "Quality Assurance".

7. Installer's Field Schedules

a. Appendix A Schedule completed, dated and signed by individual certified Installer-Applicator.

b. Appendix B Schedule completed, dated and signed by individual certified Installer-Applicator.

D. Guarantee

Installer's installation guarantee and manufacturer's material warranty.

E. Mock-up

Provide mock-up of SLU installation.

1.05 QUALITY ASSURANCE

A. Qualifications

1. Installer/Applicator: An experienced installer/ applicator, trained by the manufacturer to install their system, who has completed cement-based underlayment applications similar in material and extent to that required for this Project, and whose work has resulted in construction with a record of successful continuous in-service performance for a minimum of three (3) years.

2. Manufacturer: A minimum of four (4) years successful continuous experience in the manufacturer of hydraulic cement-based self-leveling underlayments capable of being applied over the varied substrates of existing buildings.

B. Mockups

1. Before installing self-leveling underlayment, apply mockups to demonstrate quantities of materials and execution. Comply with the following requirements, using materials indicated for the completed Work.

a. Architect will select one area or surface to represent surfaces and conditions for application on each substrate required.

1) Mock-up of installed underlayment shall be no less than 3'-0" X 3'-0" and preferably shall be 6'-0" X 6'-0".

2) Mock-up of installed underlayment shall be prepared *in-situ* and shall be retained in-situ as example of quality of installation as well as underlayment mix.

3) Mock-up of installed underlayment will be inspected no less than 7 days old.

b. Notify Authority seven days (7) in advance of dates and times when mockups will be applied.

c. Obtain Authority's approval of mockups before starting underlayment application.

d. Maintain mockups, during underlayment application and until installation of finish flooring, in an undisturbed condition as a standard for judging the complete work.

e. Approved mockups may become part of the completed work if undisturbed when finish flooring is installed.

1.06 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, mixing with other components, and application. Do not break open manufacturer's factory seals of any component packaging until installation.

B. Store materials to comply with manufacturer's written instructions to prevent deterioration from moisture or other detrimental conditions.

C. Keep all self-leveling underlayment components on a clean dry pallet raised up from the floor the pallet is sitting on in a temperature-controlled and humidity-controlled, secured and locked room until actual incorporation into the Work of this Section.

1.07 ENVIRONMENTAL REQUIREMENTS

A. Do not install self-leveling underlayment until floor penetrations and peripheral work is completed. Where placed on new concrete, concrete slab shall have cured a minimum of 28 days for normal weight concrete and 56 days for lightweight concrete and is dependant on results of moisture testing for both SLU and finish flooring. Testing shall be done under the conditions described in B below.

B. Maintain ambient conditions to which the floor will be maintained under in-situ conditions. Buildings that are or will be air conditioned shall have conditions maintained at a temperature of 78°F together with 50% relative humidity for seventy-two (72) hours continuously prior to installation of underlayment and for the same period after in the space below as well as the space in which the material is being placed. Provide temporary equipment to provide such conditions. Do not utilize forced cooling or heating that produces rapid air movement, which will result in premature wicking of moisture affecting setting and surface of the SLU setting for the first 24 hours after placement. Do not install in temperatures below 50°F or over 90°F. Comply with manufacturer's written recommendations for substrate temperature and moisture content, ambient temperature and humidity, ventilation, and other conditions affecting self-leveling underlayment material's performance.

C. Close areas to traffic during underlayment application and for a minimum twenty-four (24) hour period after installation-application (longer if needed due to actual installation conditions or material type as recommended in writing by manufacturer).

1.08 COORDINATION

A. Coordinate cement-based underlayment with requirements of finish flooring products, including adhesives, specified in Division 9 Sections.

1. Before installing surface sealers recommended by underlayment manufacturer, if any, verify compatibility with finish installation adhesives.

2. For existing construction, coordinate use of ACM materials encapsulant used under requirements of section 02081 with SLU manufacturer's requirements for substrate preparation and use of primer/bonding agent.

1.09 GUARANTEE

A. Provide Manufacturer's five-year warranty covering defects in materials.

B. Provide Contractor's two-year guarantee covering materials and workmanship that self-leveling material will not fail or cause failure of finish material.

C. For surfaces receiving moisture mitigation membrane, manufacturer's ten-year material and labor warranty against failure of those materials placed on the material due to the affects of moisture migration or bond.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Self-leveling underlayment and repair material

1. Ardex Inc.
400 Ardex Park Dr, Aliquippa, Pennsylvania 15001

2. CMP Specialty Products, Inc
601 South 10th Street, Allentown, PA 18103

3. Silpro LLC
2 New England Way, Ayer, MA 01432

4. Dramatic Surface Products/ H.B. Fuller Company
1200 Willow Lake Boulevard, St. Paul, MN 55164

5. Dayton Superior Chemical Division
4226 Kansas Avenue, Kansas City, KS 66108.

B. Moisture Mitigation Membrane

1. CMP
1200 Willow Lake Boulevard, St. Paul, MN 55164

2. Sinak
1949 W. Walnut Ave, San Diego, CA 92101

3. Ardex
400 Ardex Park Dr, Aliquippa, Pennsylvania 15001

C. Material Coordination

Contractor shall provide systems and materials compatible with and acceptable to the SLU manufacturer. Where moisture mitigation membrane is placed, the Contractor shall test the installation of the SLU on the moisture mitigation membrane with the moisture mitigation membrane manufacturer to ensure proper bond is achieved and ensure the warranty against failure will be received.

2.02 MATERIALS

A. General: All self-leveling underlayments are to be hydraulic cement based capable of being installed in spaces subject to moisture without degradation underwet conditions and able to receive floor covering in 16 hours under climate controlled conditions ("self-drying"). The products listed have been tested by the Authority's testing laboratory consultant by laboratory mock-ups and ASTM testing or through successful field testing. No other products will be accepted without going through the testing procedure, which is to be at the manufacturer's cost. Use of materials specified is also dependant on manufacturer's requirements, in which they may not permit the installation on certain substrates due to their material properties. Moisture mitigation membranes, installed prior to application of the SLU, must be acceptable to the SLU manufacturer.

B. Material/Performance Testing to be performed for product not listed – Authority will compare the following against accepted materials

1. Sulfate testing per ASTM C114

2. Compression strength test as per ASTM C109- For both specified amount of water and with additional 1 quart listing testing at 7 days and 28 days.

3. Shrinkage testing per ASTM C596 - For both specified amount of water and with additional 1 quart listing testing at 7 days, 14 days, 21 days, and 28 days.

4. Bond tensile pull in accordance with ASTM C1583.

5. Mixing and placement - For both specified amount of water and with additional 1 quart – Petrographic analysis in accordance with ASTM C1324

   a. Material Segregation during mixing

   b. Material segregation after placement and hardening. Sections taken shall clearly show the bond line and the aggregate within matrix.

6. In-situ testing - For both specified amount of water and with additional 1 quart:

   Placement on a 4x4 slab of lightweight structural concrete, with photographs. If deemed appropriate by the Authority, photographic evidence from other projects may be acceptable.

B. Self-Leveling Underlayment for placement on Hard Concrete Surface (Minimum $f'c$ = 4,000 psi)

1. Primers:

   a. Ardex — Primer P-51.

   b. CMP — AS-100 Primer

   c. Silpro — C-21, Silflo Primer

   d. Dramatic Surface Products — DSP 500 Primer

   e. Dayton Superior — J-42 Primer

2. Flash Patch:

   a. Ardex — SD-F Feather Finish

   b. CMP — Ultra Finish

   c. Silpro — Skim Pro

   d. Dramatic Surface Products — DSP 502 Skim Coat

   e. Dayton Superior — Sure Finish

3. Self-Leveling Underlayment (depending on Build up Thickness):

a.	Ardex	K-15
b.	CMP	Level 1 Finish
c.	Silpro	Silflo 230
d.	Dramatic Surface Products	DSP 520
e.	Dayton Superior	Levelayer I & II

C. Strengthening Underlayment for placement on Soft Cementitious Material – Installation of strengthening membrane to reinforce substrate

1. Strengthening Membrane (normal setting):

a.	Dayton Superior	Conspec Special Patch/ Special Bond Acrylic with fiberglass mesh
b.	Silpro	Masco/C-21 with fiberglass mesh
c.	Dramatic Surface Products	DSP 504/DSP 501 with fiberglass mesh

2. Strengthening Membrane (fast setting):

a.	Dayton Superior	Conspec Special Patch/ Special Bond Acrylic with fiberglass mesh
b.	Silpro	Fasco/C-21 with fiberglass mesh
c.	Dramatic Surface Products	DSP 506/DSP 501 with fiberglass mesh
d.	CMP	SR-P/Polybond with fiberglass mesh

D. Aggregates:

1. Provide aggregates when recommended in writing by underlayment manufacturer for underlayment thickness required.

2. Mixed with self-leveling material: Well-graded, washed 1/8" to 1/4" stone or coarse sand as recommended by underlayment manufacturer.

3. Preplaced Stone: 3/8" or 3/4" clean, crushed, washed stone of a single gradation as recommended by manufacturer.

E. Water: Shall be clean New York City (potable) water free of injurious foreign matter conforming to the requirements for water specified in ASTM C94 at a temperature of not less than 50°F nor more than 70°F.

F. Reinforcement: For underlayment applied to wood substrates, in stair tread and platform pans provide galvanized metal lath or other corrosion-resistant reinforcement recommended in writing by underlayment manufacturer.

G. Primer: Product of underlayment manufacturer recommended in writing for substrate, conditions, and application indicated.

H. Moisture Mitigation Membrane: Material that when placed will prevent moisture and alkalydes from affecting adhesives and materials and shall be placed at a rate to mitigate up to 25 pounds per 1,000 square feet in 24 hours.

1. Sinak HLQ- V-Poxy -Relay system

2. Koester Vap 2000

3. ARDEX MC Rapid or ARDEX MC Plus

4. CMP V-20 Plus or V-25

I. Moisture Test Kits:

1. Vinyl Plastics, Inc. Sheboygan, WI 53082

2. Sealflex Industries Costa Mesa, CA

3. Floor Seal Technology, Inc. San Jose, CA 95112

4. Wagner RH

5. Tramex RH

2.03 PRE-INSTALLATION MEETING

A. Conduct a pre-installation meeting with the manufacturer's representative to review the methods and procedures, including surface preparation, for a satisfactory self-leveling underlayment installation.

B. Meeting shall occur with sufficient time to have submittal, procedures, and test panels completed prior to work progressing.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates, with Installer present for conditions affecting performance of underlayment including substrate moisture content. Begin underlayment application only after unsatisfactory conditions have been corrected and substrate condition inspected and approved by the manufacturer's representative and by Architect/Engineer. SLU installer shall not proceed until above required environmental conditions can be verified and recorded on provided Schedules for a minimum of seventy-two (72) hours prior to SLU application in respective space.

B. Perform moisture tests on concrete subfloors to determine if surfaces are sufficiently cured and dry by the two following test methods. The values indicated shall be verified with the manufacturer of the actual floor finish material:

1. Tests in accordance with ASTM F1869: Moisture vapor transmission shall not exceed 3 pounds per 1,000 square feet in 24 hours.

2. Tests in accordance with ASTM F2170: Relative Humidity shall not exceed 75%.

3.02 PROTECTION

A. Protect substrate and materials from freezing before and after installation.

B. Protect adjacent finish materials and previously poured concrete slabs and SLU against spatter during SLU placement.

3.03 REMOVAL/DEMOLITION

A. Procedure for Entrapping Existing Asbestos Floor Tile and Mastic with Cement-Based Self-Leveling Underlayment:

1. All existing Asbestos Floor tile and Mastic adhesive must remain in-place and undisturbed.

2. Where wall framing requires demolition as shown on Demolition plans, remove framing carefully to leave asbestos tiles intact.

3. Where carpet exists beneath wall framing, remove existing carpet and underlayment by scraping method only. Do not abrade or chip Asbestos tile below.

4. Remove floor wax from tiles with floor wax stripper only. Do not use grinding or sanding methods.

5. Prime asbestos tiles, Mastic Adhesive and adjacent concrete slab areas with bonding agent as per manufacturer's directions.

6. Install Cement- Based Self-Leveling Underlayment System by mixing and applying as per manufacturer's directions. Do not use Gypsum-based overlay system.

7. Protect areas allowing Cement-Based Self-Leveling Underlayment to dry as per manufacturer's instructions.

3.04 SURFACE PREPARATION

A. General: The surface of the existing substrate for the new self-leveling underlayment shall not be shot-blasted, sanded, chipped or abraded. Asbestos tile and mastic adhesive areas must remain as-is and intact. Chemical treatment of the substrate (acid etching, citrus cleaner) is prohibited. After use only of wax stripper, without sanding, remove wax and carpet, notify the engineer for inspection.

1. Prepare and clean substrate according to manufacturer's written instructions for substrate indicated. Provide clean, dry, neutral-pH substrate for underlayment application.

2. Treat nonmoving substrate cracks to prevent cracks from telegraphing (reflecting) through underlayment. Rout any cracks and fill the cracks with the epoxy, scraping smooth and level with the substrate while broadcasting sand to allow for bonding of the SLU. After set, remove all loose sand.

   a. Sikadur 52 epoxy by Sika

   b. Sure-inject J-56 by Dayton Superior

   c. Ardex ArdiSeal 2C Semi-Rigid Epoxy

   d. CM-10 by CMP Specialty Products, Inc.

3. Fill substrate voids, holes and patch the low spots with the following products to prevent underlayment from leaking:

a. Sika top 122 plus patching grout by Sika

b. Ardex SD-P by Ardex

c. HD-50 or Conspec Special Patch/Special Bond Acrylic by Dayton Superior

d. Fastcrete, Mascrete, or Patchco by Silpro

e. DSP 506 by Dramatic Surface Products

f. CMP SR-P by CMP

B. New Concrete Substrates: Mechanically remove laitance, glaze, efflorescence, curing compounds, form-release agents, dust, dirt, grease, oil, and other contaminants that might impair underlayment bond according to manufacturer's written instructions.

C. Wood Substrates: Mechanically fasten loose boards and panels to eliminate substrate movement and squeaks. Sand to remove coatings that might impair underlayment bond and remove sanding dust.

1. Install underlayment reinforcement recommended in writing by manufacturer.

D. Metal stair pan Substrates: Mechanically remove rust, foreign matter, and other contaminants that might impair underlayment bond according to manufacturer's written instructions. Apply corrosion resistant coating compatible with underlayment if recommended in writing by underlayment manufacturer.

E. Nonporous Substrates: For ceramic tile, quarry tile, and terrazzo substrates, remove waxes, sealants, and other contaminants that might impair underlayment bond according to manufacturer's written instructions. No scraping or abrasive methods are allowed.

F. Adhesion Tests: After substrate preparation, test substrate for adhesion with underlayment according to manufacturer's written instructions.

3.05 APPLICATION

A. General: Mix and apply underlayment components according to manufacturer's written instructions.

1. Coordinate application of components to provide optimum underlayment-to-substrate and intercoat adhesion.

2. At substrate expansion, isolation, and other moving joints, allow joint of same width to continue through underlayment.

B. Mixing and installation of moisture mitigation membrane. Choice of material must be based on compatability to self-leveling material selected to provide the proper bond.

1. Mix material in accordance with manufacturer's instructions.

2. Provide mix and applications to provide resistance up to 25 pounds per 1,000 square feet in 24 hours, including application of materials to provide bond to the SLU.

C. Mixing of SLU

1. Provide water of exact quantity as required by manufacturer.

2. Provide mechanical mixer for mixing SLU material with water at project site. Equip mixer with a suitable water-measuring device.

3. Use only mixers that are capable of mixing the dry SLU mix and water (and aggregate where required) into a uniform self-leveling mix.

D. Apply primer over prepared substrate at manufacturer's recommended spreading rate.

E. Installation

1. Apply self-leveling underlayment, in accordance with the manufacturer's instructions, to a minimum thickness of 1/8" over high points. Utilize a gage rake to provide a uniform average thickness and finish with a smoother to provide a level, smooth plane finish, free of score marks, grooves, depressions and ripples. Finish tolerance shall be as required for finish flooring:

a. Wood floors: Finish tolerance no greater than +1/8" in ten feet.

b. Carpeting: Finish tolerance no greater than +1/4" in ten feet.

c. All Other finishes (tile, poured floors, etc): Finish tolerance no greater than +3/16" in ten feet.

2. Where joints are required, construct to match and coincide with joints in base slab. Provide other joints as shown.

3. Where depth of material will be over 3/4" deep(or less depending on manufacturer's printed literature for that product), place in two lifts by providing aggregate in the mix to extend the material of the first lift, followed by a finish pour of 1/4" without aggregate. The proportion of aggregate to SLU shall be as recommended by the manufacturer in writing. If acceptable and recommended in writing by the manufacturer, place uniform stone loose (after priming of substrate) and place self-leveling on stone. As an alternative,

place non-extended mix in 3/4" maximum lifts (or less depending on manufacturer's recommendations for that product). Allow time between lifts as recommended by manufacturer to allow for curing and shrinkage. Prepare surface of each lift as recommended by manufacturer.

4. Provide for transition between adjacent area not scheduled to receive underlayment.

3.06 PROTECTION

A. Cure underlayment according to manufacturer's written instructions. Prevent contamination during application and curing processes. Protect all freshly deposited underlayment from premature drying and excessively hot or cold temperatures and maintain it with minimal moisture loss at a relatively constant temperature for the period of time necessary for the hydration of the cement and proper hardening of the underlayment.

B. Protect underlayment against damage by covering with suitable protective materials such as kraft building paper, plywood, masonite or similar or in accordance with manufacturer's recommendations until installation of finish material.

C. Protect underlayment from concentrated and rolling loads for remainder of construction period.

D. Do not walk on or install finish flooring over underlayment for a minimum of 24 hours after placement, or longer if required by the SLU manufacturer due to material type or environmental conditions.

3.07 FIELD QUALITY CONTROL

A. Field Samples

Periodically throughout placement as recommended by manufacturer, conduct "Patty" or "Flow Ring" test to confirm proper water/cement ratio. If requested, cast three brass-molded cubes in the presence of manufacturer's representative for compressive strength documentation.

B. Inspection

Notify the Authority of the beginning of each phase of work so the Engineer or Architect-of-Record and other Authority Representatives can make inspections. Do not proceed with installation of materials until substrates have been prepared and approved by the Engineer/Architect-of-Record and the manufacturer's representative. The Authority may also elect to engage a licensed laboratory to take samples of the material and witness the mixing.

D. Manufacturer's Field Service

Obtain services of self-leveling underlayment manufacturer's representative to inspect and supervise substrate preparation and placement of the material. The manufacturer's representative is to inspect the substrate to ensure their material is appropriate for the application, that jobsite environmental conditions for placement are met, and to ensure the substrate preparation is adequate and shall provide a written report of such inspection.

3.08 ACCEPTANCE OF SELF-LEVELING UNDERLAYMENT WORK

A. General

1. Completed underlayment work that meets all applicable requirements will be accepted without qualification.

2. Completed underlayment work that fails to meet one or more requirements but which has been repaired to bring it into compliance will be accepted without qualification.

3. Failure of self-leveling underlayment to bond to substrate (as indicated by a hollow sound when tapped), or disintegration or other failure of underlayment to perform in accordance with product data, will be considered failure of materials and workmanship. Repair or replace underlayments in areas of such failures. Underlayment work judged inadequate or deemed unacceptable due to appearance shall be replaced if so directed by the Engineer at the Contractor's expense.

4. Pay all costs incurred by the Authority in providing additional testing and/or analysis required by this Section.

5. The Authority will pay all costs of additional testing and analysis made at its own request that is not required by this Section or which shows concrete is in compliance with the Contract Documents.

B. Dimensional Tolerances

Finished underlayment exceeding the tolerances may be repaired provided that strength, durability, or appearance is not adversely affected. High spots may be removed with a terrazzo grinder, low spots filled with a cement-based patching compound, or other remedial measures performed as permitted and as acceptable to the self-leveling underlayment manufacturer.

END OF SECTION

LIST OF SUBMITTALS

SUBMITTAL	DATE SUBMITTED	DATE APPROVED
Product Data:	_____	_____
1. Self-leveling underlayment		
2. Repair mortar		
3. Primer		
4. Epoxy		
5. Moisture Mitigation Membrane		
Shop Drawings:	_____	_____
Test Reports:	_____	_____
1. Product Properties		
2. Moisture Tests		
Certificates:	_____	_____
Manufacturer's Instructions:	_____	_____
Written Repair Procedure:	_____	_____
Manufacturer's Field Reports:	_____	_____
Qualifications:	_____	_____
1. Installer		
2. Manufacturer		
Appendix A Schedule:	_____	_____
Appendix B Schedule:	_____	_____
Guarantee:	_____	_____
Mock-up:	_____	_____

* * *

APPENDIX A SCHEDULE

Beginning Time/ Ambient Air Temperature	Ending Time/Ambient Air Relative Humidity	Physical Conditions of Application: Were the Windows in the outside wall? Y/N	HVAC Pre-Conditioning Was the HVAC on continuously for a minimum of 72 hours prior to your Application?	How old is the cast concrete upon which you are applying the SLU Material Slurry? At least 28/56 Days, or longer:

Signed by Individual Installer-Applicator:

Date Signed

APPENDIX B SCHEDULE

Project Number: **Project Name:** **Project Location:**

Individual Floor/Location	Day/date Test Taken	Individual Floor/Location	Day/Date Test Taken
Moisture Test per ASTM F1869 To Be Taken Prior to SLU Installation		Temperature Test on by In-field SLU Installer at time of SLU application	

Signed by Individual Installer-Applicator:

Date of Signature:

SECTION 04810 - UNIT MASONRY ASSEMBLIES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes unit masonry assemblies consisting of the following:
   1. Concrete masonry units.
   2. New brick veneers.
   3. Repairing brick veneers.
   4. Re-anchoring brick veneers.

1.2 SUBMITTALS

A. Product Data: For each masonry unit, accessory, and other manufactured product indicated.

B. Samples: Provide full range of colors and textures available for exposed masonry units and colored mortars to match exitsting masonry and mortars.

C. Material Test Reports: For each type of masonry unit, mortar, and grout required.

D. Material Certificates: For each type of masonry unit required.

1.3 QUALITY ASSURANCE

A. Restoration Specialist: Engage an experienced masonry restoration firm that has specialized in the types of work required for this Project.

B. Fire-Resistance Ratings: Where indicated, provide materials and construction identical to those of assemblies with fire-resistance ratings determined per ASTM E 119 by a testing and inspecting agency, by equivalent concrete masonry thickness, or by another means, as acceptable to authorities having jurisdiction.

1.4 PROJECT CONDITIONS

A. Cold-Weather Requirements: Do not build on frozen substrates. Remove and replace unit masonry damaged by frost or by freezing conditions. Comply with cold-weather construction requirements in ACI 530.1/ASCE 6/TMS 602.

B. Hot-Weather Requirements: When ambient temperature exceeds 90 deg F with a wind velocity greater than 8 mph, do not spread mortar beds more than 48 inches ahead of masonry. Set masonry units within one minute of spreading mortar.

C. Clean masonry surfaces only when air temperature is 40 deg F (4 deg c) and above and will remain so until masonry has dried out, but for not less than 7 days after completion of cleaning.

D. Do not tuckpoint mortar joints or repair masonry unless air temperature is between 40 deg F (4 deg C) and 80 deg F (27 deg C) and will remain so for at least 48 hours after completion of work.

E. Prevent grout or mortar used in tuckpointing and repair work from staining face of surrounding masonry and other surfaces. Immediately remove grout and mortar in contact with exposed masonry and other surfaces and clean affected areas.

F. Protect sills, ledges, and projections from mortar droppings.

1.5 SEQUENCE SCHEDULING

A. Order replacement materials at the earliest possible date, to avoid delaying completion of the Work.

B. Perform masonry restoration work in the following sequence:

1. Repair existing brick, including replacing existing brick with new masonry to match existing materials in dimension, texture, color and finish. .
2. Re-anchor brick veneer with new anchors.
3. Tuckpoint existing mortar joints of brick where indicated with mortor to match existing color.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for product selection:
1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the products to match existing masonry.
2. Products: Subject to compliance with requirements, provide one of the products specified.

2.2 COLORS AND TEXTURES

A. Exposed Masonry Units: As indicated by manufacturer's designations.

2.3 MASONRY UNITS

A. Concrete Masonry Units: ASTM C 90.
1. Type: I, moisture-controlled units.

B. Brick, General:

1. Provide units without cores or frogs and with exposed surfaces finished for ends of sills and caps and for similar applications that would otherwise expose unfinished brick surfaces.
2. Provide solid brick window sills with profile geometry to match existing sills on building.

C. Face Brick: ASTM C 216 Grade SW, Type FBS.
1. Initial Rate of Absorption: Less than 20 g/30 sq. in. per minute when tested per ASTM C 67.
2. Efflorescence: When tested per ASTM C 67 and brick is rated "not effloresced."
3. Surface Coloring: Brick with surface coloring, other than flashed or sand-finished brick, will withstand 50 cycles of freezing and thawing per ASTM C 67 with no observable difference in the applied finish when viewed from 10 feet.
4. Size: Manufactured to the following actual dimensions:

a. Modular: 3-1/2 to 3-5/8 inches wide by 2-1/4 inches high by 7-1/2 to 7-5/8 inches long. Verify in field to match existing face brick in dimension, texture and color.

5. Colors:

a. Brick shall be: As manufactured by Old Virginia Brick Company, McAvoy Brick; or approved equal by Architect.

2.4 MORTAR AND GROUT MATERIALS

A. Portland Cement: ASTM C 150, Type I or II, except Type III may be used for cold-weather construction.

B. Hydrated Lime: ASTM C 207, Type S.

C. Mortar Cement: ASTM C 1329.

1. Available Products:

a. Blue Circle Cement; Magnolia Superbond Mortar Cement.
b. Lafarge Corporation; Lafarge Mortar Cement.

D. Aggregate for Mortar: ASTM C 144; except for joints less than 1/4 inch thick, use aggregate graded with 100 percent passing the No. 16 sieve.

E. Aggregate for Grout: ASTM C 404.

F. Cold-Weather Admixture: Nonchloride, noncorrosive, accelerating admixture complying with ASTM C 494, Type C, and recommended by the manufacturer for use in masonry mortar of composition indicated.

1. Available Products:

a. Euclid Chemical Co.; Accelguard 80.
b. Grace, W. R. & Co., Construction Products Division; Morseled.

G. Water: Potable.

2.5 REINFORCING

A. Uncoated Steel Reinforcing Bars: ASTM A 615/A 615M; ASTM A 616/A 616M, including Supplement 1; or ASTM A 617/A 617M, Grade 60.

B. Masonry Joint Reinforcement: ASTM A 951: mill galvanized, carbon-steel wire for interior walls and hot-dip galvanized, carbon-steel wire for exterior walls.

1. Wire Size for Side Rods: W1.7 or 0.148-inch diameter.
2. Wire Size for Cross Rods: W1.7 or 0.148-inch diameter.
3. Single-Wythe Masonry: Use either ladder or truss type with single pair of side rods and cross rods spaced not more than 16 inches o.c.
4. Multiwythe Masonry: Use adjustable (2-piece) type with single pair of side rods and cross ties spaced not more than 16 inches o.c. and with separate adjustable veneer ties engaging the cross ties.

2.6 TIES AND ANCHORS

A. Materials, General: As follows, unless otherwise indicated:

1. Galvanized Carbon-Steel Wire: ASTM A 82; with ASTM A 153, Class B-2 coating for exterior walls and Class 1 coating for interior walls.
2. Galvanized Steel Sheet: ASTM A 366/A 366M cold-rolled, carbon-steel sheet hot-dip galvanized after fabrication to comply with ASTM A 153, at exterior walls; and ASTM A 653/A 653M, G60 , commercial-quality, steel sheet zinc coated by hot-dip process on continuous lines before fabrication at interior walls.

B. Adjustable Masonry-Veneer Anchors: Provide 2-piece assemblies that allow vertical or horizontal adjustment but resist tension and compression forces perpendicular to wall, for attachment over sheathing to wood or metal studs, and that are capable of withstanding a 100-lbf load in both tension and compression without deforming or developing play in excess of 0.05 inch.

1. Screw-Attached, Masonry-Veneer Anchors: Units with triangular wire tie and rib-stiffened, sheet metal anchor section with screw holes top and bottom and with raised rib-stiffened strap stamped into center to provide a slot for connection of wire tie.

a. Available Products:

1) Dur-O-Wal, Inc.; D/A 210 with D/A 700-708.
2) Hohmann & Barnard, Inc.; DW-10HS.
3) Masonry Reinforcing Corporation of America; 1004, Type III.

C. Masonry Repair Anchors: Mechanical fasteners designed for masonry veneer stabilization. Anchors shall consist of a ¼ inch (6 mm) diameter stainless-steel rod with brass expanding shells at each end and a water-shedding washer in the middle. Expanding shells shall be designed to provide positive mechanical anchorage to the veneer on one end and the backup masonry on the other end.

1. Product: Subject to compliance with requirements, provide Mechanical Repair Anchors, Torkfix by Helifix.

2.7 EMBEDDED FLASHING MATERIALS

A. Metal Flashing and Accessories:

1. Material: Copper, 10-oz./sq. ft. weight or 0.0135 inch thick for fully concealed flashing; 16-oz./sq. ft. weight or 0.0216 inch thick elsewhere.
2. Metal Drip Edges: Extending at least 3 inches into wall and 1/2 inch out from wall, with a hemmed outer edge bent down 30 degrees.
3. Flashing Terminations: Extending at least 3 inches into wall and out to exterior face of wall. At exterior face of wall, bend metal back on itself for 3/4 inch and then down into joint 3/8 inch to form a stop for retaining sealant backer rod.

2.8 MISCELLANEOUS MASONRY ACCESSORIES

A. Rectangular Plastic Weep/Vent Tubing: Clear butyrate, 3/8 by 1-1/2 by 3-1/2 inches.

1. Available Products:

a. Advanced Building Products, Inc.; Mortar Break.
b. Mortar Net USA, Ltd.; Mortar Net.
c. Polytite Manufacturing Corp.; Mortar Stop.

2.9 MASONRY CLEANERS

A. Job-Mixed Detergent Solution: Solution of 1/2-cup dry measure tetrasodium polyphosphate and 1/2-cup dry measure laundry detergent dissolved in 1 gal. of water.

2.10 MORTAR AND GROUT MIXES

A. General: Do not use admixtures, unless otherwise indicated. Do not use calcium chloride in mortar or grout.
B. Mortar for Unit Masonry: Comply with ASTM C 270, Proportion Specification.

1. For installation of all brick, use Type "N" mortar.
2. For mortar cement mortar, not more than 5 percent.

C. Grout for Unit Masonry: Comply with ASTM C 476.

1. Use grout of type indicated or, if not otherwise indicated, of type (fine or coarse) that will comply with Table 5 of ACI 530.1/ASCE 6/TMS 602 for dimensions of grout spaces and pour height.
2. Provide grout with a slump of 8 to 11 inches as measured according to ASTM C 143.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Cut masonry units with motor-driven saws. 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.

B. Select and arrange units for exposed unit masonry to produce a uniform blend of colors and textures.
C. Wetting of Brick: Wet brick before laying if the initial rate of absorption exceeds 30 g/30 sq. in. per minute when tested per ASTM C 67. Allow units to absorb water so they are damp but not wet at the time of laying.

D. Comply with tolerances in ACI 530.1/ASCE 6/TMS 602 and the following:

1. For conspicuous vertical lines, such as external corners, door jambs, reveals, and expansion and control joints, do not vary from plumb by more than 1/4 inch in 20 feet, nor 1/2 inch maximum.
2. For conspicuous horizontal lines, such as exposed lintels, sills, parapets, and reveals, do not vary from level by more than 1/4 inch in 20 feet ,nor 1/2 inch maximum.

3.2 LAYING MASONRY WALLS

A. Lay out walls in advance for accurate spacing of surface bond patterns with uniform joint thicknesses and for accurate location of openings, movement-type joints, returns, and offsets. Avoid using less-than-half-size units, particularly at corners, jambs, and, where possible, at other locations.

B. Bond Pattern for Exposed Masonry: Lay exposed masonry in bond pattern indicated; do not use units with less than nominal 4-inch horizontal face dimensions at corners or jambs.

C. Built-in Work: As construction progresses, build in items specified under this and other Sections of the Specifications. Fill in solidly with masonry around built-in items.

D. Fill cores in hollow concrete masonry units with grout 24 inches under bearing plates, beams, lintels, posts, and similar items, unless otherwise indicated.

3.3 MORTAR BEDDING AND JOINTING

A. Lay solid brick-size masonry units with completely filled bed and head joints; butter ends with sufficient mortar to fill head joints and shove into place. Do not deeply furrow bed joints or slush head joints.

1. At cavity walls, bevel beds away from cavity, to minimize mortar protrusions into cavity.

3.4 CAVITIES

A. Keep cavities clean of mortar droppings and other materials during construction.

1. Use wood strips temporarily placed in cavity to collect mortar droppings. As work progresses, remove strips, clean off mortar droppings, and replace in cavity.
2. Provide minimum 1" wide cavity for entire length and height of walls.

3.5 MASONRY JOINT REINFORCEMENT

A. Provide continuous masonry joint reinforcement as indicated. Install with a minimum cover of 5/8 inch on exterior side of walls, 1/2 inch elsewhere. Lap reinforcement a minimum of 6 inches.

B. Provide continuity at corners and wall intersections by using prefabricated "L" and "T" sections.

3.6 ANCHORING MASONRY

A. Anchor masonry veneers to wall framing with masonry-veneer anchors to comply with the following requirements:

1. Fasten each anchor section through sheathing to wall framing with two metal fasteners of type indicated.
2. Embed tie sections in masonry joints. Provide not less than 2 inches of air space between back of masonry veneer and face of sheathing.
3. Space anchors as indicated, but not more than 16 inches o.c. vertically and 24 inches o.c. horizontally with not less than 1 anchor for each 2.67 sq. ft. of wall area. Install additional anchors within 12 inches of openings and at intervals, not exceeding 36 inches, around perimeter.

3.8 FLASHING, WEEP HOLES, AND VENTS

A. General: Install embedded flashing and weep holes in masonry at shelf angles, lintels, ledges, other obstructions to downward flow of water in wall, and where indicated.

1. Extend flashing 4 inches at ends and turn flashing up not less than 2 inches to form a pan.
2. Install metal drip edges beneath flashing at exterior face of wall. Stop flashing 1/2 inch back from outside face of wall and adhere flashing to top of metal drip edge.

B. Install weep holes in the head joints in exterior wythes of the first course of masonry immediately above embedded flashing. Install vents in vertical head joints at the top of each continuous cavity at spacing indicated. Install weep holes at all locations noted on drawings, including window and door lintels (min. 2 ech).

1. Use rectangular plastic tubing to form weep holes and vents.
2. Space weep holes 16 inches o.c.

3.9 REINFORCED UNIT MASONRY INSTALLATION

A. Placing Reinforcement: Comply with requirements in 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 in ACI 530.1/ASCE 6/TMS 602 for cleanouts and for grout placement, including minimum grout space and maximum pour height.

3.10 PARGING

A. Parge predampened masonry walls, where indicated, with Type S or Type N mortar applied in 2 uniform coats to a total thickness of 3/4 inch with a steel-trowel finish. Form a wash at top of parging and a cove at bottom. Damp-cure parging for at least 24 hours.

3.11 BRICK REMOVAL AND REBUILDING

A. Carefully remove by hand, at locations indicated, bricks that are damaged, spalled, or deteriorated. Cut out full units from joint to joint and in a manner to permit replacement with full-size units.

B. Support and protect masonry indicated to remain that surrounds removal area. Maintain flashing, reinforcement, lintels, and adjoining construction in an undamaged condition.

C. Clean remaining brick at edges of removal areas by removing mortar, dust, and loose debris in preparation for rebuilding.

3.12 BRICK REBUILDING

A. Install new brick to replace removed brick. Fit replacement units into bonding and coursing pattern of existing brick. If cutting is required, use a motor-driven saw designed to cut masonry with clean, sharp, unchipped edges.

B. Lay replacement brick with completely filled bed, head, and collar joints. Butter ends with sufficient mortar to fill head joints and shove into place. Wet clay bricks that have ASTM C 67 initial rates of absorption (suction) of more than 30 gm per 30 sq. in. per min. Use wetting methods that ensure units are nearly saturated but surface dry when laid. Maintain joint width for replacement units to match existing units.

C. Tool exposed mortar joints in repaired areas to match joints of surrounding existing brickwork.
D. Point new mortar joints in repaired area to comply with requirements for repointing existing masonry, and rake out mortar used for laying brick before mortar sets. Match profile of existing rake and depth of joint.

3.13 RE-ANCHORING VENEERS

A. Install masonry repair anchors in horizontal mortar joints and according to manufacturer's recommendations. Install at no more than 16 inches o.c. vertically and 32 inches o.c. horizontally, except as otherwise indicated. Install at locations to avoid penetrating flashing.

B. Recess anchors at least 5/8 inch from surface of mortar joint, and fill recess with pointing mortar.

3.14 TUCKPOINTING MASONRY

A. Point joints as follows:

1. Rinse masonry joint surfaces with water to remove dust and mortar particles. Time the rinsing application so that at the time of pointing excess water has evaporated or run off and joint surfaces are damp but free of standing water.

2. Apply the first layer of pointing mortar to areas where existing mortar was removed to depths greater than surrounding areas. Apply in layers not greater than 3/8 inch until a uniform depth is formed. Compact each layer thoroughly and allow it to become thumbprint hard before applying the next layer.
3. After joints have been filled to a uniform depth, place remaining pointing mortar in three layers with each of first and second layers filling approximately two fifths of joint depth and third layer the remaining one fifth. Fully compact each layer and allow to become thumbprint hard before applying next layer. Where existing bricks have rounded edges recess final layer slightly from face. Take care not to spread mortar over edges onto exposed masonry surfaces, or to featheredge mortar.
4. When mortar is thumbprint hard, tool joints to match original appearance of joints, unless otherwise indicated. Remove excess mortar from edge of joint by brushing.
5. Cure mortar by maintaining in a damp condition for not less than 72 hours.
6. Where repointing work precedes cleaning of existing masonry, allow mortar to harden not less than 30 days before beginning cleaning work.

3.15 CLEANING

A. Clean unit masonry by dry brushing to remove mortar fins and smears before tooling joints, as work progresses.

B. After mortar is thoroughly set and cured, clean exposed masonry as follows:

1. Test cleaning methods on sample wall panel; leave one-half of panel uncleaned for comparison purposes.
2. Protect adjacent surfaces from contact with cleaner.
3. Wet wall surfaces with water before applying cleaners; remove cleaners promptly by rinsing the surfaces thoroughly with clear water.
4. Clean brick by the bucket-and-brush hand-cleaning method described in BIA Technical Notes No. 20, using job-mixed detergent solution.

3.16 MASONRY WASTE DISPOSAL

A. Masonry Waste Disposal: Dispose of clean masonry waste, including broken masonry units, waste mortar, and excess or soil-contaminated sand, by crushing and mixing with fill material as fill is placed.

1. Do not dispose of masonry waste as fill within 18 inches of finished grade.
2. Remove excess, clean masonry waste that cannot be used as fill, as described above, and other masonry waste, and legally dispose of off Owner's property.

END OF SECTION 04810

SECTION 05120 - STRUCTURAL STEEL FRAMING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Structural steel.
2. Grout.

B. Related Requirements:

1. Structural Drawings and Notes

1.2 DEFINITIONS

A. Structural Steel: Elements of the structural frame indicated on Drawings and as described in AISC 303, "Code of Standard Practice for Steel Buildings and Bridges."

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at project site: 600 Wilson Ave., Newark, NJ.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: Show fabrication of structural-steel components including connections to all assemblies.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For installer, fabricator and testing agency .

B. Welding certificates.

C. Mill test reports for structural steel, including chemical and physical properties.

D. Source quality-control reports.

E. Field quality-control and special inspection reports.

1.6 QUALITY ASSURANCE

A. Fabricator Qualifications: A qualified fabricator that participates in the AISC Quality Certification Program and is designated an AISC-Certified Plant, Category

B. Installer Qualifications: A qualified installer who participates in the AISC Quality Certification Program and is designated an AISC-Certified Erector, Category CSE.

C. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

D. Comply with applicable provisions of the following specifications and documents:
1. AISC 360.
2. RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Connections: Provide Shop Drawings that detail simple shear connections required by the Contract Documents to be selected or completed by structural-steel fabricator to withstand loads indicated and comply with other information and restrictions indicated.

1. Select and complete connections using Contract Structural Drawings
2. Use Allowable Stress Design as per Structural Drawings ;

B. Moment Connections: Provide as per Contract Structural Drawings .

C. Construction: Construct as per plans, sections , notes of Contract Structural Drawings

D. STRUCTURAL-STEEL MATERIALS

E. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 50 percent.

F. W-Shapes: ASTM A992/A992M or A572 Grade 50

G. Channels, Angles - Shapes: ASTM A 36/A 36M.

H. Plate and Bar: ASTM A36/A36M A572 or A992.

I. Cold-Formed Hollow Structural Sections: ASTM A 500.

J. Steel Pipe: ASTM.

K. Welding Electrodes: Comply with AWS requirements.

2.2 BOLTS, CONNECTORS, AND ANCHORS

A. See notes on Structural Drawing for BOLTS, FASTENERS and HARDWARE Specification.

B. Tension-Control, High-Strength Bolt-Nut-Washer Assemblies: ASTM F 1852, Type 1, heavy-hex head assemblies consisting of steel structural bolts with splined ends, heavy-hex carbon-steel nuts, and hardened carbon-steel washers.

1. Finish: Mechanically deposited zinc coating.

C. Shear Connectors: ASTM A 108, Grades 1015 through 1020, headed-stud type, cold-finished carbon steel; AWS D1.1/D1.1M, Type B.

D. Unheaded Anchor Rods: ASTM F 1554, Grade 36.

1. Configuration: Straight.
2. Finish: Mechanically deposited zinc coating, ASTM B 695, Class 50.

E. Headed Anchor Rods: ASTM F 1554, Grade 36 straight.

1. Finish: Mechanically deposited zinc coating, ASTM B 695, Class 50.

F. Threaded Rods: ASTM A 36/A 36M.

1. Finish: Mechanically deposited zinc coating, ASTM B 695, Class 50.

2.3 PRIMER

A. Low-Emitting Materials: Paints and coatings shall comply with the testing and product requirements of the California Department of Public Health's (formerly, the California Department of Health Services') "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

B. Primer: Comply with Section 09912 "Interior Painting,"

C. Primer: SSPC-Paint 25, zinc oxide, alkyd, linseed oil primer.

D. Primer: Fabricator's standard lead- and chromate-free, nonasphaltic, rust-inhibiting primer complying with MPI#79 and compatible with topcoat.

2.4 GROUT

A. Metallic, Shrinkage-Resistant Grout: ASTM C 1107/C 1107M, 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/C 1107M, factory-packaged, nonmetallic aggregate grout, noncorrosive and nonstaining, mixed with water to consistency suitable for application and a 30-minute working time.

2.5 FABRICATION

A. Structural Steel: Fabricate and assemble in shop to greatest extent possible. Fabricate according to AISC 303, "Code of Standard Practice for Steel Buildings and Bridges," and to AISC 360.

B. 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.

2.6 SHOP CONNECTIONS

A. High-Strength Bolts: Shop install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for type of bolt and type of joint specified.

1. Joint Type: Snug- tightened.

B. Weld Connections: Comply with AWS D1.1/D1.1M for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.

2.7 SHOP PRIMING

A. Shop prime steel surfaces except the following:

1. Surfaces embedded in concrete or mortar. Extend priming of partially embedded members to a depth of 2 inches
2. Surfaces to be field welded.
3. Surfaces of high-strength bolted, slip-critical connections.
4. Surfaces to receive sprayed fire-resistive materials (applied fireproofing).
5. Galvanized surfaces.
6. Surfaces enclosed in interior construction.

B. Surface Preparation: Clean surfaces to be painted. Remove loose rust and mill scale and spatter, slag, or flux deposits. Prepare surfaces according to the following specifications and standards:

1. SSPC-SP 2, "Hand Tool Cleaning."
2. SSPC-SP 3, "Power Tool Cleaning."
3. SSPC-SP 7/NACE No. 4, "Brush-off Blast Cleaning."

C. Priming: Immediately after surface preparation, apply primer according to manufacturer's written instructions and at rate recommended by SSPC to provide a minimum dry film thickness of 1.5 mils. Use priming methods that result in full coverage of joints, corners, edges, and exposed surfaces.

2.8 SOURCE QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform shop tests and inspections.

1. Provide testing agency with access to places where structural-steel work is being fabricated or produced to perform tests and inspections.

B. Bolted Connections: Inspect and test shop-bolted connections according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."

C. Welded Connections: Visually inspect shop-welded connections according to AWS D1.1/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 are not accepted.
3. Ultrasonic Inspection: ASTM E 164.
4. Radiographic Inspection: ASTM E 94.

D. Prepare test and inspection reports.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify, with certified steel erector present, elevations of concrete- and masonry-bearing surfaces and locations of anchor rods, bearing plates, and other embedments for compliance with requirements.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 ERECTION

A. Set structural steel accurately in locations and to elevations indicated and according to AISC 303 and AISC 360.

B. Baseplates Bearing Plates and Leveling Plates: Clean concrete- and masonry-bearing surfaces of bond-reducing materials, and roughen surfaces prior to setting plates. Clean bottom surface of plates.

1. Set plates for structural members on wedges, shims, or setting nuts as required.
2. Weld plate washers to top of baseplate.
3. Pretension anchor rods after supported members have been positioned and plumbed. Do not remove wedges or shims but, if protruding, cut off flush with edge of plate before packing with grout.

4. Promptly pack grout solidly between bearing surfaces and plates so no voids remain. Neatly finish exposed surfaces; protect grout and allow to cure. Comply with manufacturer's written installation instructions for shrinkage-resistant grouts.

C. Maintain erection tolerances of structural steel within AISC 303, "Code of Standard Practice for Steel Buildings and Bridges."

3.3 FIELD CONNECTIONS

A. High-Strength Bolts: Install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for type of bolt and type of joint specified.

1. Joint Type: Snug Tightened.

B. Weld Connections: Comply with AWS D1.1/D1.1M and AWS D1.8/D1.8M for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.

1. Comply with AISC 303 and AISC 360 for bearing, alignment, adequacy of temporary connections, and removal of paint on surfaces adjacent to field welds.
2. Remove backing bars or runoff tabs where indicated, back gouge, and grind steel smooth.
3. Assemble and weld built-up sections by methods that maintain true alignment of axes without exceeding tolerances in AISC 303, "Code of Standard Practice for Steel Buildings and Bridges," for mill material.

3.4 FIELD QUALITY CONTROL

A. Special Inspections: Engage a qualified special inspector to perform the following special inspections:

1. Verify structural-steel materials and inspect steel frame joint details.
2. Verify weld materials and inspect welds.
3. Verify connection materials and inspect high-strength bolted connections.

B. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

C. : Inspect and test bolted connections according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."

D. Welded Connections: Visually inspect field welds according to AWS D1.1/D1.1M.

1. In addition to visual inspection, test and inspect field welds 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 are not accepted.
c. Ultrasonic Inspection: ASTM E 164.
d. Radiographic Inspection: ASTM E 94.

END OF SECTION 05120

SECTION 05500 - METAL FABRICATIONS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Steel ladders.
2. Ladder safety cages.
3. Loose bearing and leveling plates.
4. Loose steel lintels.
5. Shelf angles.
6. Miscellaneous steel framing and supports.
7. Support for ceiling hung toilet partition pilasters.
8. Miscellaneous steel trim.

B. See Division 5 Section "Pipe and Tube Railings" for metal pipe and tube handrails and railings.

C. See Division 5 Section "Gratings" for metal gratings.

D. See Division 5 Section "Ornamental Handrails and Railings" for ornamental metal handrails and railings fabricated from stock components.

1.2 SUBMITTALS

A. Product Data: For the following:

1. Manufacturer's submittal for threaded hanging rods, anchorage support methods, bracing, and support member of pilasters.
2. Manufacturer's submittals for all metal components.

B. Shop Drawings: Include plans, elevations, sections, details of installation, and coordination of attachments to ceiling hung toilet partition pilasters. Support system to be as recommended by toilet partition manufacturer for ceiling hung pilasters.

C. Templates: For anchor bolts and hangers.

D. Manufacturer's submittal for each type of item.

PART 2 - PRODUCTS

2.1 METALS

A. Metal Surfaces, General: Provide materials with smooth, flat surfaces without blemishes.

B. Ferrous Metals:

1. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
2. Stainless-Steel Bars and Shapes: ASTM A 276, Type **[304] [316L]**.
3. Rolled-Steel Floor Plate: ASTM A 786/A 786M, rolled from plate complying with ASTM A 36/A 36M or ASTM A 283/A 283M, Grade C or D.
4. Steel Tubing: Cold-formed steel tubing complying with ASTM A 500.
5. Steel Pipe: ASTM A 53, standard weight (Schedule 40), unless another weight is indicated or required by structural loads.
6. Slotted Channel Framing: Cold-formed metal channels 1-5/8 by 1-5/8 inches with flange edges returned toward web and with 9/16-inch wide slotted holes in webs at 2 inches o.c. Channels made from galvanized steel complying with ASTM A 653/A 653M, structural quality, Grade 33, with G90 coating; 0.079-inch nominal thickness.
7. Iron Castings: ASTM A 47, Grade 32510 malleable iron or ASTM A 48, Class 30 gray iron.
8. Concrete Inserts: Threaded or wedge type; galvanized ferrous castings, either ASTM A 47 malleable iron or ASTM A 27/A 27M cast steel. Provide bolts, washers, and shims as needed, hot-dip galvanized per ASTM A 153/A 153M.

2.2 PAINT

A. Shop Primer for Ferrous Metal: SSPC-Paint 20, organic zinc-rich primer compatible with topcoat.

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
2. Products: Subject to compliance with requirements, provide one of the following:

a. Carboline Company; Carboline 621.
b. PPG Industries, Inc.; Aquapon Zinc-Rich Primer 97-670.
c. Tnemec Company, Inc.; Tneme-Zinc 90-97.

C. Galvanizing Repair Paint: SSPC-Paint 20, high-zinc-dust-content paint for regalvanizing welds in steel.

2.3 MISCELLANEOUS MATERIALS

A. Fasteners: Type 304 or 316 stainless-steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B 633, Class Fe/Zn 5, where built into exterior walls, of type, grade, and class required by application indicated.

B. Nonshrink, Nonmetallic Grout: ASTM C 1107, factory-packaged, nonstaining, noncorrosive, nongaseous grout.

C. Concrete Fill: 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, unless otherwise indicated.

2.4 FABRICATION

A. Connections, General: Use connections that maintain structural value of joined pieces.

1. Shear and punch metals cleanly and accurately. Remove burrs.
2. Weld corners and seams continuously. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals. Obtain fusion without undercut or overlap. Remove welding flux immediately. Finish exposed welds smooth and blended.
3. Fabricate joints that will be exposed to weather in a manner to exclude water, or provide weep holes.
4. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners where possible. Locate joints where least conspicuous.

B. Steel Ladders: Comply with ANSI A14.3, unless otherwise indicated.

1. Elevator Pit Ladders: Comply with ASME A17.1.
2. Siderails: Continuous, 1/2-by-2-1/2-inch steel flat bars, with eased edges, spaced 18 inches apart.
3. Bar Rungs: 3/4-inch diameter steel bars, spaced 12 inches o.c.

    a. Fit rungs in centerline of side rails; plug-weld and grind smooth on outer rail faces.

4. Support each ladder at top and bottom and not more than 60 inches o.c. with welded or bolted steel brackets. Size brackets to support design loads specified in ANSI A14.3.
5. Fabricate ladder safety cages to comply with ANSI A14.3. Assemble by welding or riveting.
6. Galvanize exterior ladders and safety cages.

C. Loose Bearing and Leveling Plates: Fabricate loose bearing and leveling plates for steel items bearing on masonry or concrete construction. Drill plates to receive anchor bolts and for grouting.

1. Galvanize plates after fabrication.

D. Loose Steel Lintels: Fabricate loose structural-steel lintels from steel angles and shapes of size indicated for openings and recesses in masonry walls and partitions at locations indicated.

1. Galvanize loose steel lintels located in exterior walls.

E. Shelf Angles: Fabricate shelf angles of sizes indicated and for attachment to framing. Fabricate with horizontally slotted holes to receive 3/4-inch bolts, spaced not more than 6 inches from ends and 24 inches o.c.

1. Galvanize shelf angles to be installed in exterior walls.
2. Furnish wedge-type concrete inserts, complete with fasteners, to attach shelf angles to cast-in-place concrete.

F. Miscellaneous Framing and Supports: Fabricate steel framing and supports that are not a part of structural-steel framework as necessary to complete the installation of ceiling mounted toilet partitions. Cut, drill, and tap units to receive hardware, hangers, and similar items.

1. Where indicated to be cast into concrete or built into masonry, equip with integrally welded anchors at 24 inches o.c.
2. Fabricate steel channels for toilet pilaster supports from continuous steel shapes.

G. Miscellaneous Steel Trim: Fabricate units with continuously welded joints and smooth exposed edges. Miter corners and use concealed splices where possible. Fabricate cutouts, fittings, and anchorages; coordinate assembly and installation with other work.

2.5 FINISHES

A. Finish metal fabrications after assembly. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes. Shop prime ferrous-metal items not indicated to be galvanized.

1. Hot-dip galvanize items indicated to be galvanized to comply with ASTM A 123 or ASTM A 153/A 153M as applicable.
2. Preparation for Shop Priming: Prepare uncoated ferrous-metal surfaces to comply with SSPC-SP 3, "Power Tool Cleaning."
3. Apply shop primer to comply with SSPC-PA 1, "Paint Application Specification No. 1," for shop painting.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General: Provide anchorage devices and fasteners for securing overhead structureal steel support for ceiling hung toilet partition pilasters to in-place construction. Perform cutting, drilling, and fitting required for installing metal fabrications. Set metal fabrications accurately in location, with edges and surfaces level, plumb, and true.

1. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.
2. Fit exposed connections accurately together. Weld connections, unless otherwise indicated. Do not weld, cut, or abrade galvanized surfaces.

B. Set bearing and leveling plates on cleaned surfaces using wedges, shims, or leveling nuts. After bearing members have been positioned and plumbed, tighten anchor bolts and pack with nonshrink, nonmetallic grout.

C. Coordination required for ceiling hung toilet partition pilasters. Confirm exact placement of toilet partition pilasters, ceiling condition, overhead anchorage, and existing clearances above ceiling.

D. Touch up surfaces and finishes after erection.

1. Painted Surfaces: Clean field welds, bolted connections, and abraded areas and touch up paint with the same material as used for shop painting.
2. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780.

END OF SECTION 05500

SECTION 05515 - LADDERS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Aluminum access ladders.

B. Related Sections:

1. 07421 Insulated Metal Wall Panels

1.2 ACTION SUBMITTALS

A. Submit Product Data: Manufacturer's data sheets on each product.

B. Shop Drawings:
1. Detail fabrication and erection of each ladder indicated. Include plans, elevations, sections, and details of metal fabrications and their connections.
2. Provide templates for anchors and bolts specified for installation under other Sections.
3. Provide reaction loads for each hanger and bracket.

C. Selection Samples: For each finish specified, two complete sets of color chips representing manufacturer's full range of available colors and finishes.

D. Verification Samples: For each finish specified, two samples, minimum size 6 inches square, represent actual product color.

1.3 INFORMATIONAL SUBMITTALS

A. Qualification Data:

1. Refer to Quality Assurance provisions for submittal requirements evidencing experience, certifications and resources.

1.4 QUALITY ASSURANCE

A. Manufacturer Qualifications: A firm experienced in producing aluminum metal ladders similar to those indicated for this Project.
1. Record of successful in-service performance.
2. Sufficient production capacity to produce required units.
3. Professional engineering competent in design and structural analysis to fabricate ladders in compliance with industry standards and local codes.

B. Installer Qualifications: Competent and experienced firm capable of selecting fasteners and installing ladders to attain designed operational and structural performance.

C. Product Qualification: Product design shall comply with OSHA 1910.27 minimum standards for ladders.

D. Mock-Up: Provide a mock-up for evaluation of surface preparation techniques and application workmanship.
   1. Install ladder in area designated by Architect.
   2. Do not proceed with remaining work until workmanship and installation are approved by Architect.

E. OSHA 1910.27 – Fixed Ladders.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Store products in manufacturer's unopened packaging until ready for installation.

1.6 PROJECT CONDITIONS

A. Field Measurements: Verify dimensions by field measurement before fabrication.
   1. Established Dimensions: Where field measurements cannot be made without delaying the Work, indicate established dimensions on shop drawing submittal and proceed with fabrication.

1.7 WARRANTY

A. Manufacturer has responsibility for an extended Corrective Period for work of this Section for a period of 5 years from date of Substantial Completion against all the conditions indicated below, and when notified in writing from Owner, manufacturer shall promptly and without inconvenience and cost to Owner correct said deficiencies.
   1. Defects in materials and workmanship.
   2. Deterioration of material and surface performance below minimum OSHA standards as certified by independent third party testing laboratory. Ordinary wear and tear, unusual abuse or neglect excepted.
   3. Within the warranty period, the manufacturer shall, at its option, repair, replace, or refund the purchase price of defective ladder.

B. Manufacturer shall be notified immediately of defective products, and be given a reasonable opportunity to inspect the goods prior to return. Manufacturer will not assume responsibility, or compensation, for unauthorized repairs or labor. Manufacturer makes no other warranty, expressed or implied, to the merchantability, fitness for a particular purpose, design, sale, installation, or use, of the ladder; and shall not be liable for incidental or consequential damages, losses of or expenses, resulting from the use of ladder products.

1.8 EXTRA MATERIALS

A. Furnish touchup kit for each type and color of paint finish provided.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturers: O'Keeffe's, Inc.; 325 Newhall St. San Francisco, CA 94124. ASD. Toll Free Tel: (888) 653-3333. Tel: (415) 824-4900. Fax: (415) 824-5900. Email: info@okeeffes.com. Web:

http://www.okeeffes.com. Or Thompson Fabricating, LLC, Toll Free 1:800-824-6182, PO Box 170160 Birmingham, AL 35217-0160, www.tfco.com

B. Requests for substitutions will be considered under approval of Architect after review of submission for substitution.

2.2 APPLICATIONS/SCOPE

A. Fixed Access Ladder:
   1. Tubular Rail Low Parapet Access Ladder with Roofover Rail Extension.
      a. Model 502 as manufactured by O'Keeffe's Inc.

2.3 FINISHES

A. Paint. Urethane over chemically pretreated substrate provide manufacturer's full line of paint colors and finishes for review and approval by Architect.

2.4 MATERIALS

A. Aluminum Extrusions: Alloy 6063-T6 to comply with ASTM B221.

2.5 FABRICATION

A. Rungs: Not less than 1-1/4 inches (32 mm) in section and 18–3/8 inches (467mm) long, formed from tubular aluminum extrusions. Squared and deeply serrated on all sides.

B. Channel Side Rails: Not less than 1/8 inch (3 mm) wall thickness by 3 inches (76 mm) wide.

C. Heavy Duty Tubular Side Rails: Assembled from two interlocking aluminum extrusions no less than 1/8 inch (3 mm) wall thickness by 3 inches (76 mm) wide. Construction shall be self-locking stainless steel fasteners, full penetration TIG welds and clean, smooth and burr-free surfaces.

D. Walk-Through Rail and Roof Rail Extension: Not less than 3 feet 6 inches (1067 mm) above the landing and shall be fitted with deeply serrated, square, tubular grab rails.

E. Security Doors: Formed 1/8 inch (3 mm) thick aluminum sheet. Security panels shall extend on both sides, perpendicular to the door face, to within 2 inches (51 mm) of the wall. Security door shall be furnished with continuous aluminum piano hinge and heavy duty forged steel locking hasps.

F. Ladder Safety Post: Retractable hand hold and tie off.

G. Rail and Harness Fall Arrest System: Supplied where specified as alternate to safety cage and landing platforms, in accordance with OSHA regulation 1910.27; permanently mounted to ladder rungs and complete with necessary components. Provide shop drawing details for review and approval.

PART 3 EXECUTION

3.1 EXAMINATION

A. Coordinate anchorages. Furnish setting drawings, templates, and anchorage structural loads for fastener resistance. See Construction Drawings for anchorage details.

B. Do not begin installation until supporting structure is complete and ladder installation will not interfere with supporting structure work.

3.2 INSTALLATION

A. Install in accordance with manufacturer's instructions and in proper relationship and coordination with adjacent construction.

3.3 PROTECTION

A. Protect installed products until completion of project.

B. Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION 05515

SECTION 05521 - PIPE RAILINGS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Steel pipe railings for raised access platform and stairs at rooftop dunnage.

1.2 ACTION SUBMITTALS

A. Product Data: For the following:

1. Manufacturer's product lines of mechanically connected railings.
2. Railing brackets.
3. Connection fittings and hardware.

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work. Coordinate installation with structural steel rooftop dunnage and platform gratings.

C. Samples: For each type of exposed finish required.

1.3 INFORMATIONAL SUBMITTALS

A. Product Test Reports: For pipe railings, for tests performed by a qualified testing agency, according to ASTM E 894 and ASTM E 935.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Steel Pipe Railings:

1. Basis-of-Design Product: Subject to compliance with requirements, provide Kee Industrial Products, Inc. or comparable product by one of the following:

a. Wagner, R & B, Inc.

b. Thompson Fabricating, LLC

2.2 PERFORMANCE REQUIREMENTS

A. Structural Performance: Railings, including attachment to building construction, shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:

1. Handrails and Top Rails of Guards:

a. Uniform load of 50 lbf/ ft. applied in any direction.
b. Concentrated load of 200 lbf applied in any direction.
c. Uniform and concentrated loads need not be assumed to act concurrently.

2.3 METALS, GENERAL

A. Brackets and Flanges: Cast or formed metal of same type of material and finish as supported rails unless otherwise indicated.

2.4 STEEL AND IRON

A. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.

B. Pipe: ASTM A 53/A 53M, Type F or Type S, Grade A, Standard Weight (Schedule 40), unless another grade and weight are required by structural loads.

1. Provide galvanized finish for exterior installations and where indicated.

C. Plates, Shapes, and Bars: ASTM A 36/A 36M.

D. Cast Iron: Either gray iron, ASTM A 48/A 48M, or malleable iron, ASTM A 47/A 47M, unless otherwise indicated.

E. Mounting Bases: Galvanized steel bases with rubber pad on underside.

F. Counterweights: Galvanized steel with rubber pad on underside.

2.5 FASTENERS

A. General: Provide the following:
1. Hot-Dip Galvanized Railings: Type 304 stainless-steel or hot-dip zinc-coated steel fasteners complying with ASTM A 153/A 153M or ASTM F 2329 for zinc coating.

2.6 MISCELLANEOUS MATERIALS

A. Etching Cleaner for Galvanized Metal: Complying with MPI#25.

B. Galvanizing Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint 20 and compatible with paints specified to be used over it.

2.7 FABRICATION

A. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.

B. Form work true to line and level with accurate angles and surfaces.

C. Nonwelded Connections: Connect members with concealed mechanical fasteners and fittings. Fabricate members and fittings to produce flush, smooth, rigid, hairline joints.

D. Form changes in direction by inserting prefabricated elbow fittings.

E. Close exposed ends of railing members with prefabricated end fittings.

F. Provide wall returns at ends of wall-mounted handrails unless otherwise indicated.

2.8 STEEL AND IRON FINISHES

A. Galvanized Railings:

1. Hot-dip galvanize steel railings, including hardware, after fabrication.
2. Comply with ASTM A 123/A 123M for hot-dip galvanized railings.
3. Comply with ASTM A 153/A 153M for hot-dip galvanized hardware.

B. Preparing Galvanized Railings for Shop Priming: After galvanizing, thoroughly clean railings of grease, dirt, oil, flux, and other foreign matter, and treat with etching cleaner.

C. Preparation for Shop Priming: Prepare uncoated ferrous-metal surfaces to comply with SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."

D. Primer Application: Apply shop primer to prepared surfaces of railings unless otherwise indicated. Comply with requirements in SSPC-PA 1, "Shop, Field, and Maintenance Painting of Steel," for shop painting. Primer need not be applied to surfaces to be embedded in concrete or masonry.

1. Do not apply primer to galvanized surfaces.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Set railings accurately in location, alignment, and elevation; measured from established lines and levels and free of rack at perimeter of raised platform and stairs.

1. Do not weld, cut, or abrade surfaces of railing components that are coated or finished after fabrication and that are intended for field connection by mechanical or other means without further cutting or fitting.
2. Set posts plumb within a tolerance of 1/16 inch in 3 feet.

3. Align rails so variations from level for horizontal members and variations from parallel with rake of steps and ramps for sloping members do not exceed 1/4 inch in 12 feet.

B. Control of Corrosion: Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.

1. Coat, with a heavy coat of bituminous paint, concealed surfaces of aluminum that are in contact with grout, concrete, masonry, wood, or dissimilar metals.

3.2 ADJUSTING AND CLEANING

A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with the same material as used for shop painting to comply with SSPC-PA 1 requirements 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/A 780M.

END OF SECTION 05521

SECTION 05530 - GRATINGS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Metal bar gratings.
2. Heavy-duty metal bar gratings.
3. Expanded metal gratings.
4. Formed-metal plank gratings.
5. Extruded-aluminum plank gratings.
6. Metal frames and supports for gratings.
7. Metal gratings for stair treads.

1.2 PERFORMANCE REQUIREMENTS

A. Grating Structural Performance: Capable of withstanding the following structural loads without exceeding the allowable design working stress of the materials involved:

1. Walkways and Elevated Platforms: Uniform load of 60 lbf/sq. ft. Limit deflection to L/360 or 1/4 inch , whichever is less.

1.3 SUBMITTALS

A. Product Data: For the following:

1. Formed-metal plank gratings.
2. Extruded-aluminum plank gratings.
3. Clips and anchorage devices for gratings.
4. Paint products.

B. Shop Drawings: Detail fabrication and installation of gratings.

1. Include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.4 QUALITY ASSURANCE

A. Metal Bar Grating Standards: Comply with applicable requirements in the following:

1. NAAMM MBG 531, "Metal Bar Grating Manual for Steel, Stainless Steel, and Aluminum Gratings and Stair Treads."
2. NAAMM MBG 532, "Heavy-Duty Metal Bar Grating Manual."

1.5 COORDINATION

A. Confirm all connections with structural steel dunnage conditions. Furnish Setting Drawings, templates, and directions for installing frames and anchorages, including concrete inserts. Deliver frames and built-in anchorages, including concrete inserts, to Project site as needed to make progress and avoid delays.

PART 2 - PRODUCTS

2.1 METALS

A. Ferrous Metals:

1. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
2. Wire Rod for Grating Crossbars: ASTM A 510.
3. Uncoated Steel Sheet: ASTM A 570/A 570M, Grade 33.
4. Galvanized Steel Sheet: ASTM A 653/A 653M, structural quality, Grade 33, with G90 coating.
5. Expanded Metal, Carbon Steel: ASTM F 1267, Class 1.

2.2 GRATINGS

A. Metal Bar Gratings:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Alabama Metal Industries Corp.
   b. All American Grating, Inc.
   c. Barnett/Bates Corp.
   d. Harris Steel Ltd., Fisher & Ludlow Div.
   e. IKG Borden.
   f. Klemp Corp.
   g. Ohio Gratings, Inc.
   h. Seidelhuber Metal Products, Inc.
   i. Tru-Weld Grating, Inc.
   j. Bustin.

3. Fasteners: Threaded bolts with nuts and washers for securing grating to supports.
   a. Fasteners: Galvanized malleable-iron flange clamp with galvanized bolt for securing grating to supports designed to be installed from above grating by one person.

      1) Product: Struct-Fast Inc.; Grate-Fast.

4. Fabricate cutouts in grating sections for penetrations indicated. Edge-band openings with bars of the same size and material as bearing bars.

2.3 PAINT

A. Shop Primer for Ferrous Metal: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with performance requirements in FS TT-P-664 and compatible with finish paint systems indicated.

2.4 FASTENERS

A. Fasteners: Provide Type 304 or 316 stainless-steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B 633, Class Fe/Zn 5, where built into exterior walls.

2.5 FABRICATION

A. Fabrication, General: Provide material in size, thickness, and finish indicated or, if not indicated, as recommended by manufacturer for indicated applications and as needed to support indicated loads.

1. Use connections that maintain structural value of joined pieces. Form from materials of size, thickness, and shapes indicated, but not less than that needed to support indicated loads.
2. Shear and punch metals cleanly and accurately. Remove burrs.
3. Fabricate toeplates for attaching in the field.

B. Grating Frames and Supports: Fabricate from structural steel of welded construction to sizes, shapes, and profiles indicated and as necessary to receive gratings. Equip units with anchors for casting into concrete or building into masonry.

1. Galvanize exterior frames and supports.

2.6 FINISHES

A. Finish gratings, frames, and supports after assembly.

B. Galvanizing: For those items indicated for galvanizing, apply zinc coating by the hot-dip process complying with ASTM A 123.

C. Preparation for Shop Priming: Prepare uncoated ferrous-metal surfaces to comply with SSPC-SP 3, "Power Tool Cleaning."

D. Apply shop primer to uncoated surfaces, unless otherwise indicated. Comply with SSPC-PA 1, "Paint Application Specification No. 1," for shop painting.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Perform cutting, drilling, and fitting required for installing gratings. Set units accurately in location, alignment, and elevation.

B. Fit exposed connections accurately together. Weld connections that are not to be left as exposed joints but cannot be shop welded. Do not weld, cut, or abrade surfaces of galvanized units that are for bolted or screwed field connections.

C. Attach toeplates to gratings by welding.

D. Metal Bar Gratings: Comply with recommendations of referenced metal bar grating standards.

1. Attach removable units with clips and fasteners indicated.
2. Attach nonremovable units to supporting members by welding where both materials are the same; otherwise, fasten by bolting.

E. Expanded Metal Gratings: Place units with straight edge of bond up and with the long direction of diamonds parallel to direction of span.

1. Attach removable units by bolting at 6-inch intervals.
2. Attach nonremovable units by welding, unless otherwise indicated. Space welds at 6-inch intervals.
3. Butt edges parallel to long direction of diamonds and weld at every second bond point. Place sections so diamonds are aligned with those of adjacent sections.

F. Metal Plank Gratings: Use manufacturer's standard anchor clips and hold-down devices for bolted connections.

1. Attach removable units by bolting at every point of contact.
2. Attach nonremovable units by welding, unless otherwise indicated.
3. Attach aluminum units by bolting at side channels at every point of contact and by bolting intermediate planks at each end on alternate sides. Bolt adjacent planks together at midspan.

G. Touch up surfaces and finishes after erection.

1. Painted Surfaces: Clean field welds, bolted connections, and abraded areas and touch up paint with the same material as used for shop painting.

2. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780.

END OF SECTION 05530

SECTION 05720 - ORNAMENTAL HANDRAILS AND RAILINGS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes ornamental metal handrails and railings.

B. See Division 5 Section "Metal Stairs" for handrails and railings associated with metal stairs.

C. See Division 5 Section "Pipe and Tube Railings" for handrails and railings fabricated from pipe and tube components.

D. See Division 5 Section "Ornamental Metal" for ornamental metal handrails and railings fabricated from custom components.

E. See construction drawings for railing at ramp at raised access floor.

1.2 PERFORMANCE REQUIREMENTS

A. Structural Performance of Handrails and Railings:

1. Comply with ASTM E 985, based on testing per ASTM E 894 and ASTM E 935.
2. Capable of withstanding structural loads required by ASCE 7 without exceeding allowable design working stresses of materials involved.
3. Capable of withstanding the following structural loads without exceeding the allowable design working stress of materials involved:

    a. Top Rail of Guards: Concentrated load of 200 lbf applied at any point and in any direction, and a uniform load of 50 lbf/ft. applied horizontally and concurrently with uniform load of 100 lbf/ft. applied vertically downward. Concentrated and uniform loads need not be assumed to act concurrently.
    b. Handrails Not Serving as Top Rails: Concentrated load of 200 lbf applied at any point and in any direction, and a uniform load of 50 lbf/ft. applied in any direction. Concentrated and uniform loads need not be assumed to act concurrently.
    c. Infill Area of Guards: Horizontal concentrated load of 200 lbf applied to 1 sq. ft. at any point in system, including panels, intermediate rails, balusters, or other elements composing infill area. Load on infill area need not be assumed to act concurrently with loads on top rails.

1.3 SUBMITTALS

A. Product Data: For handrails, railings, and brackets.

B. Shop Drawings: Include plans, elevations, sections, details of installation, attachments to other Work, and structural computations, including blocking in wall for handrail bracket support.

C. Samples: For each exposed finish required.

D. Product Test Reports: Indicating handrails and railings comply with ASTM E 985.

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. ACI Glass Products.
2. Aluminum Tube Railings, Inc.
3. Architectural Metal Works.
4. Blum, Julius & Co., Inc.
5. Blumcraft of Pittsburgh.
6. Braun, J. G. Co.
7. Clearail, Inc.
8. Cole, C. W. & Co., Inc.
9. CraneVeyor Corp.
10. L & J Specialty Corp.
11. Livers Bronze Co., Inc.
12. Newman Brothers, Inc.
13. P & P Artec.
14. Poma Corporation.
15. Rippel Architectural Metals, Inc.
16. Sterling Fabricated Systems, Inc.
17. Superior Aluminum Products, Inc.
18. Tri Tech, Inc.
19. Wagner, R & B, Inc.
20. Wylie Systems.
21. Zephyr Metals, Inc.
22. Bradley.

2.2 METALS

A. Stainless Steel:

1. Tubing: ASTM A 554, Grade MT 304.

2. Pipe: ASTM A 312/A 312M, Grade TP 304.
3. Castings: ASTM A 743/A 743M, Grade CF 8 or CF 20.
4. Plate: ASTM A 666, Type 304.

2.3 MISCELLANEOUS MATERIALS

A. Fasteners: Same basic metal as fastened metal; concealed, unless otherwise indicated or unavoidable, and standard with systems indicated. Provide manufacturer's recommended method of support blocking.

B. Anchors: Fabricated from corrosion-resistant materials with capability to sustain, without failure, a load equal to six times the load imposed.

2.5 FABRICATION

A. General: Fabricate to design, dimensions, and details indicated, but not less than that required to support structural loads.

1. Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.

B. Form changes in direction of railing members by angle of ramp, and floor.

C. Welded Connections: Connect handrail and railing members by welding. Cope and weld or use welded-in fittings. Weld connections continuously.

D. Brazed Connections: Connect copper-alloy handrails and railings members by brazing. Braze corners and seams continuously.

E. Nonwelded Connections: Connect handrail and railing members with concealed mechanical fasteners and fittings.

F. Brackets, Flanges, Fittings, and Anchors: Fabricate wall brackets, flanges, miscellaneous fittings, and anchors to connect handrails and railings to other construction.

1. Cast or form of same metal and finish as supported rails.

G. Close exposed ends of handrail and railing members with prefabricated end fittings.

1. Provide wall returns at ends of wall-mounted handrails.

2.6 FINISHES

A. Stainless Steel:

1. Bright, Directional Polish: No. 4 finish.
2. Mirrorlike Reflective, Nondirectional Polish: No. 8 finish.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Installation, General: Perform cutting, drilling, and fitting required to install handrails and railings. Set units accurately in location, alignment, and elevation with ramp and raised access floor platform.

1. Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.
2. Align rails so variations from level for horizontal members and from parallel with rake of steps and ramps for sloping members do not exceed 1/4 inch in 12 feet.

B. Anchor posts to metal surfaces with fittings designed for railing system and for this purpose. Provide solid blocking as required by manufacturer.

C. Attach handrails to wall with wall brackets or end fittings.

1. For steel-framed gypsum board assemblies, use hanger or lag bolts set into wood backing between studs or fasten to steel framing or concealed reinforcements using self-tapping screws of size and type required to support structural loads.

D. Glass-Supported Handrails and Railings: Attach base channel to building structure, then insert glass panels.

E. Touch up surfaces and finishes after erection. Clean abraded areas and touch up finish with the same material as factory finish.

END OF SECTION 05720

SECTION 06066-TRANSLUCENT RESIN PANEL SYSTEM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the Plastic Fabrication as shown and specified in the described system(s):

1. Partitions
2. Wall Cladding

B. The extent of Solid Polymer Fabrication is shown on the construction drawings.

1. Additional fabrication and installation details can be found on the manufacturer's specification data sheets.

1.3 SUBMITTALS

A. General: Submit the following in accordance with conditions of contact and Division 1 specification section 01 33 00 "Submittal Procedures".

B. Product Data: Submit manufacturer's product data; include product description, fabrication information, and compliance with specified performance requirements.

C. Submit product test reports from a qualified independent 3rd party testing agency indicating each type and class of panel system complies with the project performance requirements, based on comprehensive testing of current products. Previously completed test reports will be acceptable if for current manufacturer and indicative of products used on this project.

1. Test reports required are:
   a. Rate of Burning (ASTM D 635)
   b. Self-Ignition Temperature (ASTM D 1929)
   c. Density of Smoke (ASTM D 2843)
   d. Flame spread and Smoke developed testing (ASTM E 84)
   e. Room Corner Burn Test (NFPA 286)

D. Shop Drawings: Include plans, elevations, sections, panel dimensions, details, and attachments to other work.

E. Samples for Initial Selection:

1. Submit minimum 2-inch by 2-inch samples. Indicate full color, texture and pattern variation.

F. Samples for Verification:

1. Submit minimum 4-inch by 4-inch sample for each type, texture, pattern and color of solid plastic fabrication.

G. Mockups:

1. Build mockups to verify selections made under sample Submittals and to demonstrate aesthetic effects.
2. Build mockup of Plastic Fabrication.
3. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

H. Maintenance Data: Submit manufacturer's care and maintenance data, including care, repair and cleaning instructions. Include in Project closeout documents.

1.4 QUALITY ASSURANCE

A. Manufacturers Qualifications

1. Materials and systems shall be manufactured by a company continuously and regularly employed in the manufacture of specified materials for a period of at least three (3) consecutive years and which can show evidence of those materials being satisfactorily used on at least three (3) projects of similar size, scope and location. At least one (1) of the projects shall have been successful for use one (1) year or longer.
2. Manufacturer must have documented training and qualification program for fabrication and installation of plastic fabrications.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver Plastic Fabrications, systems and specified items in manufacturer's standard protective packaging.

B. Do not deliver Plastic Fabrications, system, components and accessories to Project site until areas are ready for installation.

C. Store materials in a flat orientation in a dry place that is not exposed to exterior elements.

D. Handle materials to prevent damage to finished surfaces. Provide protective coverings to prevent damage or staining following installation for duration of project.

E. Before installing Plastic Fabrications, permit them to reach room temperature.

1.6 PROJECT CONDITIONS

A. Environmental Limitations: Do not install Solid Polymer Fabrications until spaces are enclosed and weatherproof, and ambient temperatures and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

1.7 WARRANTY

A. Manufacturer's Special Warranty on Plastic Fabrications: Manufacturer's standard form agreeing to repair or replace panels that fail in material or workmanship within the specified warranty period.

B. Warranty Period: 1 year after ship date

PART 2 - PRODUCTS

2.1 MANUFACTURER

A. Manufacturer: 3form, Inc., Salt Lake City, Utah, USA / telephone 801-649-2500

2.2 MATERIALS

A. 3form Alabaster

1. Engineered resin
2. Sheet Size: Maximum 4' x 6'
3. Thickness: 3/8"
4. Basis of Design Product: The design of Plastic Fabrications is based on Alabaster as provided by 3form, Inc. Products from other manufacturers must be approved by the Architect or Designer prior to bidding in accordance with the Instructions to Bidders and Section 10 60 00 "Product Requirements".

B. Sheet minimum performance attributes:

1. Rate of Burning (ASTM D 635). Material must attain CC1 Rating
2. Self-Ignition Temperature (ASTM D 1929). Material must have a Self-ignition temperature greater than 980°F.
3. Density of Smoke (ASTM D 2843). Material must have a smoke density less than 12%.
4. Flame spread and Smoke developed testing (ASTM E 84). Material must be able to meet a level of Class A (Flame spread less than 25 and smoke less than 450)
5. Room Corner Burn Test (NFPA 286). Material must meet Class A criteria as described by the 2003 *International Building Code*.

2.3 FABRICATION

A. General: Fabricate Plastic Fabrications to designs, sizes and thicknesses indicated and to comply with indicated standards. Sizes, profiles and other characteristics are indicated on the drawings, additional fabrication and installation details can be found on the 3form Partner Preliminary Project Review, if applicable.

B. Comply with manufacturer's written recommendations for fabrication.

C. Machining: Acceptable means of machining are listed below. Ensure that material is not chipped or warped by machining operations.

1. Sawing: Select equipment and blades suitable for type of cut required.
2. Drilling: Drills specifically designed for use with plastic products.
3. Milling: Climb cut where possible.
4. Routing
5. Tapping

D. Laminating: Laminate to substrates indicated using adhesives and techniques recommended by manufacturer.

2.4 MISCELLANEOUS MATERIALS

A. General: Provide products of material, size, and shape required for application indicated, and with a proven record of compatibility with surfaces contacted in installation.

B. Cleaner: Type recommended by manufacturer.

C. Fasteners: Use screws designed specifically for plastics. Provide threaded metal inserts for applications requiring frequent disassembly such as light fixtures.

D. Bonding Cements: May be achieved with adhesives suitable for use with product and application.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions where installation of Plastic Fabrications will occur, with Installer present, for compliance with manufacturer's requirements. Verify that substrates and conditions are satisfactory for installation and comply with requirements specified.

3.2 INSTALLATION

A. General: Comply with manufacturer's written instructions for the installation of Plastic Fabrications. Sizes, profiles and other characteristics are indicated on the drawings, additional installation details can be found on the manufacturer's specification data sheets.

B. Manufacturer's shop to fabricate items to the greatest degree possible.

C. Installation should be performed by manufacturer's installer.

D. Utilize fasteners, adhesives and bonding agents recommended by manufacturer for type of installation indicated. Material that is chipped, warped, hazed or discolored as a result of installation or fabrication methods will be rejected.

E. Install components plumb, level and rigid, scribed to adjacent finishes, in accordance with approved shop drawings and product data.

F. Form field joints using manufacturer's recommended procedures. Locate seams in panels so that they are not directly in line with seams in substrates.

3.3 CLEANING AND PROTECTION

A. Protect surfaces from damage until date of substantial completion. Repair work or replace damaged work, which cannot be repaired to Architect's satisfaction.

End of Section 06066

SECTION 06100 ROUGH CARPENTRY

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Rooftop equipment bases and support curbs.
2. Wood blocking, cants, and nailers.
3. Wood furring and grounds.
4. Wood sleepers.
5. Wall blocking for support function.

B. See division 07555 modified bituminous protected – membrane roofing.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of process and factory-fabricated product.

1. Include data for wood-preservative treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements
2. Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements.

1.3 INFORMATIONAL SUBMITTALS

A. Material Certificates: For dimension lumber specified to comply with minimum allowable unit stresses. Indicate species and grade selected for each use and design values approved by the ALSC Board of Review.

B. Evaluation Reports: For the following, from ICC-ES:

1. Wood-preservative-treated wood.
2. Fire-retardant-treated wood.
3. Power-driven fasteners.
4. Expansion anchors.
5. Metal framing anchors.

PART 2 - PRODUCTS

2.1 WOOD PRODUCTS, GENERAL

A. Certified Wood: Materials shall be produced from wood obtained from forests certified by an FSC-accredited certification body to comply with FSC STD-01-001, "FSC Principles and Criteria for Forest Stewardship."

B. Lumber: DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, provide lumber that complies with the applicable rules of any rules-writing agency certified by the ALSC Board of Review. Provide lumber graded by an agency certified by the ALSC Board of Review to inspect and grade lumber under the rules indicated.

1. Factory mark each piece of lumber with grade stamp of grading agency.
2. Provide dressed lumber, S4S, unless otherwise indicated.

C. Maximum Moisture Content of Lumber: 19 percent unless otherwise indicated.

D. Engineered Wood Products: Provide engineered wood products acceptable to authorities having jurisdiction and for which current model code research or evaluation reports exist that show compliance with building code in effect for Project.

1. Allowable Design Stresses: Provide engineered wood products with allowable design stresses, as published by manufacturer, that meet or exceed those indicated. Manufacturer's published values shall be determined from empirical data or by rational engineering analysis and demonstrated by comprehensive testing performed by a qualified independent testing agency.

2.2 WOOD-PRESERVATIVE-TREATED LUMBER

A. Preservative Treatment by Pressure Process: AWPA U1; Use Category UC2 for interior construction not in contact with the ground, Use Category UC3b for exterior construction not in contact with the ground.

1. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium. Do not use inorganic boron (SBX) for sill plates.

B. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent. Do not use material that is warped or that does not comply with requirements for untreated material.

C. Mark lumber with treatment quality mark of an inspection agency approved by the ALSC Board of Review.

D. Application: Treat items indicated on Drawings, and the following:

1. Wood cants, nailers, curbs, equipment support bases, blocking, stripping, and similar members in connection with roofing, flashing, vapor barriers, and waterproofing.
2. Wood sills, sleepers, blocking, furring, stripping, and similar concealed members in contact with masonry or concrete.

2.3 FIRE-RETARDANT-TREATED MATERIALS

A. General: Where fire-retardant-treated materials are indicated, use materials complying with requirements in this article, that are acceptable to authorities having jurisdiction, and with fire-test-response characteristics specified as determined by testing identical products per test method indicated by a qualified testing agency.

B. Fire-Retardant-Treated Lumber and Plywood by Pressure Process: Products with a flame spread index of 25 or less when tested according to ASTM E 84, and with no evidence of significant progressive combustion when the test is extended an additional 20 minutes, and with the flame front not extending more than 10.5 feet (3.2 m) beyond the centerline of the burners at any time during the test.

1. Interior Type A: Treated materials shall have a moisture content of 28 percent or less when tested according to ASTM D 3201 at 92 percent relative humidity. Use where exterior type is not indicated.

C. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent.

D. Identify fire-retardant-treated wood with appropriate classification marking of qualified testing agency.

E. Application: Treat items indicated on Drawings, and the following:

1. Plywood backing panels. Do not paint over fire rating designation where used as panel backer support.

2.4 MISCELLANEOUS LUMBER

A. General: Provide miscellaneous lumber indicated and lumber for support or attachment of other construction, including the following:

1. Blocking.
2. Nailers.
3. Rooftop equipment bases and support curbs.
4. Cants.
5. Furring.

B. For items of dimension lumber size, provide Construction or No. 2 grade lumber of any species.

C. For concealed boards, provide lumber with 15 percent maximum moisture content and [any of]the following species and grades:

1. Mixed southern pine; No. 2 grade; SPIB.
2. Eastern softwoods; No. 2 Common grade; NeLMA.
3. Northern species; No. 2 Common grade; NLGA.
4. Western woods; Construction or No. 2 Common grade; WCLIB or WWPA.

2.5 FASTENERS

A. General: Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture.

1. Where rough carpentry is exposed to weather, in ground contact, pressure-preservative treated, or in area of high relative humidity, provide fasteners with hot-dip zinc coating complying with ASTM A 153/A 153M of Type 304 stainless steel.

B. Power-Driven Fasteners: NES NER-272.

C. Bolts: Steel bolts complying with ASTM A 307, Grade A; with ASTM A 563 hex nuts and, where indicated, flat washers.

2.6 METAL FRAMING ANCHORS

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. Cleveland Steel Specialty Co.
2. Phoenix Metal Products, Inc.
3. Simpson Strong-Tie Co., Inc.
4. USP Structural Connectors.

B. Allowable Design Loads: Provide products with allowable design loads, as published by manufacturer,that meet or exceed those of products of manufacturers listed. Manufacturer's published values shall be determined from empirical data or by rational engineering analysis and demonstrated by comprehensive testing performed by a qualified independent testing agency.

C. Galvanized-Steel Sheet: Hot-dip, zinc-coated steel sheet complying with ASTM A 653/A 653M, G60 coating designation.

1. Use for interior locations unless otherwise indicated.

D. Hot-Dip, Heavy-Galvanized Steel Sheet: ASTM A 653/A 653M; structural steel (SS), high-strength low-alloy steel Type A (HSLAS Type A), or high-strength low-alloy steel Type B (HSLAS Type B); G185 coating designation; and not less than 0.036 inch thick.

1. Use for wood-preservative-treated lumber and where indicated.

2.7 MISCELLANEOUS MATERIALS

A. Sill-Sealer Gaskets: Glass-fiber-resilient insulation, fabricated in strip form, for use as a sill sealer; 1-inch nominal thickness, compressible to 1/32 inch; selected from manufacturer's standard widths to suit width of sill members indicated.

B. Sill-Sealer Gaskets: Closed-cell neoprene foam, 1/4 inch thick, selected from manufacturer's standard widths to suit width of sill members indicated.

C. Flexible Flashing: Composite, self-adhesive, flashing product consisting of a pliable, butyl rubber or rubberized-asphalt compound, bonded to a high-density polyethylene film, aluminum foil, or spunbonded polyolefin to produce an overall thickness of not less than 0.025 inch (0.6 mm).

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Set rough carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Fit rough carpentry to other construction; scribe and cope as needed for accurate fit. Locate furring, nailers, blocking, and similar supports to comply with requirements for attaching other construction.

B. Framing Standard: Comply with AF&PA's WCD 1, "Details for Conventional Wood Frame Construction," unless otherwise indicated.

C. Framing with Engineered Wood Products: Install engineered wood products to comply with manufacturer's written instructions.

D. Install fire-retardant treated plywood backing panels with classification marking of testing agency exposed to view.

E. Metal Framing Anchors: Install metal framing anchors to comply with manufacturer's written instructions. Install fasteners through each fastener hole.

F. Do not splice structural members between supports unless otherwise indicated.

G. Comply with AWPA M4 for applying field treatment to cut surfaces of preservative-treated lumber.

H. Where wood-preservative-treated lumber is installed adjacent to metal decking, install continuous flexible flashing separator between wood and metal decking.

I. Securely attach rough carpentry work to substrate by anchoring and fastening as indicated, complying with the following:

1. NES NER-272 for power-driven fasteners.
2. Table 2304.9.1, "Fastening Schedule," in ICC's International Building Code.

3.2 PROTECTION

A. Protect wood that has been treated with inorganic boron (SBX) from weather. If, despite protection, inorganic boron-treated wood becomes wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.

B. Protect rough carpentry from weather. If, despite protection, rough carpentry becomes wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.

END OF SECTION 06100

SECTION 06402 - INTERIOR ARCHITECTURAL WOODWORK

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes interior woodwork including for the following applications:

1. Plastic-laminate cabinets and shelving.
2. Plastic-laminate countertops.
3. Solid-surfacing-material countertops.
4. Flush wood paneling and wainscots.
5. Frames and jambs.
6. Shop finishing of woodwork.
7. Wall panels and ceiling.
8. Wood veneer millwork.

B. Interior architectural woodwork includes wood furring, blocking, shims, and hanging strips, unless concealed within other construction before woodwork installation.

1.2 SUBMITTALS

A. Product Data: For the following:
1. Cabinet hardware and accessories.
2. Handrail brackets.
3. Finishing materials and processes.
4. Wood Veneer species and cut for millwork.

B. Shop Drawings: Include location of each item, plans and elevations, large-scale details, attachment devices, and other components.

C. Samples:

1. Lumber and panel products for transparent finish, for each species and cut, finished on one side and one edge.
2. Lumber and panel products with shop-applied opaque finish, for each finish system and color, with exposed surface finished.
3. Plastic-laminate-clad panel products, for each type, color, pattern, and surface finish.
4. Thermoset decorative-overlay surfaced panel products, for each type, color, pattern, and surface finish.
5. Quartz and solid-surfacing materials.

1.3 QUALITY ASSURANCE

A. Installer Qualifications: Fabricator of woodwork.

B. Quality Standard: Unless otherwise indicated, comply with WIC's "Manual of Millwork" for grades of interior architectural woodwork, construction, finishes, and other requirements.

1. Provide WIC-certified compliance certificate indicating that woodwork complies with requirements of grades specified.
2. Provide WIC-certified compliance certificate for installation.

1.4 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install woodwork until building is enclosed, wet work is complete, and HVAC system is operating and maintaining temperature and relative humidity at levels planned for building occupants during the remainder of the construction period.

PART 2 - PRODUCTS

2.1 WOODWORK FABRICATORS

A. Fabricators: Subject to compliance with requirements, provide interior architectural woodwork by qualified woodwork firm having 10 years experience with products' installation.

2.2 MATERIALS

A. Wood for Transparent Finish:

1. Species and Cut: Submit manufacturer's samples of wood species, cut and finishes for approval by Architect.

B. Wood Products:

1. Hardboard: AHA A135.4.
2. Medium-Density Fiberboard: ANSI A208.2, Grade MD.
3. Particleboard: ANSI A208.1, Grade M-2.
4. Softwood Plywood: DOC PS 1, Medium Density Overlay.
5. Hardwood Plywood and Face Veneers: HPVA HP-1.

D. Thermoset Decorative Overlay: Particleboard or medium-density fiberboard with surface of thermally fused, melamine-impregnated decorative paper complying with LMA SAT-1.

E. Clear Float Glass for Doors: ASTM C 1036, Type I, Class 1, Quality q3, 6 mm thick, unless otherwise indicated.

F. Clear Tempered Float Glass for Doors: ASTM C 1048, Kind FT, Condition A, Type I, Class 1, Quality q3; manufactured by horizontal (roller-hearth) process, with exposed edges seamed before tempering, 6 mm thick, unless otherwise indicated.

G. High-Pressure Decorative Laminate: NEMA LD 3.

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Formica Corporation.
b. International Paper; Decorative Products Div.
c. Laminart.
d. Pioneer Plastics Corp.
e. Westinghouse Electric Corp.; Specialty Products Div.
f. Wilsonart International; Div. of Premark International, Inc.

H. Solid-Surfacing Material: Homogeneous solid sheets of filled plastic resin complying with ANSI Z124.3, for Type 5 or Type 6 material and performance requirements, without a precoated finish.

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
2. Products: Subject to compliance with requirements, provide one of the following:

a. Avonite, Inc.; Avonite.
b. DuPont Polymers; Corian.
c. Formica Corporation; Surell.
d. International Paper, Decorative Products Div.; Fountainhead.
e. Swan Corporation (The); Swanstone.
f. Wilsonart International, Div. of Premark International, Inc.; Gibraltar.

2.3 FIRE-RETARDANT-TREATED MATERIALS

A. Fire-Retardant-Treated Lumber and Plywood: Materials impregnated with fire-retardant chemical formulations to comply with AWPA C20 (lumber) and AWPA C27 (plywood), Exterior Type or Interior Type A. Use fire-retardant-treatment formulations that do not bleed through or otherwise adversely affect finishes. Kiln-dry material after treatment.

B. Fire-Retardant Particleboard: Panels made from softwood particles and fire-retardant chemicals mixed together at time of panel manufacture with flame-spread index of 25 or less and smoke-developed index of 25 or less per ASTM E 84.

C. Fire-Retardant Fiberboard: ANSI A208.2 medium-density fiberboard panels made from softwood fibers, synthetic resins, and fire-retardant chemicals mixed together at time of panel

manufacture with flame-spread index of 25 or less and smoke-developed index of 200 or less per ASTM E 84.

2.4 CABINET HARDWARE AND ACCESSORIES

A. General: Provide cabinet hardware and accessory materials for a complete installation of architectural woodwork, except for items specified in Division 8 Section "Door Hardware."

B. Hardware Standard: Comply with BHMA A156.9 for items indicated by referencing BHMA numbers or items referenced to this standard.

C. Butt Hinges: 2-3/4-inch, 5-knuckle steel hinges made from 0.095-inch- thick metal.

D. Wire Pulls: Back mounted, 4 inches long, 5/16 inches in diameter.

E. Catches: Magnetic, BHMA A156.9, B03141.

F. Adjustable Shelf Standards and Supports: BHMA A156.9, B04071; with shelf rests, B04081.

G. Drawer Slides: Side-mounted, full-extension, zinc-plated steel drawer slides with steel ball bearings, BHMA A156.9, B05091 and rated for the following loads:

1. Box Drawer Slides: 75 lbf.
2. File Drawer Slides: 150 lbf.
3. Pencil Drawer Slides: 45 lbf.

H. Cabinet Door Locks: BHMA A156.11, E07121.

I. Drawer Locks: BHMA A156.11, E07041.

2.5 INSTALLATION MATERIALS

A. Furring, Blocking, Shims, and Hanging Strips: Softwood or hardwood lumber, fire-retardant-treated, kiln-dried to less than 15 percent moisture content.

B. Handrail Brackets: Cast from stainless steel with wall flange drilled and tapped for concealed hanger bolt and with support arm for screwing to underside of rail. Sized to provide 1-1/2-inch clearance between handrail and wall.

2.6 FABRICATION

A. General: Complete fabrication to maximum extent possible before shipment to Project site. Where necessary for fitting at site, provide allowance for scribing, trimming, and fitting.

1. Interior Woodwork Grade: Premium complying with the referenced quality standard.

2. Shop cut openings to maximum extent possible. Sand edges of cutouts to remove splinters and burrs.
3. Seal edges of openings in countertops with a coat of varnish.
4. Install glass to comply with applicable requirements in Division 8 Section "Glazing" and in GANA's "Glazing Manual." For glass in wood frames, secure glass with removable stops.
5. For trim items wider than available lumber, use veneered construction. Do not glue for width.
6. Backout or groove backs of flat trim members and kerf backs of other wide, flat members, except for members with ends exposed in finished work.
7. Assemble casings in plant except where limitations of access to place of installation require field assembly.

B. Wood Cabinets for Transparent Finish:

1. AWI Type of Cabinet Construction: As indicated on drawing.
2. WIC Construction Type: Type I, multiple self-supporting units rigidly joined together.
3. Grain Matching: As approved by Architect upon review of samples.
4. Veneer Matching within Panel Face: Running match.
5. Semiexposed Surfaces Other Than Drawer Bodies: [Match species and cut indicated for exposed surfaces

C. Plastic-Laminate Cabinets:

1. WIC Construction Type: Type I, multiple self-supporting units rigidly joined together.
2. Laminate Cladding for Exposed Surfaces: High-pressure decorative of grade indicated.

    a. Horizontal Surfaces Other Than Tops: HGS.
    b. Postformed Surfaces: HGP.
    c. Vertical Surfaces: HGS.
    d. Edges: HGS.

3. Materials for Semiexposed Surfaces Other Than Drawer Bodies: High-pressure decorative laminate, Grade VGS.

    a. Drawer Sides and Backs: Thermoset decorative overlay.
    b. Drawer Bottoms: Thermoset decorative overlay.

4. Colors, Patterns, and Finishes: As selected from manufacturer's full range for approval by Architect.
5. Provide dust panels of 1/4-inch plywood or tempered hardboard above compartments and drawers, unless located directly under tops.

D. Plastic-Laminate Countertops:

1. High-Pressure Decorative Laminate Grade: HGS.
2. Colors, Patterns, and Finishes: As selected from manufacturer's full range for approval by Architect.
3. Edge Treatment: Same as laminate cladding on horizontal surfaces.

4. Core Material at Sinks: Particleboard, on medium density fiberboard made with exterior glue.

E. Solid-Surfacing-Material Countertops:

1. Solid-Surfacing-Material Thickness: As noted on construction drawing.
2. Colors, Patterns, and Finishes: As selected from manufacturer's full range for approval by Architect.
3. Fabricate tops in one piece with shop-applied backsplashes and edges, unless otherwise indicated. Comply with solid-surfacing-material manufacturer's written recommendations for adhesives, sealers, fabrication, and finishing.

F. Flush Wood Paneling and Ceiling Paneling:

1. Lumber Trim and Edges: At fabricator's option, trim and edges indicated as solid wood (except moldings) may be either lumber or veneered construction compatible with grain and color of veneered panels.
2. Matching of Adjacent Veneer Leaves: Book match.
3. Veneer Matching within Panel Face: Running match.
4. Fire-Retardant-Treated Paneling: Provide panels consisting of wood veneer and fire-retardant particleboard or fire-retardant medium-density fiberboard with a flame-spread index of [75] [25] or less and smoke-developed index of 450 or less per ASTM E 84.

G. Fire-Rated Interior Frames and Jambs: Products fabricated from fire-retardant particleboard or fire-retardant medium-density fiberboard with veneered, exposed surfaces and listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated, based on testing according to NFPA 252.

1. Test Pressure: Test at atmospheric pressure.
2. Fire Rating: 20 minutes.

2.7 SHOP FINISHING

A. Finish architectural woodwork at fabrication shop. Defer only final touchup, cleaning, and polishing until after installation.

B. Backpriming: Apply one coat of sealer or primer, compatible with finish coats, to concealed surfaces of woodwork. Apply two coats to back of paneling.

C. Transparent Finish: Comply with requirements indicated below for grade, finish system, staining, and sheen, with sheen measured on 60-deg ree gloss meter per ASTM D 523:

1. Staining: Submit manufacturer's range of finishes for review and approval by Architect.

4. Color: Match sample
5. Sheen: As approved sample

PART 3 - EXECUTION

3.1 INSTALLATION

A. Condition woodwork to average prevailing humidity conditions in installation areas and examine and complete work as required, including removal of packing and backpriming before installation.

B. Quality Standard: Install woodwork to comply with AWI Section 1700 for the same grade specified in this Section for type of woodwork involved.

C. Quality Standard: Install woodwork to comply with WIC Section 26 for the same grade specified in this Section for type of woodwork involved.

D. Install woodwork level, plumb, true, and straight to a tolerance of 1/8 inch in 96 inches. Shim as required with concealed shims.

E. Scribe and cut woodwork to fit adjoining work, and refinish cut surfaces and repair damaged finish at cuts.

F. Anchor woodwork to anchors or blocking built in or directly attached to substrates. Secure with countersunk, concealed fasteners and blind nailing as required for complete installation. Use fine finishing nails for exposed fastening, countersunk and filled flush with woodwork and matching final finish if transparent finish is indicated.

G. Standing and Running Trim: Install with minimum number of joints possible, using full-length pieces (from maximum length of lumber available) to greatest extent possible. Fill gaps, if any, between top of base and wall with plastic wood filler, sand smooth, and finish same as wood base, if finished.

H. Cabinets: Install without distortion so doors and drawers fit openings properly and are accurately aligned. Adjust hardware to center doors and drawers in openings and to provide unencumbered operation.

1. Fasten wall cabinets through back, near top and bottom, at ends and not more than 16 inches o.c. with No. 10 wafer-head sheet metal screws through metal backing and blocking, or metal framing behind wall finish.

I. Countertops: Anchor securely by screwing through corner blocks of base cabinets or other supports into underside of countertop. Calk space between backsplash and wall with sealant specified in Division 7 Section "Joint Sealants."

J. Paneling: Anchor paneling to supporting substrate with concealed panel-hanger clips. Do not use face fastening, unless covered by trim.

END OF SECTION 06402

SECTION 06411 - PLASTIC-LAMINATE-FACED ARCHITECTURAL CABINETS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Plastic-laminate-faced architectural cabinets.
2. Wood furring, blocking, shims, and hanging strips for installing plastic-laminate-faced architectural cabinets unless concealed within other construction before cabinet installation.

B. Related Requirements:

1. Section 06402 Interior Architectural Woodwork.
2. Section 12360 Simulated Stone Countertops.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product, including panel products, high-pressure decorative laminate, adhesive for bonding plastic laminate, and cabinet hardware and accessories.

B. Shop Drawings: Show location of each item, dimensioned plans and elevations, large-scale details, attachment devices, and other components.

C. Samples:

1. Plastic laminates, for each color, pattern, and surface finish for Architect's approval.
2. Thermoset decorative panels, for each color, pattern, and surface finish.

1.3 INFORMATIONAL SUBMITTALS

A. Woodwork Quality Standard Compliance Certificates: AWI Quality Certification Program certificates, and WI Certified Compliance Program certificates.

1.4 QUALITY ASSURANCE

A. Fabricator Qualifications: Certified participant in AWI's Quality Certification Program and Licensee of WI's Certified Compliance Program.

B. Installer Qualifications: Certified participant in AWI Quality Certification Program.

1.5 FIELD CONDITIONS

A. Environmental Limitations: Do not deliver or install cabinets until building is enclosed, wet work is complete, and HVAC system is operating and maintaining temperature and relative humidity at occupancy levels during the remainder of the construction period.

PART 2 - PRODUCTS

2.1 PLASTIC-LAMINATE-FACED ARCHITECTURAL CABINETS

A. Quality Standard: Unless otherwise indicated, comply with the "Architectural Woodwork Standards" for grades of architectural plastic-laminate cabinets indicated for construction, finishes, installation, and other requirements.

1. Provide labels and certificates from AWI certification program indicating that woodwork, including installation, complies with requirements of grades specified.

B. Grade: Custom.

C. Type of Construction: Frameless.

D. Cabinet, Door, and Drawer Front Interface Style:

E. High-Pressure Decorative Laminate: NEMA LD 3, grades as indicated or if not indicated, as required by woodwork quality standard.

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. Abet Laminati, Inc.
b. Formica Corporation.
c. Panolam Industries International, Inc.
d. Wilsonart International; Div. of Premark International, Inc.

F. Laminate Cladding for Exposed Surfaces:

1. Horizontal Surfaces: Grade HGS.
2. Postformed Surfaces: Grade HGP.
3. Vertical Surfaces: Grade HGS.
4. Pattern Direction: Vertically for drawer fronts, doors, and fixed panels.

G. Materials for Semiexposed Surfaces:

1. Surfaces Other Than Drawer Bodies: High-pressure decorative laminate, NEMA LD 3, Grade VGS.
2. Drawer Sides and Backs: Thermoset decorative panels with PVC or polyester edge banding.
3. Drawer Bottoms: Thermoset decorative panels.

H. Dust Panels: 1/4-inch (6.4-mm) plywood or tempered hardboard above compartments and drawers unless located directly under tops.

I. Colors, Patterns, and Finishes: Provide materials and products that result in colors and textures of exposed laminate surfaces complying with the following requirements:

1. As selected by Architect from laminate manufacturer's full range in the following categories:

   a. Solid colors, matte finish.
   b. Solid colors with core same color as surface, matte finish.
   c. Wood grains, matte finish.
   d. Patterns, matte finish.

2.2 WOOD MATERIALS

A. Wood Products: Provide materials that comply with requirements of referenced quality standard for each type of woodwork and quality grade specified unless otherwise indicated.

1. Wood Moisture Content: 5 to 10 percent.

B. Composite Wood and Agrifiber Products: Provide materials that comply with requirements of referenced quality standard for each type of woodwork and quality grade specified unless otherwise indicated.

1. Recycled Content of Medium-Density Fiberboard and Particleboard: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 50 percent.
2. Composite Wood and Agrifiber Products: Products shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
3. Medium-Density Fiberboard: ANSI A208.2, Grade 130.
4. Softwood Plywood: DOC PS 1.
5. Thermoset Decorative Panels: Particleboard or medium-density fiberboard finished with thermally fused, melamine-impregnated decorative paper and complying with requirements of NEMA LD 3, Grade VGL, for test methods 3.3, 3.4, 3.6, 3.8, and 3.10.

2.3 CABINET HARDWARE AND ACCESSORIES

A. General: Provide cabinet hardware and accessory materials associated with architectural cabinets except for items specified in Section 087111 "Door Hardware (Descriptive Specification)."

B. Butt Hinges: 2-3/4-inch, five-knuckle steel hinges made from 0.095-inch thick metal, and as follows:

1. Semiconcealed Hinges for Flush Doors: BHMA A156.9, B01361.
2. Semiconcealed Hinges for Overlay Doors: BHMA A156.9, B01521.

C. Frameless Concealed Hinges (European Type): BHMA A156.9, B01602, 100 degrees of opening, self-closing.

D. Back-Mounted Pulls: BHMA A156.9, B02011.

E. Wire Pulls: Back mounted, solid metal 4 inches long, 5/16 inch in.

F. Catches: Push-in magnetic catches, BHMA A156.9, B03131.

G. Adjustable Shelf Standards and Supports: BHMA A156.9, B04071; with shelf rests, B04081.

H. Shelf Rests: BHMA A156.9, B04013; metal, two-pin type with shelf hold-down clip.

I. Drawer Slides: BHMA A156.9.

1. Grade 1 and Grade 2: Side mounted and extending under bottom edge of drawer; full-extension type; zinc-plated steel with polymer rollers.
2. For drawers not more than 3 inches high and not more than 24 inches wide, provide Grade 1.
3. For drawers more than 3 inches high but not more than 6 inches high and not more than 24 inches wide, provide Grade 1.

J. Door and Drawer Silencers: BHMA A156.16, L03011.

K. Exposed Hardware Finishes: For exposed hardware, provide finish that complies with BHMA A156.18 for BHMA finish number indicated.

1. Satin Stainless Steel: BHMA 630.

2.4 MISCELLANEOUS MATERIALS

A. Furring, Blocking, Shims, and Hanging Strips: Fire-retardant-treated softwood lumber, kiln dried to less than 15 percent moisture content.

B. Anchors: Select material, type, size, and finish required for each substrate for secure anchorage. Provide metal expansion sleeves or expansion bolts for post-installed anchors. Use nonferrous-metal or hot-dip galvanized anchors and inserts at inside face of exterior walls and at floors.

C. Adhesives: Do not use adhesives that contain urea formaldehyde.

D. Adhesives: Use adhesives that meet the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

E. Adhesive for Bonding Plastic Laminate: Unpigmented contact cement.

1. Adhesive for Bonding Edges: Hot-melt adhesive or adhesive specified above for faces.

2.5 FABRICATION

A. Complete fabrication, including assembly and hardware application, to maximum extent possible before shipment to Project site. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.

B. Shop-cut openings to maximum extent possible to receive hardware, appliances, electrical work, and similar items. Locate openings accurately and use templates or roughing-in diagrams to produce accurately sized and shaped openings. Sand edges of cutouts to remove splinters and burrs.

PART 3 - EXECUTION

3.1 PREPARATION

A. Before installation, condition cabinets to average prevailing humidity conditions in installation areas.

3.2 INSTALLATION

A. Grade: Install cabinets to comply with same grade as item to be installed.

B. Install cabinets level, plumb, true, and straight. Shim as required with concealed shims. Install level and plumb to a tolerance of 1/8 inch in 96 inches.

C. Scribe and cut cabinets to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.

D. Anchor cabinets to anchors or blocking built in or directly attached to substrates. Secure with countersunk, concealed fasteners and blind nailing. Use fine finishing nails[or finishing screws] for exposed fastening, countersunk and filled flush with woodwork.

E. Cabinets: Install without distortion so doors and drawers fit openings properly and are accurately aligned. Adjust hardware to center doors and drawers in openings and to provide unencumbered operation. Complete installation of hardware and accessory items as indicated.

1. Install cabinets with no more than 1/8 inch in 96-inch sag, bow, or other variation from a straight line.
2. Fasten wall cabinets through back, near top and bottom, and at ends not more than 16 inches o.c. with No. 10 wafer-head sheet metal screws through metal backing or metal framing behind wall finish.

END OF SECTION 06411

SECTION 07015 - PREPARATION FOR RE-ROOFING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Full tear-off of roof areas indicated on demolition plan.
2. Removal of base flashings.

1.2 DEFINITIONS

A. Roofing Terminology: Definitions in ASTM D 1079 and glossary of NRCA's "The NRCA Roofing and Waterproofing Manual" apply to work of this Section.

B. Full Roof Tear-Off: Removal of existing roofing system from deck.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Temporary Roofing Submittal: Product data and description of temporary roofing system.

1.4 INFORMATIONAL SUBMITTALS

A. Photographs or Videotape: Show existing conditions of adjoining construction and site improvements, including exterior and interior finish surfaces that might be misconstrued as having been damaged by reroofing operations. Submit to Architect before work begins.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Approved by warrantor of existing roofing system to work on existing roofing.

B. Reroofing Conference: Conduct conference at Project site.

1.6 FIELD CONDITIONS

A. Owner will occupy portions of building immediately below reroofing area. Conduct reroofing so Owner's operations are not disrupted. Provide Owner with not less than 72 hours' notice of activities that may affect Owner's operations.

1. Coordinate work activities daily with Owner so Owner can place protective dust and water-leakage covers over sensitive equipment and furnishings, shut down HVAC and fire-alarm or -detection equipment if needed, and evacuate occupants from below work area.
2. Before working over structurally impaired areas of deck, notify Owner to evacuate occupants from below affected area. Verify that occupants below work area have been evacuated before proceeding with work over impaired deck area.

B. Protect building to be reroofed, adjacent buildings, walkways, site improvements, exterior plantings, and landscaping from damage or soiling from reroofing operations.

C. Maintain access to existing walkways, corridors, and other adjacent occupied or used facilities.

D. Limit construction loads on roof for rooftop equipment wheel loads and for uniformly distributed loads.

E. Weather Limitations: Proceed with reroofing preparation only when existing and forecasted weather conditions permit Work to proceed without water entering existing roofing system or building.

PART 2 - PRODUCTS

2.1 INFILL AND REPLACEMENT MATERIALS

A. Use infill materials matching existing roofing system materials unless otherwise indicated.

2.2 AUXILIARY REROOFING MATERIALS

A. General: Use auxiliary reroofing preparation materials recommended by roofing system manufacturer for intended use and compatible with components of existing and new roofing system.

PART 3 - EXECUTION

3.1 PREPARATION

A. Shut off rooftop utilities and service piping before beginning the Work.

B. Protect existing roofing system that is not to be reroofed.

C. Coordinate with Owner to shut down air-intake equipment in the vicinity of the Work. Cover air-intake louvers before proceeding with reroofing work that could affect indoor air quality or activate smoke detectors in the ductwork.

D. Maintain roof drains in functioning condition to ensure roof drainage at end of each workday. Prevent debris from entering or blocking roof drains and conductors. Use roof-drain plugs

specifically designed for this purpose. Remove roof-drain plugs at end of each workday, when no work is taking place, or when rain is forecast.

3.2 ROOF TEAR-OFF

A. General: Notify Owner each day of extent of roof tear-off proposed for that day and obtain authorization to proceed.

B. Full Roof Tear-Off: Where indicated, remove existing roofing and other roofing system components down to the deck.

1. Bitumen and felts that are firmly bonded to concrete decks are permitted to remain if felts are dry. Remove unadhered bitumen, unadhered felts, and wet felts.
2. Remove fasteners from deck.

3.3 DECK PREPARATION

A. Inspect deck after tear-off of roofing system.

B. Verify that concrete substrate is visibly dry and free of moisture. Test for capillary moisture by plastic sheet method according to ASTM D 4263.

C. If broken or loose fasteners that secure deck panels to one another or to structure are observed, or if deck appears or feels inadequately attached, immediately notify Architect. Do not proceed with installation until directed by Architect.

D. If deck surface is unsuitable for receiving new roofing or if structural integrity of deck is suspect, immediately notify Architect. Do not proceed with installation until directed by Architect.

3.4 INFILL MATERIALS INSTALLATION

A. Immediately after roof tear-off, and inspection and repair, if needed, of deck, fill in tear-off areas to match existing roofing system construction.

B. Install new roofing patch over roof infill area. If new roofing is installed the same day tear-off is made, roofing patch is not required.

3.5 BASE FLASHING REMOVAL

A. Remove existing base flashings. Clean substrates of contaminants, such as asphalt, sheet materials, dirt, and debris.

B. Do not damage metal counterflashings that are to remain. Replace metal counterflashings damaged during removal with counterflashings specified in Section 077100 "Roof Specialties."

C. When directed by Architect, replace parapet framing, wood blocking, curbs, and nailers to comply with Section 061000 "Rough Carpentry."

3.6 DISPOSAL

A. Collect demolished materials and place in containers. Remove all materials in controlled process to not spread debris on property. Promptly dispose of demolished materials. Do not allow demolished materials to accumulate on-site.

B. Transport and legally dispose of demolished materials off Owner's property.

END OF SECTION 07015

SECTION 07411 - METAL ROOF PANELS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Factory-formed and field-assembled standing-seam metal roof panels to match existing metal roof appearance in dimension material and color.

2. Field formed flashings, gutters, and accessories.

B. The work to be performed under this contract provides:
1. Installation of new Standing Seam metal roofing, including all labor, miscellaneous materials, tools, transportation, equipment, services and facilities necessary to, and reasonably incidental to, the completion of the work as shown on the drawings and/or described in the specifications.

1.3 DEFINITIONS

A. Metal Roof Panel Assembly: Metal roof panels, attachment system components, and accessories necessary for a complete weather tight roofing system.

B. Solar Flux: Direct and diffuse radiation from the sun received at ground level over the solar spectrum, expressed in watts per square meter.

C. Solar Reflectance: Fraction of solar flux reflected by a surface, expressed as a percent or within the range of 0.00 and 1.00.

1.4 PERFORMANCE REQUIREMENTS

A. General: Provide metal roof panel assemblies that comply with performance requirements specified as determined by testing manufacturers' standard assemblies similar to those indicated for this Project, by a qualified testing and inspecting agency.

B. Water Penetration: Compliance with ASTM E 2140-01 "Standard Test Method for Water Penetration of Metal Roof Panel System by Static Water Pressure Head"

C. Thermal Movements: Provide metal roof panel assemblies that allow for thermal movements resulting from the following maximum change (+ or - 100 degrees F) in ambient and surface

temperatures by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

D. FMG Listing: Provide metal roof panels and component materials that comply with requirements in FMG 4471 as part of a panel roofing system and that are listed in FMG's "Approval Guide" for Class 1. Identify materials with FMG label.

1. Fire/Windstorm Classification: Class 1A- 90.
2. Hail Resistance: SH.

1.5 DESIGN REQUIREMENTS:

A. The architectural standing seam metal roof system, including: panels, flashings, attachment clips and attachment screws shall be designed by the architectural standing seam metal roof system manufacturer to meet the following performance and design criteria.
   a. IBC 2006
   b. Wind Speed 95 MPH.
   c. Importance Factor: 1.15
   d. Building exposure factor: A
   e. Snow Load: include in design criteria.
   f. Live Load: include in design criteria.
   g. Dead Load: include in design criteria.

B. The architectural standing seam metal roof system manufacturer shall provide an engineered analysis of the roofing system, sealed by a registered Professional Engineer employed by the manufacturer, verifying that the product and attachment methods will resist wind pressures imposed upon it pursuant to the applicable building codes and that the roofing system fully complies with all specified requirements.

C. Provide UL-90 rated roofing panels that have been tested in accordance with UL 580 protocol.

D. All details will utilize hydrostatic joinery. Manufacturer's details will take precedent over SMACNA details where conflicts occur.

1.6 SUBMITTALS

A. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of metal roof panel and accessory.

B. Shop Drawings: Show fabrication and installation layouts of metal roof panels; details of edge conditions, joints, panel profiles, corners, anchorages, trim, flashings, closures, and accessories; and special details that have been stamped and sealed by an engineer employed by the manufacturer registered in the state where project is taking place. Distinguish between factory- and field-assembled work.

1. Accessories: Include details of the following items:
   a. Flashing and trim.

b. Gutters.
c. Pipe penetration flashings
d. Dunnage penetration flashing.

2. For installed products indicated to comply with design loads, include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

C. Installer Qualification Data:
1. Installer certificate, signed by roofing system manufacturer certifying that Installer is approved, authorized, or licensed by manufacturer to install roofing system.

D. Compliance with ASTM E 2140-01 "Standard Test Method for Water Penetration of Metal Roof Panel System by Static Water Pressure Head"

E. Maintenance Data: For metal roof panels to include in maintenance manuals.

F. Warranties: Copy of Manufacturer's warranty for both low slope built up roofing and metal roofing combined.

1.7 QUALITY ASSURANCE

A. Manufacturer Approval: This specification is based on the performance characteristics of the system identified in Article 2.1.

B. Installer Qualifications:
1. A qualified firm that is approved, authorized, or licensed by roofing system manufacturer to install manufacturer's product and that is eligible to receive manufacturer's warranty.
2. Installer must maintain a full-time supervisor/foreman on the job site during all phases of the roof installation. This individual must have a copy of the specification in his possession on site.
3. During construction, the contractor is responsible for responding immediately to correct roof leakage once the installation has begun.

C. Source Limitations: Obtain each type of metal roof panels and all flat stock for fabricated pieces such as flashings, copings, and gutters through one source from a single manufacturer. Only obtain components for roofing system which are approved by roofing system manufacturer.

D. Product Options: Drawings indicate size, profiles, and dimensional requirements of metal roof panels and are based on the specific system indicated. Refer to Division 1 Section "Product Requirements."

1. Do not modify intended aesthetic effects, as judged solely by Owner, except with Owner's approval. If modifications are proposed, submit comprehensive explanatory data to Owner for review.

E. Fire-Resistance Ratings: Where indicated, provide metal roof panels identical to those of assemblies tested for fire resistance per ASTM E 119 by a testing and inspecting agency acceptable to authorities having jurisdiction.

1. Fire-Resistance Ratings: Indicated by design designations from UL's "Fire Resistance Directory" or from the listings of another testing and inspecting agency.
2. Metal roof panels shall be identified with appropriate markings of applicable testing and inspecting agency.

F. Preliminary Roofing Conference: Before starting roof deck, purlin and rafter construction, conduct conference at Project site. Comply with requirements for preinstallation conferences in Division 1 Section "Project Management and Coordination." Review methods and procedures related to roof deck, purlin and rafter construction and metal roof panels including, but not limited to, the following:

1. Meet with Owner, Architect, Owner's insurer if applicable, testing and inspecting agency representative, metal roof panel Installer, metal roof panel manufacturer's representative, deck, purlin and rafter Installer, and installers whose work interfaces with or affects metal roof panels including installers of roof accessories and roof-mounted equipment.
2. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
3. Review methods and procedures related to metal roof panel installation, including manufacturer's written instructions.
4. Examine deck substrate, purlin and rafter conditions for compliance with requirements, including flatness and attachment to structural members.
5. Review structural loading limitations of deck, purlins and rafters during and after roofing.
6. Review flashings, special roof details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that will affect metal roof panels.
7. Review governing regulations and requirements for insurance, certificates, and testing and inspecting if applicable.
8. Review temporary protection requirements for metal roof panels during and after installation.
9. Review roof observation and repair procedures after metal roof panel installation.

G. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Management and Coordination." Review methods and procedures related to metal roof panel assemblies including, but not limited to, the following:

1. Meet with Owner, Architect, Owner's insurer if applicable, testing and inspecting agency representative, metal roof panel Installer, metal roof panel manufacturer's representative, deck Installer, and installers whose work interfaces with or affects metal roof panels including installers of roof accessories and roof-mounted equipment.
2. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
3. Review methods and procedures related to metal roof panel installation, including manufacturer's written instructions.
4. Examine deck substrate conditions for compliance with requirements, including flatness and attachment to structural members.
5. Review structural loading limitations of deck during and after roofing.
6. Review flashings, special roof details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that will affect metal roof panels.
7. Review governing regulations and requirements for insurance, certificates, and testing and inspecting if applicable.
8. Review temporary protection requirements for metal roof panel assembly during and after installation.

9. Review roof observation and repair procedures after metal roof panel installation.
10. Document proceedings, including corrective measures and actions required, and furnish copy of record to each participant.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver components, sheets, metal roof panels, and other manufactured items so as not to be damaged or deformed. Package metal roof panels for protection during transportation and handling.

B. Unload, store, and erect metal roof panels in a manner to prevent bending, warping, twisting, and surface damage.

C. Stack metal roof panels on platforms or pallets, covered with suitable weathertight and ventilated covering. Store metal roof panels to ensure dryness. Do not store metal roof panels in contact with other materials that might cause staining, denting, or other surface damage.

D. Protect strippable protective covering on metal roof panels from exposure to sunlight and high humidity, except to extent necessary for period of metal roof panel installation.

E. The Contractor will be responsible for coordinating the delivery of the materials, unloading all trucks at the job site. The materials will be the responsibility of the Contractor for handling and security at the job-site.

1.9 SITE CONDITIONS

A. Field measurements and material quantities:
1. Applicator shall have SOLE responsibility for accuracy of all measurements, estimates of material quantities and sizes, and site conditions that will affect work.

B. Safety Requirements: All application, material handling, and associated equipment shall conform to and be operated in conformance with OSHA safety requirements.
1. Contractor shall advise Owner whenever work is expected to be hazardous to Owner employees and/or operators.

C. Security requirements:
1. Contractor shall comply with Owner's security requirements.
2. Contractor shall provide Owner with current list of accredited persons.
3. Contractor shall require identification to be displayed by all persons employed on this project.

D. Temporary sanitary facilities: Contractor shall furnish and maintain temporary sanitary facilities for employee use during project and shall remove immediately upon project completion.

1.10 PROJECT CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit assembly of metal roof panels to be performed according to manufacturers' written instructions and warranty requirements.

B. Field Measurements: The Contractor is responsible for field verifying all measurements on the drawings. The panels will be fabricated by the manufacturer to the length indicated on the drawings unless otherwise noted. The contractor is responsible for the panels meeting the required length for proper installation.

1.11 COORDINATION

A. Roof installer must supply and install roof accessories that are approved by the roofing manufacturer, and according to manufacturer's recommended details.

B. Coordinate metal panel roof assemblies with rain drainage work, flashing, trim, and construction of decks, parapets, walls, and other adjoining work to provide a leak proof, secure, and non-corrosive installation.

1.12 WARRANTY

A. Special Warranty on Panel Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace metal roof panels that show evidence of deterioration of factory-applied finishes within specified warranty period.

1. Fluoropolymer Finish: Deterioration includes, but is not limited to, the following:

a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.
b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.

2. Finish Warranty Period: 20 years from date of Substantial Completion.

B. Special Weathertightness Warranty for Standing-Seam Metal Roof Panels: Manufacturer's standard form in which manufacturer agrees to repair or replace standing-seam metal roof panel assemblies that fail to remain weathertight, including leaks, within specified warranty period. See Built Up Roofing for additional Warranty requirements. This warranty in conjunction with the built-up roofing warranty are to be issued by a single manufacturer and are to include all tie-ins or transitions between dissimilar roof systems and shall be warranted against leaks into the building.

1. Warranty Period: 20 years from date of Substantial Completion.
   a. Warranty must include paint adhesion for the full term of the warranty
   b. Warranty must include any damage caused to the system by wind speeds up to 90 mph

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. General: Whenever a particular make of material, trade name, and/or manufacturer's name is specified herein, it shall be regarded as indicative of the minimum standard of quality required. A bidder who proposed to quote on the basis of an alternate material and/or system will only be considered if the proposed alternate is submitted on time and is documented as being equivalent or superior in quality to the specified system in accordance with Article 2.2. Additionally, all manufacturer guidelines and performance criteria must be met as outlined in Article 1.4, 1.5, and 1.7.

B. Basis-of-Design Manufacturer/Product: The design and performance characteristics for the metal roof panel system specified is based on the Tremlock VP system manufactured by Tremco, Incorporated. Subject to compliance with requirements, provide either the named product or a product documented and approved by Owner to be equal or superior in quality in accordance with Article 1.4 "Performance Requirements" , Article 1.5 "Design Requirements", Article 1.7 "Quality Assurance" and Article 1.12 "Warranty Criteria".
1. Tremco Inc.
2. Or approved equal by Architect.

C. In other Part 2 articles where titles below introduce lists, the following requirements apply for product selection:

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the products specified.

2.2 PANEL MATERIALS

A. Metallic-Coated Steel Sheet Prepainted with Coil Coating: Steel sheet metallic coated by the hot-dip process and prepainted by the coil-coating process to comply with ASTM A 755/A 755M. Provide manufacturer's color selection range for review and approval by Architect.

1. Zinc-Coated (Galvanized) Steel Sheet: ASTM A 653/A 653M, G90 coating designation; structural quality.
2. Aluminum-Zinc Alloy-Coated Steel Sheet: ASTM A 792/A 792M, Class AZ55 coating designation, Grade 40; structural quality.
3. Surface: Smooth finish.
4. Exposed Finishes: Apply the following coil coating, as specified or indicated on Drawings.
   a. High-Performance Organic Finish: Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
   b. Fluoropolymer Two-Coat System: Manufacturer's standard two-coat, thermocured system consisting of specially formulated inhibitive primer and fluoropolymer color topcoat containing with a minimum total dry film thickness of 0.9 mil; not less than 70 percent polyvinylidene fluoride resin.

5. Concealed Finish: Apply pretreatment and manufacturer's standard white or light-colored acrylic or polyester backer finish, consisting of prime coat and wash coat with a minimum total dry film thickness of 0.5 mil.

B. Panel Sealants:

1. Sealant Tape: Pressure-sensitive, 99 percent solids, gray butyl rubber compound sealant tape with release-paper backing. Provide permanently elastic, non-sag, nontoxic, non-staining tape 1 inch wide and 1/16 inch thick minimum containing nylon spacer beads.
2. Joint Sealant: ASTM C 920; elastomeric polyurethane sealant; of type, grade, class, and use classifications required to seal joints in metal roof panels and remain weathertight; and as recommended in writing by metal roof panel manufacturer.
3. Butyl-Rubber-Based, Solvent-Release Sealant containing nylon spacer beads.

2.3 STANDING-SEAM METAL ROOF PANELS

A. Vertical-Rib, Seamed-Joint, Standing-Seam Metal Roof Panels: Factory-formed with vertical ribs at panel edges and flat pan between ribs; designed for sequential installation by mechanically attaching panels to supports using concealed clips located under one side of panels and engaging opposite edge of adjacent panels, and mechanically seaming panels together. Metal roof panel and trims are to utilize hydrostatic details at all trims, transitions, and penetrations.

1. Basis-of-Design Product: Tremco TremLock VP, Tremco Inc. Beachwood OH 44122.
2. Material: G-90 Zinc-coated galvanized steel sheet, .0276 (24 guage) thick.
   a. Exterior Finish: "Kynar 500/Hylar 5000"
   b. Color: One of manufacturer's standard colors as determined by Architect.
3. Clips: Low Moveable to accommodate thermal movement. Fixed clips in areas where design permits.
   a. Material: .0336 thick, zinc-coated (galvanized) or aluminum-zinc alloy-coated steel sheet.
4. Joint Type: Single folded
5. Panel Coverage: 16 inches.
6. Panel Height 2.0 inches.
7. Uplift Rating: UL 90.

B. On-site roll formed panels will not be allowed nor will panels manufactured from portable roll-forming equipment.

C. All details will utilize hydrostatic joinery. Manufacturer's details will take precedent over SMACNA details where conflicts occur.

2.4 ACCESSORIES

A. Roof Panel Accessories: Provide components required for a complete metal roof panel assembly including trim, gutters, copings, fasciae, corner units, ridge closures, clips, flashings, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal roof panels, unless otherwise indicated.

1. Closures: Provide closures at eaves and ridges, fabricated of same metal as metal roof panels.
2. Clips: Minimum 0..032" thick, steel panel clips designed to withstand negative-load requirements.
3. Cleats: Mechanically seamed cleats formed from minimum 0.0230-inch- thick, -steel sheet.
4. Backing Plates: Provide metal backing plates at panel end splices, fabricated from material recommended by manufacturer.
5. Closure Strips: Closed-cell, expanded, cellular, rubber or crosslinked, polyolefin-foam or closed-cell laminated polyethylene; minimum 1-inch- thick, flexible closure strips; cut or premolded to match metal roof panel profile. Provide closure strips where indicated or necessary to ensure weathertight construction.

B. Flashing and Trim: Formed from 0.0179-inch- thick, zinc-coated (galvanized) steel sheet or aluminum-zinc alloy-coated steel sheet prepainted with coil coating. Provide flashing and trim as required to seal against weather and to provide finished appearance. Locations include, but are not limited to, eaves, rakes, corners, bases, framed openings, ridges, fasciae, and fillers. Finish flashing and trim with same finish system as adjacent metal roof panels.

C. Gutters: Formed from 0.0179-inch- thick, zinc-coated (galvanized) steel sheet or aluminum-zinc alloy-coated steel sheet prepainted with coil coating. Match profile of gable trim, complete with end pieces, outlet tubes, and other special pieces as required. Fabricate in minimum 10 foot long sections, sized according to SMACNA's "Architectural Sheet Metal Manual." Furnish gutter supports and wire ball strainers at outlets. Finish gutters to match metal roof panels.

D. Downspouts: 3" round, formed from 0.0179-inch- thick, zinc-coated (galvanized) steel sheet, in 10-foot- long sections, complete with formed elbows and offsets.

E. Pipe Flashing: Premolded, EPDM pipe collar with flexible aluminum ring bonded to base and stainless steel pipe clamp to secure collar to pipe.

F. Standing Seam Clips: Dynamic Fastener S-5 Clips.

2.5 UNDERLAYMENT MATERIALS

A. Self-Adhering Underlayment: Self Adhered, cold-applied, with slip-resisting surface and release-paper backing. Provide primer when recommended by manufacturer.

1. Tremco, Powerply SA Base Sheet

2. Approved Equal.

2.6 MISCELLANEOUS MATERIALS

A. Fasteners: Self-tapping screws, bolts, nuts, self-locking rivets and bolts, end-welded studs, and other suitable fasteners designed to withstand design loads. Provide exposed fasteners with heads matching color of metal roof panels by means of factory-applied coating.

1. Fasteners for Roof Panels: Self-drilling or self-tapping, zinc-plated, hex-head carbon-steel screws, with a stainless-steel cap or zinc-aluminum-alloy head and EPDM sealing washer.
2. Fasteners for Roof Panels: Self-drilling or self-tapping 410 stainless or zinc-alloy steel hex washer head, with EPDM washer under heads of fasteners bearing on weather side of metal roof panels.
3. Fasteners for Flashing and Trim: Blind fasteners or self-drilling screws with hex washer head.
4. Blind Fasteners: High-strength aluminum or stainless-steel rivets.

2.7 FABRICATION

A. General: Fabricate and finish metal roof panels and accessories at the factory to greatest extent possible, by manufacturer's standard procedures and processes, as necessary to fulfill indicated performance requirements demonstrated by laboratory testing. Comply with indicated profiles and with dimensional and structural requirements.

B. Provide panel profile, including major ribs and intermediate stiffening ribs, if any, for full length of panel.

C. Where indicated, fabricate metal roof panel joints with factory-installed captive gaskets or separator strips that provide a tight seal and prevent metal-to-metal contact, in a manner that will minimize noise from movements within panel assembly.

D. Sheet Metal Accessories: Fabricate flashing and trim to comply with manufacturers' standard.

1. Form exposed sheet metal accessories that are without excessive oil canning, buckling, and tool marks and that are true to line and levels indicated, with exposed edges folded back to form hems.
2. Sealed Joints: Form non-expansion but movable joints in metal to accommodate elastomeric sealant to comply with SMACNA standards.
3. Conceal fasteners and expansion provisions where possible.
4. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal recommended by metal roof panel manufacturer.

    a. Size: Cleats shall be continuous and formed by flat stock.

2.8 FINISHES, GENERAL

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are

acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, metal roof panel supports, and other conditions affecting performance of work.

1. Examine primary and secondary roof framing to verify that rafters, purlins, angles, channels, and other structural panel support members and anchorages have been installed within alignment tolerances required by metal roof panel manufacturer.
2. Examine solid roof sheathing to verify that sheathing joints are supported by framing or blocking and that installation is within flatness tolerances required by metal roof panel manufacturer.
3. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of work.

B. Remove and dispose of any marked equipment and repair any open decking.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 UNDERLAYMENT INSTALLATION

A. SBS Modifeld Bitumen Underlayment: Install underlayment on roof sheathing under metal roof panels, unless otherwise recommended by metal roof panel manufacturer. Apply at locations indicated below, in shingle fashion to shed water, with lapped joints of not less than 4 inches.

1. Apply from eave to ridge.

B. Install flashings to cover underlayment to comply with requirements specified in Division 7 Section "Sheet Metal Flashing and Trim."

3.3 METAL ROOF PANEL INSTALLATION, GENERAL

A. General: Provide metal roof panels of full length from eave to ridge, unless otherwise indicated or restricted by shipping limitations. Anchor metal roof panels and other components of the Work securely in place, with provisions for thermal and structural movement.

1. Field cutting of metal roof panels by torch is not permitted.
2. Install panels perpendicular to purlins.
3. Rigidly fasten eave end of metal roof panels and allow ridge end free movement due to thermal expansion and contraction. Predrill panels.
4. Provide metal closures at peaks rake edges rake walls and each side of ridge and hip caps.

5. Flash and seal metal roof panels with weather closures at eaves, rakes, and at perimeter of all openings. Fasten with self-tapping screws.
6. Locate and space fastenings in uniform vertical and horizontal alignment.
7. Install ridge and hip caps as metal roof panel work proceeds.
8. Lap metal flashing over metal roof panels to allow moisture to run over and off the material.

B. Joint Sealers: Install sealants where indicated and where required for weatherproof performance of metal roof panel assemblies. Provide sealants recommended by metal roof panel manufacturer.

1. Seal metal roof panel end laps with manufacturer's recommended sealant, full width of panel. Seal side joints where recommended by metal roof panel manufacturer.

3.4 FIELD-ASSEMBLED METAL ROOF PANEL INSTALLATION

A. Standing-Seam Metal Roof Panels: Fasten metal roof panels to supports with concealed clips at each standing-seam joint at location, spacing, and with fasteners recommended by manufacturer.

1. Install clips to supports with self-tapping fasteners.
2. Seamed Joint: Form standing seams with manufacturer-approved motorized seamer tool so clip, metal roof panel, and factory-applied sealant are completely engaged.

3.5 ACCESSORY INSTALLATION

A. General: Install accessories with positive anchorage to building and weather tight mounting and provide for thermal expansion. Coordinate installation with flashings and other components.

1. Install components required for a complete metal roof panel assembly including trim, copings, ridge closures, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items.

B. Flashing and Trim: Comply with performance requirements, manufacturer's written installation instructions. Provide concealed fasteners where possible, and set units true to line and level as indicated. Install work with laps, joints, and seams that will be permanently watertight and weather resistant.

1. Install exposed flashing and trim that is without excessive oil canning, buckling, and tool marks and that is true to line and levels indicated, with exposed edges folded back to form hems. Install sheet metal flashing and trim to fit substrates and to result in waterproof and weather-resistant performance.
2. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim.

C. Gutters: Join sections with riveted, lapped and sealed joints. Attach gutters to eave with gutter hangers spaced not more than 4 feet o.c. using manufacturer's standard fasteners. Provide end closures and seal watertight with sealant. Provide for thermal expansion.

D. Downspouts: Join sections with 1-1/2-inch telescoping joints. Provide fasteners designed to hold downspouts securely 1 inch away from walls; locate fasteners at top and bottom and at approximately 60 inches o.c. in between.

1. Provide elbows at base of downspouts to direct water away from building.

E. Pipe Flashing: Form flashing around pipe penetration and metal roof panels. Fasten and seal to metal roof panels with aluminum blind-type clamping fastener.

3.6 ERECTION TOLERANCES

A. Installation Tolerances: Shim and align metal roof panel units within installed tolerance of 1/4 inch in 20 feet on slope and location lines as indicated and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.

3.7 FIELD QUALITY CONTROL

A. Testing Agency: Contractor shall engage manufacturer's technical service representative for a minimum of 3 full time days to provide job-site inspection and testing services. Written reports with photos shall be submitted to owner and architect.

B. Manufacturer's Field Service: Manufacturer's technical service representative shall inspect completed metal roof panel installation, including accessories. Report results in writing.

C. Remove and replace applications of metal roof panels where inspections indicate that they do not comply with specified requirements.

D. Additional inspections, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.8 CLEANING AND PROTECTION

A. Remove temporary protective coverings and strippable films, if any, as metal roof panels are installed, unless otherwise indicated in manufacturer's written installation instructions. On completion of metal roof panel installation, clean finished surfaces as recommended by metal roof panel manufacturer. Maintain in a clean condition during construction.

B. Replace metal roof panels that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 07411

SECTION 07421 - INSULATED METAL WALL PANELS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Foamed-insulation-core metal wall panels.
2. Laminated-insulation-core metal wall panels.
3. Complete insulated metal wall panel system for penthouse structure.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: Include fabrication and installation layouts of metal panels; details of edge conditions, joints, panel profiles, corners, anchorages, attachment system, trim, flashings, closures, and accessories; and special details.

C. Samples: For each type of metal panel indicated. Manufacturer's full range of color selections to be submitted for review and approval by Architect.

1.5 INFORMATIONAL SUBMITTALS

A. Product test reports.

B. Warranties: Samples of special warranties.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance data.

1.7 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of metal panel systems that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Two years from date of Substantial Completion.

B. Special Warranty on Panel Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace metal panels that show evidence of deterioration of factory-applied finishes within specified warranty period.

1. Finish Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Structural Performance: Provide metal panel systems capable of withstanding the effects of the following loads, based on testing according to ASTM E 72:

1. Wind Loads: 35 PSF, inward and outward
2. Deflection Limits: For wind loads, no greater than 1/240 of the span.

B. Air Infiltration: Air leakage of not more than 0.06 cfm/sq. ft. when tested according to ASTM E 283 at the following test-pressure difference:

1. Test-Pressure Difference: 6.24 lbf/sq. ft.

C. Water Penetration under Static Pressure: No water penetration when tested according to ASTM E 331 at the following test-pressure difference:

1. Test-Pressure Difference: 6.24 lbf/sq. ft.

D. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.

E. Fire-Test-Response Characteristics: Provide metal wall panels and system components with the following fire-test-response characteristics, as determined by testing identical panels and system components per test method indicated below by UL or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify products with appropriate markings of applicable testing agency.

1. Fire-Resistance Characteristics: Provide materials and construction tested for fire resistance per ASTM E 119.

2. Intermediate-Scale Multistory Fire Test: Tested mockup, representative of completed multistory wall assembly of which wall panel is a part, complies with NFPA 285 for test method and required fire-test-response characteristics of exterior non-load-bearing wall panel assemblies.
3. Radiant Heat Exposure: No ignition when tested according to NFPA 268.
4. Potential Heat: Acceptable level when tested according to NFPA 259.
5. Surface-Burning Characteristics: Provide wall panels with a flame-spread index of 25 or less and a smoke-developed index of 450 or less, per ASTM E 84.

2.2 FOAMED-INSULATION-CORE METAL WALL PANELS

A. General: Provide factory-formed and -assembled metal wall panels fabricated from two metal facing sheets and insulation core foamed in place during fabrication, and with joints between panels designed to form weathertight seals. Include accessories required for weathertight installation.

1. Panel Performance:

   a. Flatwise Tensile Strength: 30 psi when tested according to ASTM C 297/C 297M.
   b. Humid Aging: Volume increase not greater than 6.0 percent and no delamination or metal corrosion when tested for seven days at 140 deg F and 100 percent relative humidity according to ASTM D 2126.
   c. Heat Aging: Volume increase not greater than 2.0 percent and no delamination, surface blistering, or permanent bowing when tested for seven days at 200 deg F according to ASTM D 2126.
   d. Cold Aging: Volume decrease not more than 1.0 percent and no delamination, surface blistering, or permanent bowing when tested for seven days at minus 20 deg F according to ASTM D 2126.
   e. Fatigue: No evidence of delamination, core cracking, or permanent bowing when tested to a 20-lbf/sq. ft.positive and negative wind load and with deflection of L/180 for 2 million cycles.
   f. Autoclave: No delamination when exposed to 2-psi pressure at a temperature of 212 deg F for 2-1/2 hours.

2. Insulation Core: Modified isocyanurate or polyurethane foam using a non-CFC blowing agent, with maximum flame-spread and smoke-developed indexes of 25 and 450, respectively.

   a. Closed-Cell Content: 90 percent when tested according to ASTM D 6226.
   b. Density: 2.0 to 2.6 lb/cu. ft. when tested according to ASTM D 1622.
   c. Compressive Strength: Minimum 20 psi when tested according to ASTM D 1621.
   d. Shear Strength: 26 psi when tested according to ASTM C 273/C 273M.

B. Concealed-Fastener, Foamed-Insulation-Core Metal Wall Panels: Formed with tongue-and-groove panel edges; designed for sequential installation by interlocking panel edges and mechanically attaching panels to supports using concealed clips or fasteners.
1. Basis-of-Design Product: Subject to compliance with requirements, provide CENTRIA Architectural Systems: Formawall Dimension Series-T or comparable product by one of the following:
   a. IPS - Insulated Panel Systems, an NCI company

b. Kingspan
c. Metl-Span LLC
d. Centria

2. Metallic-Coated Steel Sheet: Facings of zinc-coated (galvanized) steel sheet complying with ASTM A 653/A 653M, G90 coating designation, or aluminum-zinc alloy-coated steel sheet complying with ASTM A 792/A 792M, Class AZ50 coating designation; structural quality. Prepainted by the coil-coating process to comply with ASTM A 755/A 755M.

   a. Nominal Thickness: 0.028 inch
   b. Exterior Finish: Two-coat fluoropolymer.

      1) Color: As selected by Architect from manufacturer's full range

3. Panel Coverage: As indicated on drawings
4. Panel Thickness: 3.0 inches
5. Thermal-Resistance Value (R-Value): 20.58 according to ASTM C 1363.

2.3 MISCELLANEOUS MATERIALS

A. Miscellaneous Metal Subframing and Furring: ASTM C 645, cold-formed, metallic-coated steel sheet, ASTM A 653/A 653M, G90 coating designation or ASTM A 792/A 792M,Class AZ50aluminum-zinc-alloy coating designation unless otherwise indicated. Provide manufacturer's standard sections as required for support and alignment of metal panel system.

B. Panel Accessories: Provide components required for a complete, weathertight panel system including trim, copings, fasciae, mullions, sills, corner units, clips, flashings, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal panels unless otherwise indicated.

1. Closures: Provide closures at eaves and rakes, fabricated of same metal as metal panels.
2. Backing Plates: Provide metal backing plates at panel end splices, fabricated from material recommended by manufacturer.
3. Closure Strips: Closed-cell, expanded, cellular, rubber or crosslinked, polyolefin-foam or closed-cell laminated polyethylene; minimum 1-inch thick, flexible closure strips; cut or premolded to match metal panel profile. Provide closure strips where indicated or necessary to ensure weathertight construction.

C. Flashing and Trim: Provide flashing and trim formed from same material as metal panelsas required to seal against weather and to provide finished appearance. Locations include, but are not limited to, bases, drips, sills, jambs, corners, endwalls, framed openings, rakes, fasciae, parapet caps, soffits, reveals, and fillers. Finish flashing and trim with same finish system as adjacent metal panels.

D. Panel Fasteners: Self-tapping screws designed to withstand design loads. Provide exposed fasteners with heads matching color of metal panels by means of plastic caps or factory-applied coating. Provide EPDM or PVC sealing washers for exposed fasteners.

E. Panel Sealants: Provide sealant type recommended by manufacturer that are compatible with panel materials, are nonstaining, and do not damage panel finish.

1. Sealant Tape: Pressure-sensitive, 100 percent solids, gray polyisobutylene compound sealant tape with release-paper backing; 1/2 inch wide and 1/8 inch thick.
2. Joint Sealant: ASTM C 920; as recommended in writing by metal panel manufacturer.
3. Butyl-Rubber-Based, Solvent-Release Sealant: ASTM C 1311.

2.4 FABRICATION

A. General: Fabricate and finish metal panels and accessories at the factory, by manufacturer's standard procedures and processes, as necessary to fulfill indicated performance requirements demonstrated by laboratory testing. Comply with indicated profiles and with dimensional and structural requirements.

B. Provide panel profile, including major ribs and intermediate stiffening ribs, if any, for full length of panel.

C. Fabricate metal panel joints with factory-installed captive gaskets or separator strips that provide a weathertight seal and prevent metal-to-metal contact, and that minimize noise from movements.

D. Sheet Metal Flashing and Trim: Fabricate flashing and trim to comply with manufacturer's recommendations and recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, metal, and other characteristics of item indicated.

2.5 FINISHES

A. Panels and Accessories:

1. Two-Coat Fluoropolymer: AAMA 621. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
2. Siliconized Polyester: Epoxy primer and silicone-modified, polyester-enamel topcoat; with a dry film thickness of not less than 0.2 mil for primer and 0.8 mil for topcoat.
3. Concealed Finish: Apply pretreatment and manufacturer's standard white or light-colored acrylic or polyester backer finish consisting of prime coat and wash coat with a minimum total dry film thickness of 0.5 mil.

PART 3 - EXECUTION

3.1 PREPARATION

A. Miscellaneous Supports: Install subframing, furring, and other miscellaneous panel support members and anchorages according to ASTM C 754 and metal panel manufacturer's written recommendations.

3.2 INSULATED METAL WALL PANEL INSTALLATION

A. General: Apply continuous ribbon of sealant to panel joint on concealed side of insulated metal wall panels as vapor seal; apply sealant to panel joint on exposed side of panels for weather seal.

1. Fasten foamed-insulation-core metal wall panels to supports with fasteners at each lapped joint at location and spacing and with fasteners recommended by manufacturer.
2. Apply panels and associated items true to line for neat and weathertight enclosure. Avoid "panel creep" or application not true to line.
3. Provide metal-backed washers under heads of exposed fasteners on weather side of insulated metal wall panels.
4. Locate and space exposed fasteners in uniform vertical and horizontal alignment. Use proper tools to obtain controlled uniform compression for positive seal without rupture of washer.
5. Provide sealant tape at lapped joints of insulated metal wall panels and between panels and protruding equipment, vents, and accessories.
6. Apply a continuous ribbon of sealant tape to panel side laps and elsewhere as needed to make panels weathertight.
7. Apply snap-on battens to exposed-fastener, insulated-core metal wall panel seams to conceal fasteners.

B. Foamed-Insulation-Core Metal Wall Panels: Fasten metal wall panels to supports with concealed clips at each joint at location and spacing and with fasteners recommended by manufacturer. Fully engage tongue and groove of adjacent panels.

1. Install clips to supports with self-tapping fasteners.

C. Accessory Installation: Install accessories with positive anchorage to building and weathertight mounting, and provide for thermal expansion. Coordinate installation with flashings and other components.

D. Flashing and Trim: Comply with performance requirements, manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, and set units true to line and level. Install work with laps, joints, and seams that are permanently watertight.

3.3 CLEANING

A. Remove temporary protective coverings and strippable films, if any, as metal panels are installed, unless otherwise indicated in manufacturer's written installation instructions. On completion of metal panel installation, clean finished surfaces as recommended by metal panel manufacturer. Maintain in a clean condition during construction.

END OF SECTION 07421

SECTION 07555 - MODIFIED BITUMINOUS MEMBRANE ROOFING

PART 1 - GENERAL

1.1 SUMMARY

A. Cold applied, Energy Star rated SBS-modified bituminous membrane roofing system on concrete deck.

B. Tapered roof insulation and coverboard.

C. Flexible base flashing system.

1.2 DEFINITIONS

A. Roofing Terminology: See ASTM D 1079 and glossary of NRCA's "The NRCA Roofing and Waterproofing Manual" for definition of terms related to roofing work in this Section.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Roofing Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For roofing system. Include plans, elevations, sections, details, and attachments to other work.

C. Samples for Verification: For the following products:

1. Cap sheet, of color required.
2. Flashing sheet, of color required.

1.5 INFORMATIONAL SUBMITTALS

A. Research/Evaluation Reports: For components of roofing system, from ICC-ES.

B. Sample Warranties: For manufacturer's special warranties.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: For roofing system to include in maintenance manuals.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: A qualified firm that is approved, authorized, or licensed by roofing system manufacturer to install manufacturer's product and that is eligible to receive manufacturer's special warranty.

B. Manufacturer's Technical Representative Qualifications: An authorized full-time employee representative of manufacturer experienced in the installation and maintenance of the specified roofing system and qualified to determine Installer's compliance with the requirements of this Project.

1. If the technical inspector is not an employee of the manufacturer, they shall be certified as a Registered Roof Observer by the Roof Consultants Institute, and shall be experienced in the installation and maintenance of the specified roofing system and qualified to determine Installer's compliance with the requirements of this Project.

C. Source Limitations: Obtain components for roofing system from or approved by roofing system manufacturer.

1.8 WARRANTY

A. Special Warranty: Manufacturer's Roofing System Quality Assurance Warranty, in which manufacturer agrees to repair or replace components of roofing system that fail in materials or workmanship within specified warranty period. Failure includes roof leaks.

1. Tremco's 20 Year QA Plus Roof Warranty for new roof systems.

2. Special warranty includes all non-manufactured metal flashings at pipes, projections and penetrations in the field. The manufacturer will, during the second and fifth year of this warranty, inspect and provide a written Executive Summary (additional owner's documents may apply). Material manufacturer shall make pro-active roof repairs when conducting the 2, 5, 10, 15 and 20 year warranty inspections. Warranty to commence upon substantial completion.
3. Warranty Period: 20 years from date of substantial Completion with two (2) five (5) year extension options.

B. Special Project Warranty: Submit roofing Installer's warranty, on warranty form at end of this Section, signed by Installer, covering Work of this Section, including all components of roofing system such as roofing membrane, base flashing, roof insulation, fasteners, cover boards, substrate boards, vapor retarders, roof pavers, and walkway products, for the following warranty period:

1. Warranty Period: Two years from date of Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. SBS-Modified Bituminous Roofing:

1. Manufacturers: Existing roofing to remain is by Tremco. In order to retain warranty on existing roofing; provide areas of new roofing and tie-ins to existing roofing by Tremco.

B. Source Limitations: Obtain components including roof insulation and fasteners for roofing system from same manufacturer as roofing or manufacturer approved by roofing manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. General: Provide installed roofing membrane and base flashings that remain watertight; do not permit the passage of water; and resist specified uplift pressures, thermally induced movement, and exposure to weather without failure.

B. Accelerated Weathering: Roofing system shall withstand 2000 hours of exposure when tested according to ASTM G 152, ASTM G 154, or ASTM G 155.

C. FMG Listing: Provide roofing membrane, base flashings, and component materials that comply with requirements in FMG 4450 and FMG 4470 as part of a roofing system and that are listed in FMG's "Approval Guide" for Class 1 or noncombustible construction, as applicable. Identify materials with FMG markings.
1. Fire/Windstorm Classification: Class 1A-120.
2. Hail Resistance: SH. Roofing system shall resist impact damage when tested according to ASTM D 3746 or ASTM D 4272.

D. Fire-Test-Response Characteristics: Provide roofing materials with the fire-test-response characteristics indicated as determined by testing identical products per test method below by UL, FMG, or another testing and inspecting agency acceptable to authorities having jurisdiction. Materials shall be identified with appropriate markings of applicable testing and inspecting agency.

1. Exterior Fire Test Exposure: Class A; ASTM E 108, for application and roof slopes indicated.

2. Fire-Resistance Ratings: ASTM E 119, for fire-resistance-rated roof assemblies of which roofing system is a part.

E. LEED Requirements: The roofing materials must be eligible for the following United States Green Building Council's LEED items:
1. SS Credit 7.2 – Heat island Effect
2. MR Credit 4.1 – Recycled Content

F. Material Compatibility: Provide roofing materials that are compatible with one another under conditions of service and application required, as demonstrated by roofing manufacturer based on testing and field experience.

G. Flashings: Comply with requirements of Division 7 Section "Roof Specialties" Provide base flashings, perimeter flashings, detail flashings and component materials that comply with requirements and recommendations of the following:
1. FMG 1-49 Loss Prevention Data Sheet for Perimeter Flashings.
2. FMG 1-29 Loss Prevention Data Sheet for Above Deck Roof Components.

3. NRCA Roofing and Waterproofing Manual (Fifth Edition) for construction details and recommendations.
4. SMACNA Architectural Sheet Metal Manual (Fifth Edition) for construction details.

2.3 ROOFING MEMBRANE PLY SHEETS

A. Recycled Content Tri-Laminate Ply Sheets: Tremco Burmastic Composite Ply Premium Green:
1. Tensile Strength: 220 lbf/in MD, 235 lbf/in XMD, ASTM D5147
2. Elongation: 6.5% MD, 6.5% XMD, ASTM D 5147
3. Tear Strength: 345 lbf MD, 330 XMD, ASTM D 5147

2.4 ROOFING MEMBRANE CAP SHEET, SBS-MODIFIED BITUMEN

A Roofing Membrane Cap Sheet: Tremco, POWERply Standard FR T24: ASTM D 6163.
1. Exterior Fire-Test Exposure, ASTM E 108: Class A.
2. Tensile Strength, ASTM D 5147: machine direction 130 lbf/in; cross machine direction 100 lbf/in.
3. Elongation at 73 deg. F, minimum, ASTM D 5147: machine direction, 5 percent; cross 4. machine direction, 5 percent.
4. Thickness, minimum, ASTM D 5147: 0.157 inch.
5. Initial SRI: 93, ASTM E 1980
6. 3 Year SRI: 74, ASTM E 1980

2.5 FLEXIBLE BASE FLASHING SHEET

A. CSPE Elastomeric Flashing Sheet: Tremco Hypalon Elastomeric Sheeting:
1. Tensile Strength: 225 lbf, ASTM D 751-89
2. Elongation at Fabric Break: 25%, ASTM D 751-89
3. Tear Resistance: 90 lbf, ASTM D 751-89
4. Low Temperature Flexibility: -40% degrees F, ASTM D 2136-84

B Glass-Fiber Fabric: Burmesh, Wound fiberglass reinforcement for reinforcement of roofing cements and adhesives.

2.6 ASPHALT MATERIALS

A. Water-Based Asphalt Primer: Tremco, Improved Tremprime WB: Water-based, polymer modified, asphalt primer with the following physical properties:
1. Asbestos Content, EPA 600/R13/116: None.
2. Non-Volatile Content, minimum, ASTM D 2823: 32 percent.
3. Volatile Organic Compounds (VOC), maximum, ASTM D 3960: 65 g/L.

B. Cold-Applied Adhesive: Tremco, POWERply Standard Cold Adhesive LV: One-part, asbestos-free, low-volatile, cold-applied adhesive specially formulated for compatibility and use with specified roofing membranes and flashings, with the following physical properties:
1. Asbestos Content, EPA 600 R-93/116: None.
2. Volatile Organic Compounds (VOC), maximum, ASTM D 6511: 250 g/L.

3. Nonvolatile Content, minimum, ASTM D 6511: 75 percent.
4. Flash Point, minimum, ASTM D 93: 100 deg. F.
5. Density at 77 deg F ASTM D 6511: 8.1 lb/gal.
6. Uniformity and Consistency, ASTM D 6511: Pass.
7. Asphalt Content, minimum, ASTM D 6511: 42 percent.

C. Cold Applied Cap Sheet Adhesive: Tremco, White On White (WOW) Adhesive: One-part, asbestos-free, cold-applied adhesive specially formulated for compatibility and use with SBS-modified bitumen roofing membranes and flashings, with the following physical properties:
1. Asbestos Content, EPA 600 R-93/116: None.
2. Volatile Organic Compounds (VOC), maximum, ASTM D 6511: <250 g/L.
3. Nonvolatile Content, minimum, ASTM D 6511: 50 percent.
4. Flash Point, minimum, ASTM D 93: >105 deg. F.
5. Density at 77 deg. F, minimum, ASTM D 6511: 8.7 lb/gal.
6. Uniformity and Consistency, ASTM D 6511: Pass.

D. Elastomeric Flashing Adhesive: Tremco, Sheeting Bond: One-part, asbestos-free, cold-applied, butyl rubber-based, elastomeric trowel-grade adhesive specially formulated for compatibility and use with specified roofing membranes and flashings, with the following properties:
1. Adhesion in Peel, minimum, ASTM D 1876: 3 lbf/in.
2. Lap Shear Adhesion, minimum, ASTM D 816: 18 psi.
3. Asbestos Content: ASTM D 276: None.
4. Volatile Organic Compounds (VOC), maximum, ASTM D 3960: 250 g/L.
5. Color: White.

2.7 AUXILIARY ROOFING MEMBRANE MATERIALS

A General: Auxiliary materials recommended by roofing system manufacturer for intended use and compatible with roofing membrane.

B Asphalt Roofing Cement: Tremco, Polyroof SF. Solvent free roof mastic for flashing s trippings and concrete deck seals.

C. Asphalt Roofing Cement: Tremco, ELS. Heavy bodied, solvent based roofing cement for daily tie-ins and general use during roofing.

E. Mastic Sealant: Polyisobutylene, plain or modified bitumen, nonhardening, nonmigrating, nonskinning, and nondrying.

F. Metal Flashing Sheet: Metal flashing sheet is specified in Division 7 Section "Sheet Metal Flashing and Trim."

G. Miscellaneous Accessories: Provide miscellaneous accessories recommended by roofing system manufacturer.

2.8 ROOF INSULATION

A. General: Provide preformed roof insulation boards that comply with requirements and referenced standards, selected from manufacturer's standard sizes and of thicknesses indicated.

B. Polyisocyanurate Board Insulation: ASTM C 1289, Type II, Class 1, Grade 2, HCFC-free, with felt or glass-fiber mat facer on both major surfaces, minimum of 1.5" thick.

C. Tapered Insulation: Provide factory-tapered insulation boards fabricated to the slopes indicated on the drawings, unless otherwise indicated.

D. Provide preformed saddles, crickets, tapered edge strips, and other insulation shapes where indicated for sloping to drain. Fabricate to slopes indicated.

2.9 INSULATION ACCESSORIES

A. General: Roof insulation accessories recommended by insulation manufacturer for intended use and compatible with membrane roofing.

B. Insulation Adhesive: Tremco, Fas-n-Free Adhesive: Solvent-free, cold fluid-applied, bituminous-urethane adhesive formulated to adhere roof insulation to substrate, with the following physical properties:
1. Asbestos Content, EPA 600/R13/116: None.
2. Volatile Organic Compounds (VOC), maximum, ASTM D 3960: 20 g/L.
3. Non-Volatile Content, minimum, ASTM D 1644: 98 percent.
4. Density at 77 deg F, minimum: ASTM D 1875: 8.5 lb/gal.
5. Elongation at 77 deg. F, minimum, ASTM D 412: 1200 percent.
6. T-Peel Strength at 77 deg. F, minimum: ASTM D 1876: 15 lbf.
7. Adhesion Strength in Shear at 77 deg. F, minimum, ASTM D 816: 80 psi.
8. Low-Temperature Flexibility, maximum, ASTM D 816: -60 deg. F.

C. Insulation Cant Strips: ASTM C 208, Type II, Grade 1, cellulosic-fiber insulation board.

D. Tapered Edge Strips: ASTM C 208, Type II, Grade 1, cellulosic-fiber insulation board.

E. Cover Board: GP Gypsum Dens-Deck: ASTM C 1177/C 1177M, glass-mat, water-resistant gypsum substrate, 1/2 inch.

F. Substrate Joint Tape: 6- or 8-inch-wide, coated, glass-fiber joint tape.

3.0 COATING MATERIALS

A. White Flashing/Stripping Coating: Tremco, Polarcote FR: Intumescent, fire-retardant, Energy Star Certified, CRRC Certified, elastomeric, acrylic latex roof coating formulated for use on bituminous roof surfaces, with the following physical properties:
1. Asbestos Content, EPA/600/R-93/116: None.
2. Non-Volatile Content (by weight), minimum, ASTM D 1644: 67 percent.
3. Reflectance, minimum, ASTM E 903: 82 percent.
4. Volatile Organic Compounds (VOC), maximum, ASTM D 3960: 155 g/L.

PART 3 - EXECUTION

3.1 ROOFING INSTALLATION, GENERAL

A. Install roofing system in accordance with manufacturer's recommendations.

B. Start installation of roofing membrane in presence of roofing system manufacturer's technical personnel. Technical inspector shall be on site for each phase of roofing work.

C. Install roofing system according to roofing system manufacturer's written instructions and applicable recommendations in ARMA/NRCA's "Quality Control Guidelines for the Application of Polymer Modified Bitumen Roofing" and as follows:

1. Membrane: Modified Bituminous (SBS)
2. Deck Type: Concrete
3. Adhering Method: Cold Applied
4. Number of Composite Ply Sheets: Two (2)
5. Number of SBS Modified Bituminous Sheets: One (1)
6. Surfacing Type: - Factory Coated Modified Bituminous, White

D. Install roofing membrane, base flashings, and component materials in compliance with requirements in FMG 4450 and FMG 4470 as part of a membrane roofing system as listed in FMG's "Approval Guide" for fire/windstorm classification indicated. Comply with recommendations in FMG Loss Prevention Data Sheet 1-49, including requirements for wood nailers and cants.

E. Cooperate with testing and inspecting agencies engaged or required to perform services for installing roofing system.

F. Coordinate installing roofing system so insulation and other components of the roofing membrane system not permanently exposed are not subjected to precipitation or left uncovered at the end of the workday or when rain is forecast.

1. Provide tie-offs at end of each day's work to cover exposed roofing membrane sheets and insulation with a course of coated felt set in roofing cement or hot roofing asphalt with joints and edges sealed.
2. Complete terminations and base flashings and provide temporary seals to prevent water from entering completed sections of roofing system.
3. Remove and discard temporary seals before beginning work on adjoining roofing.

3.2 CONCRETE DECK PREPARATION

A. Substrate-Joint Penetrations: Prevent roofing asphalt from penetrating substrate joints, entering building, or damaging roofing system components or adjacent building construction.

B. Prime prepared concrete deck with asphalt primer as recommended by the manufacturer.

C. Seal all penetrations of the concrete deck with a solid application Polyroof SF and Burmesh prior to roof insulation installation.

3.3 INSULATION INSTALLATION

A. Comply with roofing system manufacturer's written instructions for installing roof insulation.

B. Insulation Cant Strips: Install and secure preformed 45-degree insulation cant strips at junctures of built-up roofing membrane system with vertical surfaces or angle changes greater than 45 degrees.

C. Install tapered insulation under area of roofing to conform to slopes indicated.

D. Install insulation with long joints of insulation in a continuous straight line with end joints staggered between rows, abutting edges and ends between boards. Fill gaps exceeding 1/4 inch with insulation.
   1. Cut and fit insulation within 1/4 inch of nailers, projections, and penetrations.

E. Install insulation at minimum thickness of 1-1/2 inches.

F. Install one or more layers of insulation under area of roofing to achieve required thickness. Where overall insulation thickness is 1-1/2 inches or greater, install 2 or more layers with joints of each succeeding layer staggered from joints of previous layer a minimum of 6 inches in each direction.

G. Trim surface of insulation where necessary at roof drains so completed surface is flush and does not restrict flow of water.

H. Install tapered edge strips at perimeter edges of roof that do not terminate at vertical surfaces.

I. Adhered Insulation: Install each layer of insulation and adhere to substrate as follows:
   1. Set each layer of insulation in a ribbon applied application of solvent free insulation adhesive.

J. Install cover boards over insulation with long joints in continuous straight lines with end joints staggered between rows. Stagger joints from joints in insulation below a minimum of 6 inches in each direction.
   1. Fasten according to requirements in FMG's "Approval Guide" for specified Windstorm Resistance Classification.
   2. Fasten to resist uplift pressure at corners, perimeter, and field of roof.
   3. Apply solvent free insulation adhesive to the first layer of insulation and immediately bond cover board to substrate.

3.4 SBS-MODIFIED BITUMINOUS ROOFING MEMBRANE INSTALLATION

A. Install two ply sheets starting at low point of roofing system. Align ply sheets without stretching. Shingle side laps of ply sheets uniformly to achieve required number of plies throughout thickness of roofing membrane. Shingle in direction to shed water. Extend ply sheets over and terminate beyond cants.
   1. Adhere to substrate in cold-applied adhesive.

B. Install modified bituminous roofing membrane cap sheet according to roofing manufacturer's written instructions, starting at low point of roofing system. Offset laps from laps of preceding

ply sheets and align cap sheet without stretching. Lap in direction to shed water. Extend cap sheet over and terminate beyond cants.

1. Unroll roofing membrane sheets and allow them to relax for minimum time period required by manufacturer.
2. Adhere membrane in WOW adhesive at a rate of 2 -2.25 gallons per square.
3. Roll membrane into adhesive with a 75lb. weighted roller.

C. Laps: Accurately align roofing membrane sheets, without stretching, and maintain uniform side and end laps. Stagger end laps. Completely bond and seal laps, leaving no voids.
1. Repair tears and voids in laps and lapped seams not completely sealed.

3.5 FLASHING AND STRIPPING INSTALLATION

A. Install base flashing over cant strips and other sloping and vertical surfaces, at roof edges, and at penetrations through roof, and secure to substrates according to roofing system manufacturer's written instructions and as follows:
1. Prime substrates with asphalt primer if required by roofing system manufacturer.
2. Flashing Sheet Application: Adhere flashing sheet to substrate in cold-applied adhesive at rate required by roofing system manufacturer.

B. Extend base flashing up walls or parapets a minimum of 8 inches above roofing membrane and 6 inches onto field of roofing membrane.

C. Mechanically fasten top of base flashing securely at terminations and perimeter of roofing.
1. Seal top termination of base flashing with a termination bar secured every 8" o.c.
2. Flashing-Sheet Stripping: Install flashing-sheet stripping in a continuous coating of asphalt flashing cement, and extend onto roofing membrane.

D. Install roofing membrane cap-sheet stripping where metal flanges and edgings are set on membrane roofing according to roofing system manufacturer's written instructions.

E. Metal Edge Flashing
1. Assemble fascia holder, deck brackets and clamping rings to form deck bracket units.
2. Assemble fascia sections, deck bracket units and joint plate leading end only to form each 10' section. Three deck brackets required on each 6" fascia section, four on each 8" section.
3. Beginning at corners, snap prefab. Corner with joint plates onto first fascia section, providing a ¼" expansion gap between sections. Position assembled fascia and corner unit onto matching roof corner and loosely secure deck brackets with one fastener in center slot.
4. Install remaining fascia sections.
5. Do not install sections less than 24" in length.
6. Work from corners to center.
7. Visually align. Secure deck brackets to wood nailer with two additional spiral fasteners/bracket.
8. Install new wood cant strip over deck brackets and apply roofing membrane to top edge of cant strip.

F. Wall flashing
1. Raise the existing counter flashing.

2. Adhere cant strips with asphaltic mastic.
3. Apply asphalt primer to the wall surface.
4. Run new roofing two inches above the top of the cant.
5. Adhere flashing to the roofing and wall in a solid application of flashing adhesive.
6. The top of the flashing will be secured with termination bar secured every 8" o.c. TF Tape will be applied between the wall and the top edge of the flashing before fastening the flashing. Caulk the top edge of the termination bar using urethane sealant.
7. Seal the roof edge of the flashing with flashing adhesive and reinforcing mesh.

G. Non-Parapet Wall Flashing for Lower Roof Sections.
1. Remove the bottom course of fasteners from the metal panel wall.
2. Remove the sill and counter flashing metal.
3. Run new roofing two inches above the top of the cant.
4. Adhere flashing to the roofing and wall in a solid application of flashing adhesive.
5. Terminate the top edge of the flashing so that it extends up behind the metal wall panel.
6. Install new sill and counter flashing so that the sill allows water to run off.
7. Resecure the bottom course of fasteners for the wall panel.

H. Wood Curbs
1. Add blocking to ensure that the new curb is no less than 8" above the height of the new roof.
2. Install cant strip to the base of the curb with asphaltic mastic.
3. Run the new roofing two inches above the top of the cant.
4. Fasten the flashing to the interior of the wood curb with 1" cap nails, 3" on center.
5. Adhere the flashing to the curb with a solid application of flashing adhesive. Ensure the flashing is solidly adhered without wrinkles or voids.
6. Seal the roof edge of the flashing with flashing adhesive and reinforcing mesh.
7. Install equipment and fasten onto curb with lag bolts.

I. Metal curbs, pitch pans, and lead sleeves and equipment stand flashings:
1. Run new roofing plies to the base of the projection.
2. Set the flange of the flashing or the lead pan into an application of asphalt mastic. Nail the flange 3" O.C. into the wood blocking.
3. Strip the flange with two ply application of ply sheet stripping set in membrane adhesive. First ply is composite ply to extend beyond the flange a minimum of 4". The second ply sheet should extend beyond the first a minimum of 4". The second ply should be stripped in to the roof membrane with asphaltic mastic and reinforcing mesh.
4. All pitch pockets shall be filled with quick setting grout to within an inch of the rim, with the remainder filled with asphaltic mastic. Ensure the mastic is mounded to promote drainage.
5. A hood or storm collar will be fabricated to cover the all pitch pockets and sleeves as shown in the detail drawing.
6. The hood may be attached to the projection with a draw band or by welding.

J. Roof Drains: Set 30-by-30-inch metal flashing in bed of asphalt roofing cement on completed roofing membrane. Cover metal flashing with roofing membrane cap-sheet stripping and extend a minimum of 6 inches beyond edge of metal flashing onto field of roofing membrane. Clamp roofing membrane, metal flashing, and stripping into roof-drain clamping ring.
1. Install stripping according to roofing system manufacturer's written instructions.

3.6 SURFACING AND COATING INSTALLATION

A. Apply coatings to base flashings according to manufacturer's written instructions, by spray, roller, or other suitable application method.

3.7 FIELD QUALITY CONTROL

A. Manufacturer's Technical Representative: Contractor shall engage a qualified manufacturer's technical representative acceptable to Owner on a full-time basis to perform roof tests and inspections and to prepare test reports.

B. Test Cuts: Before flood coating and surfacing built-up roofing membrane, test specimens will be removed to evaluate problems observed during quality-assurance inspections of roofing membrane as follows:
   1. Approximate quantities of components within roofing membrane will be determined according to ASTM D 3617.
   2. Test specimens will be examined for interply voids according to ASTM D 3617 and to comply with criteria established in Appendix 3 of ARMA/NRCA's "Quality Control Guidelines for the Application of Built-up Roofing."

C. Final Roof Inspection: Arrange for roofing system manufacturer's technical personnel to inspect roofing installation on completion and submit report to Architect.
   1. Notify Architect and Owner 48 hours in advance of date and time of inspection.

D. Repair or remove and replace components of roofing system where test results or inspections indicate that they do not comply with specified requirements.

E. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.8 PROTECTING AND CLEANING

A. Protect roofing system from damage and wear during remainder of construction period. When remaining construction will not affect or endanger roofing, inspect roofing for deterioration and damage, describing its nature and extent in a written report, with copies to Architect and Owner.

B. Correct deficiencies in or remove roofing system that does not comply with requirements, repair substrates, and repair or reinstall roofing system to a condition free of damage and deterioration at time of Substantial Completion and according to warranty requirements.

C. Clean overspray and spillage from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

END OF SECTION 07555

SECTION 07710 - ROOF SPECIALTIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions apply to this Section.

1.2 SUMMARY

A. Section Includes:
1. Roof-edge flashings.
2. Roof-edge drainage systems.
3. Reglets and counterflashings.
4. Expansion joint flashing system.

1.3 PERFORMANCE REQUIREMENTS

A. General Performance: Roof specialties shall withstand exposure to weather and resist thermally induced movement without failure, rattling, leaking, or fastener disengagement due to defective manufacture, fabrication, installation, or other defects in construction, and will not allow water infiltration into building assemblies or the building interior.

B. SPRI Wind Design Standard: Manufacture and install roof-edge flashings tested according to SPRI ES-1.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

B. Shop Drawings: For roof specialties. Include plans, elevations, expansion-joint locations, keyed details, and attachments to other work. Distinguish between plant- and field-assembled work. Include the following:

1. Details for expansion and contraction; locations of expansion joints, including direction of expansion and contraction.
2. Pattern of seams and layout of fasteners, cleats, clips, and other attachments.
3. Details of termination points and assemblies, including fixed points.
4. Details of special conditions.

1.5 INFORMATIONAL SUBMITTALS

A. Warranty: Sample of special warranty.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: For roofing specialties to include in maintenance manuals.

1.7 QUALITY ASSURANCE

A. Pre-installation Conference: Conduct conference at Project site.

1. Meet with Owner, Architect, Owner's insurer if applicable, Installer, and installers whose work interfaces with or affects roof specialties including installers of roofing materials and accessories.
2. Examine substrate conditions for compliance with requirements, including flatness and attachment to structural members.
3. Review special roof details, roof drainage, and condition of other construction that will affect roof specialties.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Do not store roof specialties in contact with other materials that might cause staining, denting, or other surface damage. Store roof specialties away from uncured concrete and masonry.

B. Protect strippable protective covering on roof specialties from exposure to sunlight and high humidity, except to extent necessary for the period of roof specialties installation.

1.9 WARRANTY

A. Refer to warranty requirements of Division 07 Section 07555 Modified Bituminous Roof Systems for terms and conditions of warranties covering work of this Section.

B. Special Warranty on Painted Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace roof specialties that show evidence of deterioration of factory-applied finishes within specified warranty period.

1. Fluoropolymer Finish: Deterioration includes, but is not limited to, the following:

a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.
b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.

2. Finish Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

1. Manufacturers: Existing roofing and metal edge flashings and trim are to remain manufactured by Tremco. In order to retain warranty on existing roofing; provide areas of new roofing and tie-ins to existing roofing by Tremco roofing system components and accessories.

2.2 EXPOSED METALS

A. Aluminum Sheet: ASTM B 209 (ASTM B 209M), alloy as standard with manufacturer for finish required, with temper to suit forming operations and performance required.

1. Surface: Embossed finish.
2. Mill Finish: As manufactured.
3. Exposed Coil-Coated Finishes: Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

    a. Two-Coat Fluoropolymer: AAMA 620. System consisting of primer and fluoropolymer color topcoat containing not less than 70 percent PVDF resin by weight.

B. Aluminum Extrusions: ASTM B 221(ASTM B 221M), alloy and temper recommended by manufacturer for type of use and finish indicated, finished as follows:

1. Exposed High-Performance Organic Finish: Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

    a. Two-Coat Fluoropolymer: [AAMA 2604] [AAMA 2605]. System consisting of primer and fluoropolymer color topcoat containing not less than 70 percent PVDF resin by weight.

C. Zinc-Coated (Galvanized) Steel Sheet: ASTM A 653/A 653M, G90 (Z275) coating designation.

1. Surface: Embossed finish.
2. Exposed Coil-Coated Finishes: Pre-painted by the coil-coating process to comply with ASTM A 755/A 755M. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

    a. Two-Coat Fluoropolymer: AAMA 621. System consisting of primer and fluoropolymer color topcoat containing not less than 70 percent PVDF resin by weight.

D. Expansion joint flashing. See construction drawings for coordination with existing roofing system.

2.3 CONCEALED METALS

A. Aluminum Sheet: ASTM B 209 (ASTM B 209M), alloy and temper recommended by manufacturer for type of use and structural performance indicated, mill finished.

B. Aluminum Extrusions: ASTM B 221 (ASTM B 221M), alloy and temper recommended by manufacturer for type of use and structural performance indicated, mill finished.

C. Stainless-Steel Sheet: ASTM A 240/A 240M or ASTM A 666, Type 304.

D. Zinc-Coated (Galvanized) Steel Sheet: ASTM A 653/A 653M, G90 (Z275) coating designation.

2.4 UNDERLAYMENT MATERIALS

A. Self-Adhering, High-Temperature Sheet: Minimum 30 to 40 mils thick, consisting of slip-resisting polyethylene-film top surface laminated to layer of butyl or SBS-modified asphalt adhesive, with release-paper backing; cold applied. Provide primer when recommended by underlayment manufacturer.

1. Thermal Stability: ASTM D 1970; stable after testing at 240 deg F (116 deg C).
2. Low-Temperature Flexibility: ASTM D 1970; passes after testing at minus 20 deg F (29 deg C).

2.5 MISCELLANEOUS MATERIALS

A. General: Provide materials and types of fasteners, protective coatings, sealants, and other miscellaneous items required by manufacturer for a complete installation.

B. Fasteners: Manufacturer's recommended fasteners, suitable for application and designed to meet performance requirements. Furnish the following unless otherwise indicated:

1. Exposed Penetrating Fasteners: Gasketed screws with hex washer heads matching color of sheet metal.
2. Fasteners for Aluminum: Aluminum or Series 300 stainless steel.
3. Fasteners for Zinc-Coated (Galvanized) Steel Sheet: Series 300 stainless steel or hot-dip zinc-coated steel according to ASTM A 153/A 153M or ASTM F 2329.

C. Elastomeric Sealant: ASTM C 920, elastomeric silicone polymer sealant of type, grade, class, and use classifications required by roofing-specialty manufacturer for each application.

D. Bituminous Coating: Cold-applied asphalt emulsion complying with ASTM D 1187.

E. Asphalt Roofing Cement: ASTM D 4586, asbestos free, of consistency required for application.

F. Roof-Edge Fascia: Manufactured, two-piece, roof-edge fascia consisting of snap-on metal fascia cover in section lengths not exceeding 12 feet (3.6 m) and a formed- or extruded-aluminum anchor bar with integral drip-edge cleat to engage fascia cover. Provide matching corner units.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Tremco, TremLine Fascia

2. Fascia Cover: Fabricated from the following exposed metal:

   a. Extruded Aluminum: 0.110 inch thick by 8 inch high thick.

3. Corners: Factory mitered and continuously welded.
4. Splice Plates: Concealed, of same material, finish, and shape as fascia cover.
5. Fascia Accessories: Fascia extenders with continuous hold-down cleats
6. Spill Outs: Factory mitered and continuously welded.

G. Aluminum Finish:

1. Color: As selected by Architect from manufacturer's full range.

2.6 REGLETS AND COUNTERFLASHINGS

A. Basis-of-Design Product: Subject to compliance with requirements, provide Tremco, TremLock Counterflashing or comparable product.

B. Reglets: Manufactured units formed to provide secure interlocking of separate reglet and counterflashing pieces, from the following exposed metal:

1. Extruded Aluminum: 0.100 inch thick.
2. Corners: Factory prefabricated.
3. Masonry Type, Embedded: Provide reglets with offset top flange for embedment in cut masonry mortar joint.

C. Counterflashings: Manufactured units of heights to overlap top edges of base flashings by 4 inches and in lengths not exceeding 12 feet (3.6 m) designed to snap into reglets and compress against base flashings with joints lapped, from the following exposed metal:

1. Extruded Aluminum: 0.032 inch (0.81 mm) thick.

D. Accessories:

1. Counterflashing Wind-Restraint Clips: Provide clips to be installed before counterflashing to prevent wind uplift of counterflashing lower edge.

E. Aluminum Finish:

1. Color: As selected by Architect from manufacturer's full range.

2.7 GENERAL FINISH REQUIREMENTS

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, to verify actual locations, dimensions, and other conditions affecting performance of the Work.

B. Examine walls, roof edges, and parapets for suitable conditions for roof specialties.

C. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 UNDERLAYMENT INSTALLATION

A. Self-Adhering Sheet Underlayment: Install wrinkle free. Apply primer if required by underlayment manufacturer. Comply with temperature restrictions of underlayment manufacturer for installation; use primer rather than nails for installing underlayment at low temperatures. Apply in shingle fashion to shed water. Overlap edges not less than 3-1/2 inches. Roll laps with roller. Cover underlayment within 14 days.

3.3 INSTALLATION, GENERAL

A. General: Install roof specialties according to manufacturer's written instructions. Anchor roof specialties securely in place, with provisions for thermal and structural movement. Use fasteners, solder, protective coatings, separators, sealants, and other miscellaneous items as required to complete roof-specialty systems.

1. Install roof specialties level, plumb, true to line and elevation; with limited oil-canning and without warping, jogs in alignment, buckling, or tool marks.
2. Provide uniform, neat seams with minimum exposure of solder and sealant.
3. Install roof specialties to fit substrates and to result in watertight performance. Verify shapes and dimensions of surfaces to be covered before manufacture.
4. Torch cutting of roof specialties is not permitted.
5. Do not use graphite pencils to mark metal surfaces.

B. Metal Protection: Protect metals against galvanic action by separating dissimilar metals from contact with each other or with corrosive substrates by painting contact surfaces with bituminous coating or by other permanent separation as recommended by manufacturer.

1. Coat concealed side of uncoated aluminum roof specialties with bituminous coating where in contact with wood, ferrous metal, or cementitious construction.
2. Underlayment: Where installing metal flashing directly on cementitious or wood substrates, install a course of self-adhering, high-temperature sheet underlayment.
3. Bed flanges in thick coat of asphalt roofing cement where required by manufacturers of roof specialties for waterproof performance.

C. Expansion Provisions: Allow for thermal expansion of exposed roof specialties.

1. Space movement joints at a maximum of 12 feet (3.6 m) with no joints within 18 inches (450 mm) of corners or intersections unless otherwise shown on Drawings.
2. When ambient temperature at time of installation is between 40 and 70 deg F (4 and 21 deg C), set joint members for 50 percent movement each way. Adjust setting proportionately for installation at higher ambient temperatures.

D. Fastener Sizes: Use fasteners of sizes that will penetrate substrate not less than recommended by fastener manufacturer to achieve maximum pull-out resistance.

E. Seal joints with elastomeric sealant as required by roofing-specialty manufacturer.

F. Seal joints as required for watertight construction. Place sealant to be completely concealed in joint. Do not install sealants at temperatures below 40 deg F.

3.4 ROOF-EDGE FLASHING INSTALLATION

A. Install cleats, cants, and other anchoring and attachment accessories and devices with concealed fasteners.

B. Anchor roof edgings with manufacturer's required devices, fasteners, and fastener spacing to meet performance requirements.

3.5 REGLET AND COUNTERFLASHING INSTALLATION

A. General: Coordinate installation of reglets and counterflashings with installation of base flashings.

B. Embedded Reglets: See Division 04 Section "Unit Masonry" for installation of reglets.

C. Counterflashings: Insert counterflashings into reglets or other indicated receivers; ensure that counterflashings overlap 4 inches (100 mm) over top edge of base flashings. Lap counterflashing joints a minimum of 4 inches (100 mm) and bed with elastomeric sealant. Fit counterflashings tightly to base flashings.

3.6 CLEANING AND PROTECTION

A. Clean and neutralize flux materials. Clean off excess solder and sealants.

B. Remove temporary protective coverings and strippable films as roof specialties are installed. On completion of installation, clean finished surfaces including removing unused fasteners, metal filings, pop rivet stems, and pieces of flashing. Maintain roof specialties in a clean condition during construction.

C. Replace roof specialties that have been damaged or that cannot be successfully repaired by finish touchup or similar minor repair procedures.

END OF SECTION 07710

SECTION 07720 - ROOF ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Roof curbs.
2. Equipment supports.
3. Roof hatches.
4. Roof Edge Free-Standing Counterweighted Guard Rail System
5. Roof walk pads.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of roof accessory indicated.

B. Shop Drawings: For roof accessories.

C. Samples: For each exposed product and for each color and texture specified.

1.3 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Roof plans, drawn to scale, and coordinating penetrations and roof-mounted items. Indicate profiles, sizes, connections, size and type of fasteners and accessories.

B. Warranty: Sample of special warranty.

1.4 FIELD MEASUREMENTS

A. Verify Field Measurements prior to assembly and/or ordering.

1.5 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

1.6 WARRANTY

A. Special Warranty on Painted Finishes: Manufacturer's standard form in which manufacturer agrees to repair finishes or replace roof accessories that show evidence of deterioration of factory-applied finishes within 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 METAL MATERIALS

A. Zinc-Coated (Galvanized) Steel Sheet: ASTM A 653/A 653M, G90 coating designation.

1. Baked-Enamel or Powder-Coat Finish: Manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat, with a minimum dry film thickness of 1 mil for topcoat.

B. Aluminum-Zinc Alloy-Coated Steel Sheet: ASTM A 792/A 792M, AZ50 coated.

1. Baked-Enamel or Powder-Coat Finish: Manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat, with a minimum dry film thickness of 1 mil for topcoat.

C. Aluminum Sheet: ASTM B 209, manufacturer's standard alloy for finish required, with temper to suit forming operations and performance required.

1. Factory Prime Coating: Where field painting is indicated, apply pretreatment and white or light-colored, factory-applied, baked-on epoxy primer coat, with a minimum dry film thickness of 0.2 mil.
2. Baked-Enamel or Powder-Coat Finish: AAMA 2603 except with a minimum dry film thickness of 1.5 mils.

D. Aluminum Extrusions and Tubes: ASTM B 221, manufacturer's standard alloy and temper for type of use, finished to match assembly where used, otherwise mill finished.

E. Stainless-Steel Sheet and Shapes: ASTM A 240/A 240M or ASTM A 666, Type 304.

F. Steel Shapes: ASTM A 36/A 36M, hot-dip galvanized according to ASTM A 123/A 123M unless otherwise indicated.

2.2 MISCELLANEOUS MATERIALS

A. General: Provide materials and types of fasteners, protective coatings, sealants, and other miscellaneous items required by manufacturer for a complete installation.

B. Wood Nailers: Softwood lumber, pressure treated with waterborne preservatives for aboveground use, acceptable to authorities having jurisdiction, containing no arsenic or chromium, and complying with AWPA C2; not less than 1-1/2 inches thick.

C. Fasteners: Roof accessory manufacturer's recommended fasteners suitable for application and metals being fastened. Match finish of exposed fasteners with finish of material being fastened. Provide non-removable fastener heads to exterior exposed fasteners.

D. Sealants: As recommended by roof accessory manufacturer for installation indicated.

E. Roof walk pads to match existing. See Roof Plan for new extent and location for path of travel.

2.3 ROOF CURBS

A. Roof Curbs: Internally reinforced roof-curb units with integral spring-type vibration isolators and capable of supporting superimposed live and dead loads, including equipment loads and other construction indicated on Drawings; with welded or mechanically fastened and sealed corner joints, and integrally formed deck-mounting flange at perimeter bottom.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. AES Industries, Inc.
b. Custom Solution Roof and Metal Products.
c. Greenheck Fan Corporation.
d. LM Curbs.
e. Metallic Products Corp.
f. Pate Company (The).
g. Roof Products, Inc.
h. Thybar Corporation.
i. Vent Products Co., Inc.

B. Material: Zinc-coated (galvanized) steel sheet, 0.052 inch thick.

1. Finish: Baked enamel or powder coat.
2. Color: As selected by Architect from manufacturer's full range.

C. Construction:

1. Insulation: Factory insulated with 1-1/2-inch thick cellulosic-fiber board insulation.
2. Liner: Same material as curb, of manufacturer's standard thickness and finish.
3. Factory-installed wood nailer at top of curb, continuous around curb perimeter.
4. Fabricate curbs to minimum height of 12 inches unless otherwise indicated.
5. Top Surface: Level around perimeter with roof slope accommodated by sloping the deck-mounting flange.
6. Security Grille: Provide where indicated.

2.4 EQUIPMENT SUPPORTS

A. Equipment Supports: Internally reinforced metal equipment supports capable of supporting superimposed live and dead loads, including equipment loads and other construction indicated on Drawings; with welded or mechanically fastened and sealed corner joints, and integrally formed deck-mounting flange at perimeter bottom.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. AES Industries, Inc.
b. Custom Solution Roof and Metal Products.
c. Greenheck Fan Corporation.

d. LM Curbs.
e. Milcor Inc.; Commercial Products Group of Hart & Cooley, Inc.
f. Pate Company (The).
g. Roof Products, Inc.
h. Thybar Corporation.
i. Vent Products Co., Inc.

B. Material: Zinc-coated (galvanized) steel sheet, 0.079 inch thick.

1. Finish: Baked enamel or powder coat.
2. Color: As selected by Architect from manufacturer's full range.

C. Construction:

1. Insulation: Factory insulated with 1-1/2-inch-thick cellulosic-fiber board insulation.
2. Liner: Same material as equipment support, of manufacturer's standard thickness and finish.
3. Factory-installed continuous wood nailers 5-1/2 inches wide at tops of equipment supports.
4. Metal Counterflashing: Manufacturer's standard, removable, fabricated of same metal and finish as equipment support.
5. Fabricate equipment supports to minimum height of 12 inches unless otherwise indicated.

2.5 Roof Edge Guard Rail System

A. Provide and install freestanding Roof Edge Fall Protection System, including pipe railings, uprights, bases, counterweights, fittings and delivery to site. Freestanding counterweighted guardrail system with 42" nominal height to provide a pedestrian egress barrier on the roof which withstands a minimum load of 200 lbs. in any direction applied to the top rail as per OSHA regulation noted below.

B. Reference OSHA: 29 CFR 1910.23 (e) (1)-(e) (3) (iv); 29 CDR 1910.502 (b) (1)-(b) (14), all applicable state, local and regional codes.

C. Finish: Pipe for handrails, mid-rails, uprights and counterweight connection is to be galvanized mil finish to the requirements of ASTM A153. Fittings shall be galvanized to meet ASTM A153.

D. Design Requirements:
1. Railings shall consist of top rails, mid rails, uprights, counterweights and connections.
2. All pipe connections to be roof edge guard system manufacturer's structural pipe fittings.
3. Railing assembly shall be capable of withstanding a load of at least 200 pounds applied in any direction at any point on the top rail. Test in accordance with OSHA Regulation 29 CFR 1910.23 (e) (1); (e) (3) (1v).
4. 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. Kee Safety, Inc

E. Components:

1. Pipe: ASTM A53 1-1-1/2 inch schedule 40, galvanized
2. Rails and Posts: 1-1/2" diameter steel pipe, galvanized.
3. Clamp fittings: Elboes, crossovers, wall flanges, Tees, Couplings, galvanized. Mounting bases: Steel bases are galvanized and are supplied with a rubber pad on underside of the component.

F. Assembly:
1. Fit and shop-assembled components in largest practical sizes for delivery to site.
2. Upright tops shall be plugged with weather and light resistant material.
3. Assemble components with joints tightly fitted and secured with set screws tightened to 29 pounds of torque.
4. Accurately form components to suit installation.

2.6 INSTALLATION

A. General: Verify dimensions of roof openings for roof accessories. Install roof accessories according to manufacturer's written instructions.

1. Install roof accessories level, plumb, true to line and elevation, and without warping, jogs in alignment, excessive oil canning, buckling, or tool marks.
2. Anchor roof accessories securely in place so they are capable of resisting indicated loads.
3. Use fasteners, separators, sealants, and other miscellaneous items as required to complete installation of roof accessories and fit them to substrates.
4. Install roof accessories to resist exposure to weather without failing, rattling, leaking, or loosening of fasteners and seals.
5. For installation of Roof Edge Free-Standing Guard Rail system, all connections with manufacturer's fittings, each set screw is to be tightened to 29 pounds of torque. Placement of uprights and counterweights to meet manufacturer specifications as stated in their installation instructions. Terminate the run as stated in the manufacturer's instructions.

B. Metal Protection: Protect metals against galvanic action by separating dissimilar metals from contact with each other or with corrosive substrates by painting contact surfaces with bituminous coating or by other permanent separation as recommended by manufacturer.

1. Coat concealed side of uncoated aluminum and stainless-steel roof accessories with bituminous coating where in contact with wood, ferrous metal, or cementitious construction.
2. Underlayment: Where installing roof accessories directly on cementitious or wood substrates, install a course of felt underlayment and cover with a slip sheet, or install a course of polyethylene sheet.

C. Seal joints with sealant as required by roof accessory manufacturer.

2.7 REPAIR AND CLEANING

A. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing according to ASTM A 780.

B. Touch up factory-primed surfaces with compatible primer ready for field painting according to Section 099113 "Exterior Painting" and Section 099123 "Interior Painting."

C. Replace roof accessories that have been damaged or that cannot be successfully repaired by finish touchup or similar minor repair procedures.

END OF SECTION 07720

SECTION 07841 - PENETRATION FIRESTOPPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Penetrations in fire-resistance-rated walls.
2. Penetrations in horizontal assemblies.
3. Penetrations in smoke barriers.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. LEED Submittals:

1. Product Data for Credit IEQ 4.1: For penetration firestopping sealants and sealant primers, documentation including printed statement of VOC content.
2. Laboratory Test Reports for Credit IEQ 4: For penetration firestopping selants and sealant primers, documentation indicating that products comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

C. Product Schedule: For each penetration firestopping system. Include location and design designation of qualified testing and inspecting agency.

1. Where Project conditions require modification to a qualified testing and inspecting agency's illustration for a particular penetration firestopping condition, submit illustration, with modifications marked, approved by penetration firestopping manufacturer's fire-protection engineer as an engineering judgment or equivalent fire-resistance-rated assembly.

2. See construction drawings for firestopping details at piping.

1.3 INFORMATIONAL SUBMITTALS

A. Installer Certificates: From Installer indicating penetration firestopping has been installed in compliance with requirements and manufacturer's written recommendations.

B. Product test reports.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: A firm that has been approved by FM Global according to FM Global 4991, "Approval of Firestop Contractors," or been evaluated by UL and found to comply with its "Qualified Firestop Contractor Program Requirements."

B. Fire-Test-Response Characteristics: Penetration firestopping shall comply with the following requirements:

1. Penetration firestopping tests are performed by UL.
2. Penetration firestopping is identical to those tested per testing standard referenced in "Penetration Firestopping" Article. Provide rated systems bearing marking of qualified testing and inspection agency.

C. Preinstallation Conference: Conduct conference at Project site.

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. Grace Construction Products.
2. Specified Technologies Inc.
3. Tremco, Inc.; Tremco Fire Protection Systems Group.

2.2 PENETRATION FIRESTOPPING

A. Provide penetration firestopping that is produced and installed to resist spread of fire according to requirements indicated, resist passage of smoke and other gases, and maintain original fire-resistance rating of construction penetrated. Penetration firestopping systems shall be compatible with one another, with the substrates forming openings, and with penetrating items if any.

B. Penetrations in Fire-Resistance-Rated Walls: Ratings determined per ASTM E 814 or UL 1479, based on testing at a positive pressure differential of 0.01-inch wg (2.49 Pa).

1. F-Rating: Not less than the fire-resistance rating of constructions penetrated.

C. Penetrations in Horizontal Assemblies: Ratings determined per ASTM E 814 or UL 1479, based on testing at a positive pressure differential of 0.01-inch wg (2.49 Pa).

1. T-Rating: At least 1 hour, but not less than the fire-resistance rating of constructions penetrated except for floor penetrations within the cavity of a wall.

D. Penetrations in Smoke Barriers: Provide penetration firestopping with ratings determined per UL 1479.

1. L-Rating: Not exceeding 5.0 cfm/sq. ft. (0.025 cu. m/s per sq. m) of penetration opening at 0.30-inch wg (74.7 Pa) at both ambient and elevated temperatures.

E. Exposed Penetration Firestopping: Provide products with flame-spread and smoke-developed indexes of less than 25 and 450, respectively, as determined per ASTM E 84.

F. VOC Content: Penetration firestopping sealants and sealant primers shall comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):

1. Sealants: 250 g/L.
2. Sealant Primers for Nonporous Substrates: 250 g/L.
3. Sealant Primers for Porous Substrates: 775 g/L.

G. Low-Emitting Materials: Penetration firestopping sealants and sealant primers 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."

H. Accessories: Provide components for each penetration firestopping system that are needed to install fill materials and to maintain ratings required. Use only those components specified by penetration firestopping manufacturer and approved by qualified testing and inspecting agency for firestopping indicated.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for opening configurations, penetrating items, substrates, and other conditions affecting performance of the Work.

B. Install penetration firestopping to comply with manufacturer's written installation instructions and published drawings for products and applications indicated.

C. Install forming materials and other accessories of types required to support fill materials during their application and in the position needed to produce cross-sectional shapes and depths required to achieve fire ratings indicated.

1. After installing fill materials and allowing them to fully cure, remove combustible forming materials and other accessories not indicated as permanent components of firestopping.

D. Install fill materials for firestopping by proven techniques to produce the following results:

1. Fill voids and cavities formed by openings, forming materials, accessories, and penetrating items as required to achieve fire-resistance ratings indicated.
2. Apply materials so they contact and adhere to substrates formed by openings and penetrating items.
3. For fill materials that will remain exposed after completing the Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

3.2 IDENTIFICATION

A. Identify penetration firestopping with preprinted metal or plastic labels. Attach labels permanently to surfaces adjacent to and within 6 inches (150 mm) of firestopping edge so labels

will be visible to anyone seeking to remove penetrating items or firestopping. Use mechanical fasteners to permanently fasten metal labels. Include the following information on labels:

1. The words "Warning - Penetration Firestopping - Do Not Disturb. Notify Building Management of Any Damage."
2. Contractor's name, address, and phone number.
3. Designation of applicable testing and inspecting agency.
4. Date of installation.
5. Manufacturer's name.
6. Installer's name.

3.3 FIELD QUALITY CONTROL

A. Owner will engage a qualified testing agency to perform tests and inspections.

B. Where deficiencies are found or penetration firestopping is damaged or removed because of testing, repair or replace penetration firestopping to comply with requirements.

C. Proceed with enclosing penetration firestopping with other construction only after inspection reports are issued and installations comply with requirements.

END OF SECTION 07841

SECTION 07920 - JOINT SEALANTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Silicone joint sealants.
2. Urethane joint sealants.
3. Latex joint sealants.
4. Preformed joint sealants.

1.2 ACTION SUBMITTALS

A. Product Data: For each joint-sealant product indicated.

B. Samples: For each kind and color of joint sealant required.

C. Joint-Sealant Schedule: Include the following information:

1. Joint-sealant application, joint location, and designation.
2. Joint-sealant manufacturer and product name.
3. Joint-sealant formulation.
4. Joint-sealant color.

1.3 INFORMATIONAL SUBMITTALS

A. Product test reports.

B. Preconstruction compatibility and adhesion test reports.

C. Preconstruction field-adhesion test reports.

D. Field-adhesion test reports.

E. Warranties.

1.4 QUALITY ASSURANCE

A. Testing Agency Qualifications: Qualified according to ASTM C 1021 to conduct the testing indicated.

1.5 WARRANTY

A. Special Installer's Warranty: Manufacturer's standard form in which Installer agrees to repair or replace joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.

1. Warranty Period: Two years from date of Substantial Completion.

B. Special Manufacturer's Warranty: Manufacturer's standard form in which joint-sealant manufacturer agrees to furnish joint sealants to repair or replace those that do not comply with performance and other requirements specified in this Section within specified warranty period.

1. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

A. VOC Content of Interior Sealants: Sealants and sealant primers used inside the weatherproofing system shall comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):

1. Architectural Sealants: 250 g/L.
2. Sealant Primers for Nonporous Substrates: 250 g/L.
3. Sealant Primers for Porous Substrates: 775 g/L.

B. Low-Emitting Interior Sealants: Sealants and sealant primers used inside the weatherproofing system shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

C. Liquid-Applied Joint Sealants: Comply with ASTM C 920 and other requirements indicated for each liquid-applied joint sealant specified, including those referencing ASTM C 920 classifications for type, grade, class, and uses related to exposure and joint substrates.

1. Suitability for Immersion in Liquids. Where sealants are indicated for Use I for joints that will be continuously immersed in liquids, provide products that have undergone testing according to ASTM C 1247. Liquid used for testing sealants is deionized water, unless otherwise indicated.

D. Stain-Test-Response Characteristics: Where sealants are specified to be nonstaining to porous substrates, provide products that have undergone testing according to ASTM C 1248 and have not stained porous joint substrates indicated for Project.

E. Suitability for Contact with Food: Where sealants are indicated for joints that will come in repeated contact with food, provide products that comply with 21 CFR 177.2600.

2.2 SILICONE JOINT SEALANTS

A. Mildew-Resistant Neutral-Curing Silicone Joint Sealant: ASTM C 920.

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. BASF Building Systems.
   b. Dow Corning Corporation.
   c. GE Advanced Materials - Silicones.
   d. Pecora Corporation.
   e. Sika Corporation; Construction Products Division.
   f. Tremco Incorporated.

2. Type: Single component (S).
3. Grade: nonsag (NS).
4. Class: 50.
5. Uses Related to Exposure: Nontraffic (NT).

2.3 URETHANE JOINT SEALANTS

A. Urethane Joint Sealant: ASTM C 920.

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. BASF Building Systems.
   b. Bostik, Inc.
   c. Lymtal, International, Inc.
   d. May National Associates, Inc.
   e. Pacific Polymers International, Inc.
   f. Pecora Corporation.
   g. Polymeric Systems, Inc.
   h. Schnee-Morehead, Inc.
   i. Sika Corporation; Construction Products Division.
   j. Tremco Incorporated.

2. Type: Single component (S).
3. Grade: nonsag (NS).
4. Class: 50.
5. Uses Related to Exposure: Nontraffic (NT).

2.4 LATEX JOINT SEALANTS

A. Latex Joint Sealant: Acrylic latex or siliconized acrylic latex, ASTM C 834, Type OP, Grade NF.

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. BASF Building Systems.
   b. Bostik, Inc.
   c. May National Associates, Inc.
   d. Pecora Corporation.
   e. Schnee-Morehead, Inc.
   f. Tremco Incorporated.

2.5 JOINT SEALANT BACKING

A. Cylindrical Sealant Backings: ASTM C 1330, Type C (closed-cell material with a surface skin, and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance.

B. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer.

2.6 MISCELLANEOUS MATERIALS

A. Primer: Material recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.

B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials.

C. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

PART 3 - EXECUTION

3.1 PREPARATION

A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions.

   1. Remove laitance and form-release agents from concrete.
   2. Clean nonporous joint substrate surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants.

B. Joint Priming: Prime joint substrates where recommended by joint-sealant manufacturer or as indicated by preconstruction joint-sealant-substrate tests or prior experience. Apply primer to

comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.

C. Masking Tape: Use masking tape where required to prevent contact of sealant or primer with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

3.2 INSTALLATION

A. Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.

B. Install sealant backings of kind indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.

1. Do not leave gaps between ends of sealant backings.
2. Do not stretch, twist, puncture, or tear sealant backings.
3. Remove absorbent sealant backings that have become wet before sealant application and replace them with dry materials.

C. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.

D. Install sealants using proven techniques that comply with the following and at the same time backings are installed:

1. Place sealants so they directly contact and fully wet joint substrates.
2. Completely fill recesses in each joint configuration.
3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.

E. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified in subparagraphs below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.

1. Remove excess sealant from surfaces adjacent to joints.
2. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.
3. Provide concave joint profile per Figure 8A in ASTM C 1193, unless otherwise indicated.

F. Clean off excess sealant or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved in writing by manufacturers of joint sealants and of products in which joints occur.

3.3 JOINT-SEALANT SCHEDULE

A. Joint-Sealant Application: Exterior joints in vertical surfaces and horizontal nontraffic surfaces.

1. Joint Locations:

   a. Construction joints in cast-in-place concrete.
   b. Joints between metal panels.
   c. Joints between different materials listed above.
   d. Perimeter joints between materials listed above and frames of doors and windows.
   e. Other joints as indicated.

2. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

B. Joint-Sealant Application: Interior joints in horizontal traffic surfaces.

1. Joint Locations:
   a. Control and expansion joints in stone flooring.
   b. Control and expansion joints in tile flooring.
   c. Other joints as indicated.

2. Joint Sealant: Silicone.
3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

C. Joint-Sealant Application: Interior joints in vertical surfaces and horizontal nontraffic surfaces.

1. Joint Locations:

   a. Control and expansion joints on exposed interior surfaces of exterior walls.
   b. Perimeter joints of exterior openings where indicated.
   c. Tile control and expansion joints.
   d. Vertical joints on exposed surfaces of interior unit masonry, concrete, walls, and partitions.
   e. Perimeter joints between interior wall surfaces and frames of [interior doors] [windows] [and] [elevator entrances].
   f. Other joints as indicated.

2. Joint Sealant: Latex.
3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

D. Joint-Sealant Application: Mildew-resistant interior joints in vertical surfaces and horizontal nontraffic surfaces.

1. Joint Sealant Location:

   a. Joints between plumbing fixtures and adjoining walls, floors, and counters.
   b. Tile control and expansion joints where indicated.
   c. Other joints as indicated.

2. Joint Sealant: Silicone.
3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

END OF SECTION 07920

SECTION 08111 - HOLLOW METAL DOORS AND FRAMES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Standard and custom hollow metal doors and frames.
2. Steel sidelight, borrowed lite and transom frames.
3. Louvers installed in hollow metal doors.
4. Light frames and glazing installed in hollow metal doors.

B. Related Sections:

1. Division 04 Section "Unit Masonry" for embedding anchors for hollow metal work into masonry construction.
2. Division 08 Section "Flush Wood Doors".
3. Division 08 Section "Glazing" for glass view panels in hollow metal doors.
4. Division 08 Section "Door Hardware".
5. Division 09 Section "Interior Painting" for field painting hollow metal doors and frames.

C. Codes and References: Comply with the version year adopted by the Authority Having Jurisdiction.

1. ANSI/SDI A250.8 - Recommended Specifications for Standard Steel Doors and Frames.
2. ANSI/SDI A250.4 - Test Procedure and Acceptance Criteria for Physical Endurance for Steel Doors, Frames, Frames Anchors and Hardware Reinforcing.
3. ANSI/SDI A250.6 - Recommended Practice for Hardware Reinforcing on Standard Steel Doors and Frames.
4. ANSI/SDI A250.10 - Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames.
5. ANSI/SDI A250.11 - Recommended Erection Instructions for Steel Frames.
6. ASTM A1008 - Standard Specification for Steel Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability.
7. ASTM A653 - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
8. ASTM A924 - Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process.
9. ASTM C 1363 - Standard Test Method for Thermal Performance of Building Assemblies by Means of a Hot Box Apparatus.
10. ANSI/BHMA A156.15 - Hardware Preparation in Steel Doors and Frames.

11. ANSI/SDI 122 - Installation and Troubleshooting Guide for Standard Steel Doors and Frames.
12. ANSI/NFPA 80 - Standard for Fire Doors and Fire Windows; National Fire Protection Association.
13. ANSI/NFPA 105: Standard for the Installation of Smoke Door Assemblies.
14. NFPA 252 - Standard Methods of Fire Tests of Door Assemblies; National Fire Protection Association.
15. UL 10C - Positive Pressure Fire Tests of Door Assemblies.
16. UL 1784 - Standard for Air Leakage Tests of Door Assemblies.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material descriptions, core descriptions, hardware reinforcements, profiles, anchors, fire-resistance rating, and finishes.

B. Door hardware supplier is to furnish templates, template reference number and/or physical hardware to the steel door and frame supplier in order to prepare the doors and frames to receive the finish hardware items.

C. Shop Drawings: Include the following:

1. Elevations of each door design.
2. Details of doors, including vertical and horizontal edge details and metal thicknesses.
3. Frame details for each frame type, including dimensioned profiles and metal thicknesses.
4. Locations of reinforcement and preparations for hardware.
5. Details of anchorages, joints, field splices, and connections.
6. Details of accessories.
7. Details of moldings, removable stops, and glazing.
8. Details of conduit and preparations for power, signal, and control systems.

D. Samples for Verification:

1. Samples are only required by request of the architect and for manufacturers that are not current members of the Steel Door Institute.

1.4 QUALITY ASSURANCE

A. Source Limitations: Obtain hollow metal doors and frames through one source from a single manufacturer wherever possible.

B. Quality Standard: In addition to requirements specified, comply with ANSI/SDI A250.8, latest edition, "Recommended Specifications for Standard Steel Doors and Frames".

C. Fire-Rated Door Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing at positive pressure according to NFPA 252 (neutral pressure at 40" above sill) or UL 10C.
1. Smoke Control Door Assemblies: Comply with NFPA 105.

a. Smoke "S" Label: Doors to bear "S" label, and include smoke and draft control gasketing applied to frame and on meeting stiles of pair doors.

D. Fire-Rated, Borrowed-Light Frame Assemblies: Assemblies complying with NFPA 80 that are listed and labeled, by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated, based on testing according to NFPA 257. Provide labeled glazing material.

E. Pre-Submittal Conference: Conduct conference in compliance with requirements in Division 01 Section "Project Meetings" with attendance by representatives of Supplier, Installer, and Contractor to review proper methods and procedures for installing hollow metal doors and frames and to verify installation of electrical knockout boxes and conduit at frames with electrified or access control hardware.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver hollow metal work palletized, wrapped, or crated to provide protection during transit and Project site storage. Do not use non-vented plastic.

B. Deliver welded frames with two removable spreader bars across bottom of frames, tack welded to jambs and mullions.

C. Store hollow metal work under cover at Project site. Place in stacks of five units maximum in a vertical position with heads up, spaced by blocking, on minimum 4-inch high wood blocking. Do not store in a manner that traps excess humidity.

1. Provide minimum 1/4-inch space between each stacked door to permit air circulation. Door and frames to be stacked in a vertical upright position.

1.6 PROJECT CONDITIONS

A. Field Measurements: Verify actual dimensions of openings by field measurements before fabrication.

1.7 COORDINATION

A. Coordinate installation of anchorages for hollow metal frames. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors. Deliver such items to Project site in time for installation.

1.8 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace doors that fail in materials or workmanship within specified warranty period.

B. Warranty includes installation and finishing that may be required due to repair or replacement of defective doors.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. CECO Door Products.
2. Curries Company.
3. Steelcraft.

2.2 MATERIALS

A. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B; suitable for exposed applications.

B. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B; with minimum G60 (Z180) or A60 (ZF180) metallic coating.

C. Frame Anchors: ASTM A 653/A 653M, Commercial Steel (CS), Commercial Steel (CS), Type B; with minimum G60 (Z180) or A60 (ZF180) metallic coating.

2.3 ENERGY-EFFICIENT HOLLOW METAL DOORS

A. General: Provide 1-3/4 inch doors of design specified, not less than thickness indicated; fabricated with smooth surfaces, without visible joints or seams on exposed faces unless otherwise indicated. Comply with ANSI/SDI A250.8 and ANSI/NAAMM HMMA 867.

B. Manufacturers Basis of Design:

1. Curries Company 777 Trio-E/Trio Series.

2.4 STANDARD HOLLOW METAL FRAMES

A. General: Comply with ANSI/SDI A250.8 and with details indicated for type and profile.

B. Exterior Frames: Fabricated of hot-dipped zinc coated steel that complies with ASTM A 653/A 653M, Coating Designation A60.

1. Fabricate frames with mitered or coped corners.
2. Fabricate frames, with the exception of knock down types, with "closed and tight" miter seams continuously welded on face, finished smooth with no visible seam unless otherwise indicated.
3. Frames for Level 3 Steel Doors (up to 48 inches in width): Minimum 14 gauge (0.067-inch -1.7-mm) thick steel sheet.
4. Frames for Level 3 Steel Doors (48 inches and up in width): Minimum 12 gauge (0.081-inch -2.7-mm) thick steel sheet.
5. Frames for Level 2 Steel Doors: Minimum 16 gauge (0.053-inch -1.3-mm) thick steel sheet.

6. Manufacturers Basis of Design:

   a. CECO Door Products SQ/SU/SR Series.
   b. Curries Company M/G Series.

C. Interior Frames: Fabricated from cold-rolled steel sheet that complies with ASTM A 1008/A 1008M.

1. Fabricate frames with mitered or coped corners.
2. Fabricate frames, with the exception of slip-on drywall types, with "closed and tight" miter seams continuously welded on face, finished smooth with no visible seam unless otherwise indicated.
3. Frames for Level 2 Steel Doors: Minimum 16 gauge (0.053-inch -1.3-mm) thick steel sheet.
4. Frames for Level 3 Steel Doors (up to 48 inches in width): Minimum 16 gauge (0.053-inch -1.3-mm) thick steel sheet.]
5. Frames for Level 3 Steel Doors (48 inches and up in width): Minimum 14 gauge (0.067-inch -1.7-mm) thick steel sheet.]
6. Frames for Wood Doors: Minimum 16 gauge (0.053-inch-1.3-mm-) thick steel sheet.
7. Frames for Borrowed Lights: Minimum 16 gauge (0.053-inch-1.3-mm-) thick steel sheet.
8. Manufacturers Basis of Design:

   a. CECO Door Products BQ/BU/DQ/DU/BR/DR Series (Drywall Profile).
   b. CECO Door Products SQ/SU/SR Series (Masonry Profile).
   c. Curries Company C/CM/CG Series (Drywall Profile).
   d. Curries Company M/G Series (Masonry Profile).

D. Fire rated frames: Fabricate frames in accordance with NFPA 80, listed and labeled by a qualified testing agency, for fire-protection ratings indicated.

E. Hardware Reinforcement: Fabricate according to ANSI/SDI A250.6 Table 4 with reinforcement plates from same material as frames.

2.5 FRAME ANCHORS

A. Jamb Anchors:

1. Masonry Type: Adjustable strap-and-stirrup or T-shaped anchors to suit frame size, formed from A60 metallic coated material, not less than 0.042 inch thick, with corrugated or perforated straps not less than 2 inches wide by 10 inches long; or wire anchors not less than 0.177 inch thick.
2. Stud Wall Type: Designed to engage stud and not less than 0.042 inch thick.
3. Compression Type for Drywall Slip-on (Knock-Down) Frames: Adjustable compression anchors.
4. Windstorm Opening Anchors: Types as tested and required for indicated wall types to meet specified wind load design criteria.
5. FEMA 361 Storm Shelter Anchors: Masonry T-shaped, wire masonry type, or existing opening type anchors.

B. Floor Anchors: Floor anchors to be provided at each jamb, formed from A60 metallic coated material, not less than 0.042 inches thick.

C. Mortar Guards: Formed from same material as frames, not less than 0.016 inches thick.

2.6 HOLLOW METAL PANELS

A. Provide hollow metal panels of same materials, construction, and finish as specified for adjoining hollow metal work.

2.7 LIGHT OPENINGS AND GLAZING

A. Stops and Moldings: Provide stops and moldings around glazed lites where indicated. Form corners of stops and moldings with butted or mitered hairline joints at fabricator's shop. Fixed and removable stops to allow multiple glazed lites each to be removed independently. Coordinate frame rabbet widths between fixed and removable stops with the type of glazing and installation indicated.

B. Moldings for Glazed Lites in Doors and Loose Stops for Glazed Lites in Frames: Minimum 20 gauge thick, fabricated from same material as door face sheet in which they are installed.

C. Fixed Frame Moldings: Formed integral with hollow metal frames, a minimum of 5/8 inch (16 mm) high unless otherwise indicated. Provide fixed frame moldings and stops on outside of exterior and on secure side of interior doors and frames

D. Preformed Metal Frames for Light Openings: Manufacturer's standard frame formed of 0.048-inch-thick, cold rolled steel sheet; with baked enamel or powder coated finish; and approved for use in doors of fire protection rating indicated. Match pre-finished door paint color where applicable.

E. Glazing: Comply with requirements in Division 08 Section "Glazing" and with the hollow metal door manufacturer's written instructions.

1. Factory Glazing: Factory install glazing in doors as indicated. Doors with factory installed glass to include all of the required glazing material.

2.8 ACCESSORIES

A. Mullions and Transom Bars: Join to adjacent members by welding or rigid mechanical anchors.

B. Grout Guards: Formed from same material as frames, not less than 0.016 inches thick.

2.9 FABRICATION

A. Fabricate hollow metal work to be rigid and free of defects, warp, or buckle. Accurately form metal to required sizes and profiles, with minimum radius for thickness of metal. Where practical, fit and assemble units in manufacturer's plant. When shipping limitations so dictate, frames for large openings are to be fabricated in sections for splicing or splining in the field by others.

B. Tolerances: Fabricate hollow metal work to tolerances indicated in ANSI/SDI A250.8.

C. Hollow Metal Doors:

1. Exterior Doors: Provide optional weep-hole openings in bottom of exterior doors to permit moisture to escape where specified.
2. Glazed Lites: Factory cut openings in doors with applied trim or kits to fit. Factory install glazing where indicated.
3. Astragals: Provide overlapping astragals as noted in door hardware sets in Division 08 Section "Door Hardware" on one leaf of pairs of doors where required by NFPA 80 for fire-performance rating or where indicated. Extend minimum 3/4 inch beyond edge of door on which astragal is mounted.
4. Continuous Hinge Reinforcement: Provide welded continuous 12 gauge strap for continuous hinges specified in hardware sets in Division 08 Section "Door Hardware".

D. Hollow Metal Frames:

1. Shipping Limitations: Where frames are fabricated in sections due to shipping or handling limitations, provide alignment plates or angles at each joint, fabricated of same thickness metal as frames.
2. Welded Frames: Weld flush face joints continuously; grind, fill, dress, and make smooth, flush, and invisible.

    a. Welded frames are to be provided with two steel spreaders temporarily attached to the bottom of both jambs to serve as a brace during shipping and handling. Spreader bars are for bracing only and are not to be used to size the frame opening.

3. Sidelight and Transom Bar Frames: Provide closed tubular members with no visible face seams or joints, fabricated from same material as door frame. Fasten members at crossings and to jambs by butt welding.
4. High Frequency Hinge Reinforcement: Provide high frequency hinge reinforcements at door openings 48-inches and wider with mortise butt type hinges at top hinge locations.
5. Continuous Hinge Reinforcement: Provide welded continuous 12 gauge straps for continuous hinges specified in hardware sets in Division 08 Section "Door Hardware".
6. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated for removable stops, provide security screws at exterior locations.
7. Mortar Guards: Provide guard boxes at back of hardware mortises in frames at all hinges and strike preps regardless of grouting requirements.
8. Floor Anchors: Weld anchors to bottom of jambs and mullions with at least four spot welds per anchor.
9. Jamb Anchors: Provide number and spacing of anchors as follows:

    a. Stud Wall Type: Locate anchors not more than 18 inches from top and bottom of frame. Space anchors not more than 32 inches o.c. and as follows:

        1) Three anchors per jamb up to 60 inches high.
        2) Four anchors per jamb from 60 to 90 inches high.
        3) Five anchors per jamb from 90 to 96 inches high.
        4) Five anchors per jamb plus 1 additional anchor per jamb for each 24 inches or fraction thereof above 96 inches high.
        5) Two anchors per head for frames above 42 inches wide and mounted in metal stud partitions.

10. Door Silencers: Except on weatherstripped or gasketed doors, drill stops to receive door silencers. Silencers to be supplied by frame manufacturer regardless if specified in Division 08 Section "Door Hardware".

E. Hardware Preparation: Factory prepare hollow metal work to receive template mortised hardware; include cutouts, reinforcement, mortising, drilling, and tapping according to the Door Hardware Schedule and templates furnished as specified in Division 08 Section "Door Hardware."

1. Locate hardware as indicated, or if not indicated, according to ANSI/SDI A250.8.
2. Reinforce doors and frames to receive non-template, mortised and surface mounted door hardware.
3. Comply with applicable requirements in ANSI/SDI A250.6 and ANSI/DHI A115 Series specifications for preparation of hollow metal work for hardware.
4. Coordinate locations of conduit and wiring boxes for electrical connections with Division 26 Sections.

2.10 STEEL FINISHES

A. Prime Finishes: Doors and frames to be cleaned, and chemically treated to insure maximum finish paint adhesion. Surfaces of the door and frame exposed to view to receive a factory applied coat of rust inhibiting shop primer.

1. Shop Primer: Manufacturer's standard, fast-curing, lead and chromate free primer complying with ANSI/SDI A250.10 acceptance criteria; recommended by primer manufacturer for substrate; and compatible with substrate and field-applied coatings.

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. General Contractor to verify the accuracy of dimensions given to the steel door and frame manufacturer for existing openings or existing frames (strike height, hinge spacing, hinge back set, etc.).

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Remove welded in shipping spreaders installed at factory. Restore exposed finish by grinding, filling, and dressing, as required to make repaired area smooth, flush, and invisible on exposed faces.

B. Prior to installation, adjust and securely brace welded hollow metal frames for squareness, alignment, twist, and plumbness.

C. Tolerances shall comply with SDI-117 "Manufacturing Tolerances Standard Steel Doors and Frames."

D. Drill and tap doors and frames to receive non-template, mortised, and surface-mounted door hardware.

3.3 INSTALLATION

A. General: Install hollow metal work plumb, rigid, properly aligned, and securely fastened in place; comply with Drawings and manufacturer's written instructions.

B. Hollow Metal Frames: Install hollow metal frames of size and profile indicated. Comply with ANSI/SDI A250.11 and NFPA 80 at fire rated openings.

1. Set frames accurately in position, plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete and frames properly set and secured, remove temporary braces, leaving surfaces smooth and undamaged. Shim as necessary to comply with installation tolerances.

2. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor, and secure with post-installed expansion anchors.
3. Masonry Walls: Coordinate installation of frames to allow for solidly filling space between frames and masonry with mortar.
4. Grout Requirements: Do not grout head of frames unless reinforcing has been installed in head of frame. Do not grout vertical or horizontal closed mullion members.

C. Hollow Metal Doors: Fit hollow metal doors accurately in frames, within clearances specified below. Shim as necessary.

1. Non-Fire-Rated Standard Steel Doors:

a. Jambs and Head: 1/8 inch plus or minus 1/16 inch.
b. Between Edges of Pairs of Doors: 1/8 inch plus or minus 1/16 inch.
c. Between Bottom of Door and Top of Threshold: Maximum 3/8 inch.
d. Between Bottom of Door and Top of Finish Floor (No Threshold): Maximum 3/4 inch.

2. Fire-Rated Doors: Install doors with clearances according to NFPA 80.

D. Field Glazing: Comply with installation requirements in Division 08 Section "Glazing" and with hollow metal manufacturer's written instructions.

3.4 ADJUSTING AND CLEANING

A. Final Adjustments: Check and readjust operating hardware items immediately before final inspection. Leave work in complete and proper operating condition. Remove and replace defective work, including hollow metal work that is warped, bowed, or otherwise unacceptable.

B. Remove grout and other bonding material from hollow metal work immediately after installation.

C. Prime-Coat and Painted Finish Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat, or painted finishes, and apply touchup of compatible air drying, rust-inhibitive primer, zinc rich primer (exterior and galvanized openings) or finish paint.

END OF SECTION 08111

SECTION 08141 - FLUSH WOOD DOORS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes:

1. Solid core flush wood doors with wood veneer and stain grade faces and edges
2. Factory finishing wood doors.
3. Factory machining for hardware.
4. Light frames and glazing installed in wood doors.

B. Related Sections:
1. Division 08 Section "Hollow Metal Doors and Frames" for wood doors in steel frames.
2. Division 08 Section "Glazing" for glass view panels in wood doors.
3. Division 08 Section "Door Hardware" for door hardware for flush wood doors.

C. Standards and References: Comply with the version year adopted by the Authority Having Jurisdiction.

1. ANSI A208.1 – Wood Particleboard.
2. Intertek Testing Service (ITS Warnock Hersey) - Certification Listings for Fire Doors.
3. NFPA 80 - Standard for Fire Doors and Fire Windows; National Fire Protection Association.
4. NFPA 252 - Standard Methods of Fire Tests of Door Assemblies; National Fire Protection Association.
5. UL 10C – (Positive Pressure) and UL 10 B (Neutral Pressure) Fire Tests of Door Assemblies; UL 1784 - Standard for Air Leakage Tests of Door Assemblies.
6. Window and Door Manufacturers Association - WDMA I.S.1-A Architectural Wood Flush Doors.

1.2 SUBMITTALS

A. Product Data: Submit door manufacturer's product construction data, hardware attachment performance data, specification and installation instructions for each type of wood door indicated in construction document drawing's door and hardware schedule. Include details of core and edge construction, louvers, trim for lite openings, and WDMA I.S.1-A or AWS classifications. Include factory finishing specifications.

B. Door hardware supplier is to furnish templates, template reference number and/or physical hardware to the wood door supplier in order to prepare the doors and frames to receive the finish hardware items.

C. Shop Drawings: Indicate location, size and hand of each door; elevation of each kind of door; construction details not covered in Product Data; location and extent of hardware blocking; and other pertinent data.

1. Indicate dimensions and locations of mortises and holes for hardware.
2. Indicate dimensions and locations of cutouts.
3. Indicate requirements for veneer matching.
4. Indicate doors to be factory finished and finish requirements.
5. Indicate fire protection ratings for fire rated doors.

D. Samples for Initial Selection: For factory finished doors.

1. Factory finishes applied to actual door face materials, approximately 8 by 10 inches, for each material and finish. For each wood species and transparent finish, provide set of three samples showing typical range of color and grain to be expected in the finished work.

2. Corner sections of doors, 8 by 10 inches, with door faces and edges representing actual materials to be used.

   a. Provide samples for each species of veneer and solid lumber required.
   b. Finish veneer faced door samples with same materials proposed for factory finished doors.

3. Frames for light openings, 6 inches long, for each material, type, and finish required.

E. Informational Submittals:

1. Submit manufacturer's environmental documentation and applicable sustainability program credits that are available to contribute towards a LEED rated project certification.

F. Warranty: Sample of special warranties.

1.3 QUALITY ASSURANCE

A. Source Limitations: Obtain flush wood doors through one source from a single manufacturer wherever possible.

B. Quality Standard: In addition to requirements specified, comply with WDMA I.S.1-A, latest edition, "Industry Standard for Architectural Wood Flush Doors'.

C. Pre-Submittal Conference: Conduct conference in compliance with requirements in Division 01 Section "Project Meetings" with attendance by representatives of Supplier, Installer, and Contractor to review proper methods and procedures for receiving, handling, and installing flush wood doors.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Comply with requirements of referenced standard and manufacturer's written instructions.

B. Package pre-finished doors individually in plastic bags or cardboard cartons and wrap bundles of doors in plastic sheeting.

C. Mark each door on top rail with opening number used on Shop Drawings.

1.5 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install doors until spaces are enclosed and weather tight, wet work in spaces is complete and dry, and HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

1.6 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace doors that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Warping (bow, cup, or twist) more than 1/4 inch in a 42-by-84-inch section.
b. Telegraphing of core construction in wood face veneers exceeding 0.01 inch in a 3-inch span.
c. Telegraphing of core construction and delaminating of face in decorative laminate-faced doors.

2. Warranty includes installation and finishing that may be required due to repair or replacement of defective doors.

3. Warranty Period for Solid Core Interior Doors: Life of installation according to manufacturer's written warranty.

PART 2 - PRODUCTS

2.1 DOOR CONSTRUCTION – GENERAL

A. WDMA I.S.1-A Performance Grade: Extra Heavy Duty; Aesthetic Grade: Premium.

2.2 CORE CONSTRUCTION

A. 5-Ply Engineered Composite Lumber Core Doors:

1. Structural Composite Lumber, Meets requirements of LEED MR4,

2. Adhesive: Fully bonded construction using Type I adhesives which contain no Urea-formaldehyde.

3. Blocking: When through-bolted hardware is not used, provide blocking as follows:

   a. 5-inch (125-mm) top-rail blocking, in doors indicated to have closers.
   b. 5-inch (125-mm) mid-rail blocking, in doors indicated to have exit devices.

2.3 VENEERED DOORS FOR TRANSPARENT FINISH

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Graham, ASSA ABLOY

B. Interior Solid Core Doors:

1. Grade: Premium

2. Faces: Veneer grades as noted below; veneer minimum 1/50-inch (0.5mm) thickness at moisture content of 12% or less.

   a. Apricot #1675 Plain sliced cherry, A grade faces.

3. Match between Veneer Leaves: Book match.

4. Assembly of Veneer Leaves on Door Faces:

   a. Running Match.

5. Pair and Set Match: Provide for doors hung in same opening or separated only by mullions.
6. Transom Match: Continuous match.
7. Vertical Edges: Matching vertical edges same species as faces. Structural composite lumber (SCL) laminated to a hardwood face, or veneered, bonded to core. (Standard for Oak, Birch and Maple) Minimum requirements per WDMA section P-1, Performance Standards for Architectural Wood Flush Doors.
8. Horizontal Edges: Top and Bottom rails structural composite lumber bonded to core meeting the minimum requirements per WDMA section P-1, Performance Standards for Architectural Wood Flush Doors. 1" minimum after factory trim. No additional blocking required for thru bolted closers.
9. Construction: Five plies. Stiles and rails are bonded to core, then entire unit sanded before applying face veneers.
10. At doors over 40% of the face cut-out for lights and or louvers, furnish engineered composite lumber core.
11. Acoustical Rating: Sound Transmission Class (STC) 31 with required seals.
12. Fire Rating: 20 minute fire rating, Meeting UL 10b (neutral pressure) and UL 10c (positive pressure) Category "B" requirements, Option to 10C (positive pressure) Category 'A"

13. Construction Grade: Performance WDMA/AWS- Extra Heavy Duty, Aesthetic: WDMA-Premium grade.

2.4 LIGHT FRAMES AND GLAZING

A. Metal Frames for Light Openings in Fire Rated Doors over 20-minute rating: Manufacturer's standard frame formed of 0.048-inch-thick, cold rolled steel sheet; with baked enamel or powder coated finish; and approved for use in doors of fire protection rating indicated.

B. Glazing: Comply with installation requirements in Division 08 Section "Glazing" and with the flush wood door manufacturer's written instructions.

2.5 FABRICATION

A. Factory fit doors to suit frame opening sizes indicated. Comply with clearance requirements of referenced quality standard for fitting unless otherwise indicated.

1. Comply with requirements in NFPA 80 for fire rated doors.

B. Factory machine doors for hardware that is not surface applied. Comply with final hardware schedules, door frame Shop Drawings, DHI A115-W series standards, and hardware templates.

1. Coordinate with hardware mortises in metal frames to verify dimensions and alignment before factory machining.
2. Metal Astragals: Factory machine astragals and formed steel edges for hardware for pairs of fire rated doors.

C. Openings: Cut and trim openings through doors in factory.

1. Light Openings: Trim openings with moldings of material and profile indicated.
2. Glazing: Comply with applicable requirements in Division 08 Section "Glazing."
3. Louvers: Factory install louvers in prepared openings.

2.6 FACTORY FINISHING

A. General: Comply with referenced quality standard for factory finishing. Complete fabrication, including fitting doors for openings and machining for hardware that is not surface applied, before finishing.

1. Finish faces, all four edges, edges of cutouts, and mortises. Stains and fillers may be omitted on top and bottom edges, edges of cutouts, and mortises.

B. Transparent Finish: Provide a clear protective coating over the wood veneer allowing the natural color and grain of the selected wood species to provide the appearance specified. Stain is applied to the wood surface underneath the transparent finish to add color and design flexibility.

1. Grade: Premium.
2. Finish: Meet or exceed WDMA I.S. 1A TR6 Catalyzed Polyurethane finish performance requirements and Architectural Woodwork Standards (AWS) First Edition- System#9.

3. Staining: As selected by Architect from manufacturer's full range.
4. Sheen: Satin.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine doors and installed door frames before hanging doors.

1. Verify that frames comply with indicated requirements for type, size, location, and swing characteristics and have been installed with level heads and plumb jambs.
2. Reject doors with defects.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Hardware: For installation, see Division 8 Section "Door Hardware."

B. Installation Instructions: Install doors to comply with manufacturer's written instructions and the referenced quality standard, and as indicated.

1. Install fire rated doors in corresponding fire rated frames according to NFPA 80.

C. Factory Fitted Doors: Align in frames for uniform clearance at each edge.

D. Factory Finished Doors: Restore finish before installation if fitting or machining is required at Project site.

3.3 ADJUSTING

A. Operation: Re-hang or replace doors that do not swing or operate freely.

B. Finished Doors: Replace doors that do not comply with requirements. Doors may be repaired or refinished if work complies with requirements and shows no evidence of repair or refinishing.

END OF SECTION 08141

SECTION 08411 - ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Exterior and interior storefront framing.
2. Storefront framing for window walls.
3. Exterior and interior manual-swing entrance doors and door-frame units.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: Include plans, elevations, sections, full-size details, and attachments to other work.

1. Show connection to and continuity with adjacent thermal, weather, air, and vapor barriers.

C. Samples: For each exposed finish required.

D. Entrance Door Hardware Schedule: Prepared by or under supervision of supplier, detailing fabrication and assembly of entrance door hardware, as well as procedures and diagrams.

E. Delegated-Design Submittal: For aluminum-framed entrances and storefronts indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.4 INFORMATIONAL SUBMITTALS

A. Energy Performance Certificates: NFRC-certified energy performance values from manufacturer.

B. Product test reports.

C. Field quality-control reports.

D. Sample warranties.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance data.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

B. Testing Agency Qualifications: Qualified according to ASTM E 699 for testing indicated and accredited by IAS or ILAC Mutual Recognition Arrangement as complying with ISO/IEC 17025.

C. Product Options: Information on Drawings and in Specifications establishes requirements for aesthetic effects and performance characteristics of assemblies. Aesthetic effects are indicated by dimensions, arrangements, alignment, and profiles of components and assemblies as they relate to sightlines, to one another, and to adjoining construction.

1. Do not change intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If changes are proposed, submit comprehensive explanatory data to Architect for review.

1.7 WARRANTY

A. Special Warranty: Installer agrees to repair or replace components of aluminum-framed entrances and storefronts that do not comply with requirements or that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Two years from date of Substantial Completion.

B. Special Finish Warranty: Standard form in which manufacturer agrees to repair finishes or replace aluminum that shows evidence of deterioration of factory-applied finishes within specified warranty period.

1. Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design aluminum-framed entrances and storefronts.

B. General Performance: Comply with performance requirements specified, as determined by testing of aluminum-framed entrances and storefronts representing those indicated for this Project without failure due to defective manufacture, fabrication, installation, or other defects in construction.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Comply with requirements of referenced standard and manufacturer's written instructions.

B. Package pre-finished doors individually in plastic bags or cardboard cartons and wrap bundles of doors in plastic sheeting.

C. Mark each door on top rail with opening number used on Shop Drawings.

1.5 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install doors until spaces are enclosed and weather tight, wet work in spaces is complete and dry, and HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

1.6 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace doors that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Warping (bow, cup, or twist) more than 1/4 inch in a 42-by-84-inch section.
b. Telegraphing of core construction in wood face veneers exceeding 0.01 inch in a 3-inch span.
c. Telegraphing of core construction and delaminating of face in decorative laminate-faced doors.

2. Warranty includes installation and finishing that may be required due to repair or replacement of defective doors.

3. Warranty Period for Solid Core Interior Doors: Life of installation according to manufacturer's written warranty.

PART 2 - PRODUCTS

2.1 DOOR CONSTRUCTION – GENERAL

A. WDMA I.S.1-A Performance Grade: Extra Heavy Duty; Aesthetic Grade: Premium.

2.2 CORE CONSTRUCTION

A. 5-Ply Engineered Composite Lumber Core Doors:

1. Structural Composite Lumber, Meets requirements of LEED MR4,

2. Adhesive: Fully bonded construction using Type I adhesives which contain no Urea-formaldehyde.

3. Blocking: When through-bolted hardware is not used, provide blocking as follows:

   a. 5-inch (125-mm) top-rail blocking, in doors indicated to have closers.
   b. 5-inch (125-mm) mid-rail blocking, in doors indicated to have exit devices.

2.3 VENEERED DOORS FOR TRANSPARENT FINISH

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Graham, ASSA ABLOY

B. Interior Solid Core Doors:

1. Grade: Premium

2. Faces: Veneer grades as noted below; veneer minimum 1/50-inch (0.5mm) thickness at moisture content of 12% or less.

   a. Apricot #1675 Plain sliced cherry, A grade faces.

3. Match between Veneer Leaves: Book match.

4. Assembly of Veneer Leaves on Door Faces:

   a. Running Match.

5. Pair and Set Match: Provide for doors hung in same opening or separated only by mullions.
6. Transom Match: Continuous match.
7. Vertical Edges: Matching vertical edges same species as faces. Structural composite lumber (SCL) laminated to a hardwood face, or veneered, bonded to core. (Standard for Oak, Birch and Maple) Minimum requirements per WDMA section P-1, Performance Standards for Architectural Wood Flush Doors.
8. Horizontal Edges: Top and Bottom rails structural composite lumber bonded to core meeting the minimum requirements per WDMA section P-1, Performance Standards for Architectural Wood Flush Doors. 1" minimum after factory trim. No additional blocking required for thru bolted closers.
9. Construction: Five plies. Stiles and rails are bonded to core, then entire unit sanded before applying face veneers.
10. At doors over 40% of the face cut-out for lights and or louvers, furnish engineered composite lumber core.
11. Acoustical Rating: Sound Transmission Class (STC) 31 with required seals.
12. Fire Rating: 20 minute fire rating, Meeting UL 10b (neutral pressure) and UL 10c (positive pressure) Category "B" requirements, Option to 10C (positive pressure) Category 'A"

13. Construction Grade: Performance WDMA/AWS- Extra Heavy Duty, Aesthetic: WDMA-Premium grade.

2.4 LIGHT FRAMES AND GLAZING

A. Metal Frames for Light Openings in Fire Rated Doors over 20-minute rating: Manufacturer's standard frame formed of 0.048-inch-thick, cold rolled steel sheet; with baked enamel or powder coated finish; and approved for use in doors of fire protection rating indicated.

B. Glazing: Comply with installation requirements in Division 08 Section "Glazing" and with the flush wood door manufacturer's written instructions.

2.5 FABRICATION

A. Factory fit doors to suit frame opening sizes indicated. Comply with clearance requirements of referenced quality standard for fitting unless otherwise indicated.

1. Comply with requirements in NFPA 80 for fire rated doors.

B. Factory machine doors for hardware that is not surface applied. Comply with final hardware schedules, door frame Shop Drawings, DHI A115-W series standards, and hardware templates.

1. Coordinate with hardware mortises in metal frames to verify dimensions and alignment before factory machining.
2. Metal Astragals: Factory machine astragals and formed steel edges for hardware for pairs of fire rated doors.

C. Openings: Cut and trim openings through doors in factory.

1. Light Openings: Trim openings with moldings of material and profile indicated.
2. Glazing: Comply with applicable requirements in Division 08 Section "Glazing."
3. Louvers: Factory install louvers in prepared openings.

2.6 FACTORY FINISHING

A. General: Comply with referenced quality standard for factory finishing. Complete fabrication, including fitting doors for openings and machining for hardware that is not surface applied, before finishing.

1. Finish faces, all four edges, edges of cutouts, and mortises. Stains and fillers may be omitted on top and bottom edges, edges of cutouts, and mortises.

B. Transparent Finish: Provide a clear protective coating over the wood veneer allowing the natural color and grain of the selected wood species to provide the appearance specified. Stain is applied to the wood surface underneath the transparent finish to add color and design flexibility.

1. Grade: Premium.
2. Finish: Meet or exceed WDMA I.S. 1A TR6 Catalyzed Polyurethane finish performance requirements and Architectural Woodwork Standards (AWS) First Edition- System#9.

3. Staining: As selected by Architect from manufacturer's full range.
4. Sheen: Satin.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine doors and installed door frames before hanging doors.

1. Verify that frames comply with indicated requirements for type, size, location, and swing characteristics and have been installed with level heads and plumb jambs.
2. Reject doors with defects.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Hardware: For installation, see Division 8 Section "Door Hardware."

B. Installation Instructions: Install doors to comply with manufacturer's written instructions and the referenced quality standard, and as indicated.

1. Install fire rated doors in corresponding fire rated frames according to NFPA 80.

C. Factory Fitted Doors: Align in frames for uniform clearance at each edge.

D. Factory Finished Doors: Restore finish before installation if fitting or machining is required at Project site.

3.3 ADJUSTING

A. Operation: Re-hang or replace doors that do not swing or operate freely.

B. Finished Doors: Replace doors that do not comply with requirements. Doors may be repaired or refinished if work complies with requirements and shows no evidence of repair or refinishing.

END OF SECTION 08141

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2. Storefront framing for window walls.
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1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: Include plans, elevations, sections, full-size details, and attachments to other work.

1. Show connection to and continuity with adjacent thermal, weather, air, and vapor barriers.

C. Samples: For each exposed finish required.

D. Entrance Door Hardware Schedule: Prepared by or under supervision of supplier, detailing fabrication and assembly of entrance door hardware, as well as procedures and diagrams.

E. Delegated-Design Submittal: For aluminum-framed entrances and storefronts indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.4 INFORMATIONAL SUBMITTALS

A. Energy Performance Certificates: NFRC-certified energy performance values from manufacturer.

B. Product test reports.

C. Field quality-control reports.

D. Sample warranties.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance data.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

B. Testing Agency Qualifications: Qualified according to ASTM E 699 for testing indicated and accredited by IAS or ILAC Mutual Recognition Arrangement as complying with ISO/IEC 17025.

C. Product Options: Information on Drawings and in Specifications establishes requirements for aesthetic effects and performance characteristics of assemblies. Aesthetic effects are indicated by dimensions, arrangements, alignment, and profiles of components and assemblies as they relate to sightlines, to one another, and to adjoining construction.

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1.7 WARRANTY

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1. Warranty Period: Two years from date of Substantial Completion.

B. Special Finish Warranty: Standard form in which manufacturer agrees to repair finishes or replace aluminum that shows evidence of deterioration of factory-applied finishes within specified warranty period.

1. Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design aluminum-framed entrances and storefronts.

B. General Performance: Comply with performance requirements specified, as determined by testing of aluminum-framed entrances and storefronts representing those indicated for this Project without failure due to defective manufacture, fabrication, installation, or other defects in construction.

1. Aluminum-framed entrances and storefronts shall withstand movements of supporting structure including, but not limited to, story drift, twist, column shortening, long-term creep, and deflection from uniformly distributed and concentrated live loads.
2. Failure also includes the following:

    a. Thermal stresses transferring to building structure.
    b. Glass breakage.
    c. Noise or vibration created by wind and thermal and structural movements.
    d. Loosening or weakening of fasteners, attachments, and other components.
    e. Failure of operating units.

C. Structural Loads:

1. Wind Loads: 35 PSF, inward and outward

D. Deflection of Framing Members: At design wind pressure, as follows:

1. Deflection Normal to Wall Plane: Limited to edge of glass in a direction perpendicular to glass plane not exceeding 1/175 of the glass edge length for each individual glazing lite or an amount that restricts edge deflection of individual glazing lites to 3/4 inch, whichever is less.
2. Deflection Parallel to Glazing Plane: Limited to 1/360 of clear span or 1/8 inch, whichever is smaller.

    a. Operable Units: Provide a minimum 1/16-inch clearance between framing members and operable units.

3. Cantilever Deflection: Where framing members overhang an anchor point, as follows:

    a. Perpendicular to Plane of Wall: No greater than 1/240 of clear span plus 1/4 inch for spans greater than 11 feet 8-1/4 inches or 1/175 times span, for spans less than 11 feet 8-1/4 inches.

E. Structural: Test according to ASTM E 330 as follows:

1. When tested at positive and negative wind-load design pressures, assemblies do not evidence deflection exceeding specified limits.
2. When tested at 150 percent of positive and negative wind-load design pressures, assemblies, including anchorage, do not evidence material failures, structural distress, or permanent deformation of main framing members exceeding 0.2 percent of span.
3. Test Durations: As required by design wind velocity, but not less than 10 seconds.

F. Air Infiltration: Test according to ASTM E 283 for infiltration as follows:

1. Fixed Framing and Glass Area:

    a. Maximum air leakage of 0.06 cfm/sq. ft. at a static-air-pressure differential of 1.57 lbf/sq. ft..

2. Entrance Doors:

a. Pair of Doors: Maximum air leakage of 1.0 cfm/sq. ft. at a static-air-pressure differential of 1.57 lbf/sq. ft..

G. Water Penetration under Static Pressure: Test according to ASTM E 331 as follows:

1. No evidence of water penetration through fixed glazing and framing areas when tested according to a minimum static-air-pressure differential of 20 percent of positive wind-load design pressure, but not less than 6.24 lbf/sq. ft..

H. Energy Performance: Certify and label energy performance according to NFRC as follows:

1. Thermal Transmittance (U-factor): Fixed glazing and framing areas shall have U-factor of not more than 0.57 Btu/sq. ft. x h x deg F as determined according to NFRC 100.
2. Solar Heat Gain Coefficient: Fixed glazing and framing areas shall have a solar heat gain coefficient of no greater than [0.35] [0.40] [0.45] <Insert value> as determined according to NFRC 200.
3. Condensation Resistance: Fixed glazing and framing areas shall have an NFRC-certified condensation resistance rating of no less than 45 as determined according to NFRC 500.

I. Windborne-Debris Impact Resistance: Pass missile-impact and cyclic-pressure tests when tested according to ASTM E 1886 and testing information in ASTM E 1996 for Wind Zone 1 specific to project site.

1. Large-Missile Test: For glazed openings located within 30 feet of grade.

J. Thermal Movements: Allow for thermal movements resulting from ambient and surface temperature changes:

1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

2.2 MANUFACTURERS

A. Basis-of-Design Product: Subject to compliance with requirements, provide Kawneer North America or comparable product by one of the following:
1. EFCO Corporation.
2. YKK AP America Inc.

2.3 FRAMING

A. Framing Members: Manufacturer's extruded- or formed-aluminum framing members of thickness required and reinforced as required to support imposed loads.

1. Construction: Thermally broken
2. Glazing System: Retained mechanically with gaskets on four sides.
3. Glazing Plane: Center.
4. Finish: Clear anodic finish
5. Fabrication Method: Field-fabricated stick system.

B. Backer Plates: Manufacturer's standard, continuous backer plates for framing members, if not integral, where framing abuts adjacent construction.

C. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with nonstaining, nonferrous shims for aligning system components.

D. Materials:

1. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.

   a. Sheet and Plate: ASTM B 209.
   b. Extruded Bars, Rods, Profiles, and Tubes: ASTM B 221.
   c. Extruded Structural Pipe and Tubes: ASTM B 429/B 429M.
   d. Structural Profiles: ASTM B 308/B 308M.

2. Steel Reinforcement: Manufacturer's standard zinc-rich, corrosion-resistant primer complying with SSPC-PS Guide No. 12.00; applied immediately after surface preparation and pretreatment. Select surface preparation methods according to recommendations in SSPC-SP COM, and prepare surfaces according to applicable SSPC standard.

   a. Structural Shapes, Plates, and Bars: ASTM A 36/A 36M.
   b. Cold-Rolled Sheet and Strip: ASTM A 1008/A 1008M.
   c. Hot-Rolled Sheet and Strip: ASTM A 1011/A 1011M.

2.4 ENTRANCE DOOR SYSTEMS

A. Entrance Doors: Manufacturer's standard glazed entrance doors for manual-swing operation.

1. Door Construction: 1-3/4-inch overall thickness, with minimum 0.125-inch- thick, extruded-aluminum tubular rail and stile members. Mechanically fasten corners with reinforcing brackets that are deeply penetrated and fillet welded or that incorporate concealed tie rods.

   a. Thermal Construction: High-performance plastic connectors separate aluminum members exposed to the exterior from members exposed to the interior.

2. Door Design: Medium stile; 3-1/2-inch nominal width
3. Glazing Stops and Gaskets: Square snap-on, extruded-aluminum stops and preformed gaskets.

   a. Provide nonremovable glazing stops on outside of door.

2.5 ENTRANCE DOOR HARDWARE

A. Entrance Door Hardware: Hardware not specified in this Section is specified in Section 087100 "Door Hardware."

B. General: Provide entrance door hardware **and** entrance door hardware sets indicated in door and frame schedule for each entrance door to comply with requirements in this Section.

1. Entrance Door Hardware Sets: Provide quantity, item, size, finish or color indicated, and products complying with BHMA standard referenced.
2. Sequence of Operation: Provide electrified door hardware function, sequence of operation, and interface with other building control systems indicated.
3. Opening-Force Requirements:

   a. Egress Doors: Not more than 15 lbf to release the latch and not more than 30 lbf to set the door in motion and not more than 15 lbf to open the door to its minimum required width.
   b. Accessible Interior Doors: Not more than 5 lbf to fully open door.

C. Designations: Requirements for design, grade, function, finish, size, and other distinctive qualities of each type of entrance door hardware are indicated in "Entrance Door Hardware Sets" Article. Products are identified by using entrance door hardware designations as follows:

1. Named Manufacturers' Products: Manufacturer and product designation are listed for each door hardware type required for the purpose of establishing minimum requirements. Manufacturers' names are abbreviated in "Entrance Door Hardware Sets" Article.
2. References to BHMA Standards: Provide products complying with these standards and requirements for description, quality, and function.

D. Pivot Hinges: BHMA A156.4, Grade 1.

1. Offset-Pivot Hinges: Provide top, bottom, and intermediate offset pivots at each door leaf.

E. Continuous-Gear Hinges: Manufacturer's standard with stainless-steel bearings between knuckles, fabricated to full height of door and frame.

F. Panic Exit Devices: BHMA A156.3, Grade 1, listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for panic protection, based on testing according to UL 305.

G. Cylinders: As specified in Section 087100 "Door Hardware."

1. Keying: [No master] [Master] key system. Permanently inscribe each key with a visual key control number and include notation ["DO NOT DUPLICATE"] [to be furnished by Owner].

H. Strikes: Provide strike with black-plastic dust box for each latch or lock bolt; fabricated for aluminum framing.

I. Operating Trim: BHMA A156.6.

J. Removable Mullions: BHMA A156.3, extruded aluminum.

1. When used with panic exit devices, provide removable mullions listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for panic

protection, based on testing according to UL 305. Use only mullions that have been tested with exit devices to be used.

K. Closers: BHMA A156.4, Grade 1, with accessories required for a complete installation, sized as required by door size, exposure to weather, and anticipated frequency of use; adjustable to comply with field conditions and requirements for opening force.

L. Door Stops: BHMA A156.16, Grade 1, floor or wall mounted, as appropriate for door location indicated, with integral rubber bumper.

M. Weather Stripping: Manufacturer's standard replaceable components.

N. Weather Sweeps: Manufacturer's standard exterior-door bottom sweep with concealed fasteners on mounting strip.

O. Silencers: BHMA A156.16, Grade 1.

P. Thresholds: BHMA A156.21, raised thresholds beveled with a slope of not more than 1:2, with maximum height of 1/2 inch.

2.6 GLAZING

A. Glazing: Comply with Section 088000 "Glazing."

B. Glazing Gaskets: Manufacturer's standard sealed-corner pressure-glazing system of black, resilient elastomeric glazing gaskets, setting blocks, and shims or spacers.

C. Glazing Sealants: As recommended by manufacturer.

D. Sealants used inside the weatherproofing system shall have a VOC content of 250 g/L.

E. Sealants used inside the weatherproofing system shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

2.7 FABRICATION

A. Form or extrude aluminum shapes before finishing.

B. Weld in concealed locations to greatest extent possible to minimize distortion or discoloration of finish. Remove weld spatter and welding oxides from exposed surfaces by descaling or grinding.

C. Fabricate components that, when assembled, have the following characteristics:

1. Profiles that are sharp, straight, and free of defects or deformations.
2. Accurately fitted joints with ends coped or mitered.
3. Physical and thermal isolation of glazing from framing members.

4. Accommodations for thermal and mechanical movements of glazing and framing to maintain required glazing edge clearances.
5. Provisions for field replacement of glazing from exterior and interior.
6. Fasteners, anchors, and connection devices that are concealed from view to greatest extent possible.

D. Mechanically Glazed Framing Members: Fabricate for flush glazing without projecting stops.

E. Entrance Door Frames: Reinforce as required to support loads imposed by door operation and for installing entrance door hardware.

F. Entrance Doors: Reinforce doors as required for installing entrance door hardware.

G. Entrance Door Hardware Installation: Factory install entrance door hardware to the greatest extent possible. Cut, drill, and tap for factory-installed entrance door hardware before applying finishes.

H. After fabrication, clearly mark components to identify their locations in Project according to Shop Drawings.

2.8 ALUMINUM FINISHES

A. Clear Anodic Finish: AAMA 611, AA-M12C22A41, Class I, 0.018 mm.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General:

1. Comply with manufacturer's written instructions.
2. Do not install damaged components.
3. Fit joints to produce hairline joints free of burrs and distortion.
4. Rigidly secure nonmovement joints.
5. Install anchors with separators and isolators to prevent metal corrosion and electrolytic deterioration and to prevent impeding movement of moving joints.
6. Seal perimeter and other joints watertight unless otherwise indicated.

B. Metal Protection:

1. Where aluminum is in contact with dissimilar metals, protect against galvanic action by painting contact surfaces with materials recommended by manufacturer for this purpose or by installing nonconductive spacers.
2. Where aluminum is in contact with concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.

C. Set continuous sill members and flashing in full sealant bed as specified in Section 079200 "Joint Sealants" to produce weathertight installation.

D. Install components plumb and true in alignment with established lines and grades.

E. Install operable units level and plumb, securely anchored, and without distortion. Adjust weather-stripping contact and hardware movement to produce proper operation.

F. Install glazing as specified in Section 088000 "Glazing."

G. Entrance Doors: Install doors to produce smooth operation and tight fit at contact points.

1. Exterior Doors: Install to produce weathertight enclosure and tight fit at weather stripping.
2. Field-Installed Entrance Door Hardware: Install surface-mounted entrance door hardware according to entrance door hardware manufacturers' written instructions using concealed fasteners to greatest extent possible.

3.2 ENTRANCE DOOR HARDWARE SETS

END OF SECTION 08411

SECTION 08452 - TRANSLUCENT FIBERGLASS SANDWICH PANEL WALL SYSTEM

PART 1- GENERAL

1.1 SUMMARY

A. Section includes the insulated translucent sandwich panel system and accessories as shown and specified. Work includes providing and installing:

1. Flat factory prefabricated structural insulated translucent sandwich panels
2. Aluminum installation system
3. Aluminum sill flashing

1.2 SUBMITTALS

A. Submit manufacturer's product data. Include construction details, material descriptions, profiles and finishes of components.

B. Submit shop drawings. Include elevations and details of installation into exterior wall system.

C. Submit manufacturer's color charts showing the full range of colors available for factory-finished aluminum. Approval to be by Architect.

1. When requested, submit samples for each exposed finish required, in same thickness and material indicated for the work and in size indicated below. If finishes involve normal color variations, include sample sets consisting of two or more units showing the full range of variations expected.

a. Sandwich panels: 14" x 28" units
b. Factory finished aluminum: 5" long sections

D. Submit Installer Certificate, signed by installer, certifying compliance with project qualification requirements.

E. Submit product reports from a qualified independent testing agency indicating each type and class of panel system complies with the project performance requirements, based on comprehensive testing of current products. Previously completed reports will be acceptable if for current manufacturer and indicative of products used on this project.

1. Reports required are:

a. International Building Code Evaluation Report
b. Flame Spread and Smoke Developed (UL 723) – Submit UL Card
c. Burn Extent (ASTM D 635)
d. Color Difference (ASTM D 2244)
e. Impact Strength (UL 972)
f. Bond Tensile Strength (ASTM C 297 after aging by ASTM D 1037)
g. Bond Shear Strength (ASTM D 1002)
h. Beam Bending Strength (ASTM E 72)

i. Insulation U-Factor (NFRC 100)
j. NFRC System U-Factor Certification (NFRC 700)
k. Solar Heat Gain Coefficient (NFRC or Calculations)
l. Condensation Resistance Factor (AAMA 1503)
m. Air Leakage (ASTM E 283)
n. Structural Performance (ASTM E 330)
o. Water Penetration (ASTM E 331)
p. 1200°F Fire Resistance (SWRI)
q. LEED Credits

1.3 QUALITY ASSURANCE

A. Manufacturer's Qualifications

1. Material and products shall be manufactured by a company continuously and regularly employed in the manufacture of specified materials for a period of at least ten consecutive years and which can show evidence of those materials being satisfactorily used on at least six projects of similar size, scope and location. At least three of the projects shall have been in successful use for ten years or longer.
2. Panel system must be listed by an ANSI accredited Evaluation Service, which requires quality control inspections and fire, structural and water infiltration testing of sandwich panel systems by an accredited agency.
3. Quality control inspections shall be conducted at least once each year and shall include manufacturing facilities, sandwich panel components and production sandwich panels for conformance with AC177 "Translucent Fiberglass Reinforced Plastic (FRP) Faced Panel Wall, Roof and Skylight Systems" as issued by the ICC-ES.

B. Installer's Qualifications: Installation shall be by an experienced installer, which has been in the business of installing specified panel systems for at least two consecutive years and can show evidence of satisfactory completion of projects of similar size, scope and type.

1.4 PERFORMANCE REQUIREMENTS

A. The manufacturer shall be responsible for the configuration and fabrication of the complete panel system.

1. When requested, include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
2. Standard panel system shall have less than 0.01 cfm/ft² air leakage by ASTM E 283 at 6.24 PSF (50 mph) and no water penetration by ASTM E 331 at 15 PSF; and structural testing by ASTM E 330.
3. Structural Loads; Provide system capable of handling the following loads:

a. Positive Wind Load: _____ PSF
b. Negative Wind Load: _____ PSF

1.5 DELIVERY STORAGE AND HANDLING

A. Deliver panel system, components and materials in manufacturer's standard protective packaging.

B. Store panels on the long edge; several inches above the ground, blocked and under cover in accordance with manufacturer's storage and handling instructions.

1.6 WARRANTY

A. Submit manufacturer's and installer's written warranty agreeing to repair or replace panel system work, which fails in materials or workmanship within two years of the date of delivery. Failure of materials or workmanship shall include leakage, excessive deflection, deterioration of finish on metal in excess of normal weathering and defects in accessories, insulated translucent sandwich panels and other components of the work.

PART 2- PRODUCTS

2.1 MANUFACTURER

A. Approved manufacturer and basis of design for this specification is for products manufactured by KALWALL Corporation. Other manufacturers may bid this project provided they comply with all of the performance requirements of this specification and submit evidence thereof. Listing other manufacturers' names in this specification does not constitute approval of their products or relieve them of compliance with all the performance requirements contained herein.

B. Kalwall Corporation, Tel: (800) 258-9777 – Fax: (603) 627-7905 – Email: info@kalwall.com

2.2 PANEL COMPONENTS

A. Face Sheets

1. Translucent faces: Manufactured from glass fiber reinforced thermoset resins, formulated specifically for architectural use.

   a. Thermoplastic (e.g. polycarbonate, acrylic) faces are not acceptable.
   b. Face sheets shall not deform, deflect or drip when subjected to fire or flame.

2. Interior face sheets:

   a. Flame spread: Underwriters Laboratories (UL) listed, which requires periodic unannounced retesting, with flame spread rating no greater than 20 and smoke developed no greater than 200 when tested in accordance with UL 723.
   b. Burn extent by ASTM D 635 shall be no greater than 1".

3. Exterior face sheets:

   a. Color stability: Full thickness of the exterior face sheet shall not change color more than 3 CIE Units DELTA E by ASTM D 2244 after 5 years outdoor South Florida weathering at 5° facing south, determined by the average of at least three white samples with and without a protective film or coating to ensure long-term color stability. Color stability shall be unaffected by abrasion or scratching.

b. Strength: Exterior face sheet shall be uniform in strength, impenetrable by hand held pencil and repel an impact minimum of 70 ft. lbs. without fracture or tear when impacted by a 3-1/4" diameter, 5 lb. free-falling ball per UL 972.

4. Appearance:

a. Exterior face sheets: Smooth .070" thick and Crystal in color.
b. Interior face sheets: Smooth .045" thick and White in color.
c. Face sheets shall not vary more than ± 10% in thickness and be uniform in color.

B. Grid Core

1. Thermally broken I-beam grid core shall be of 6063-T6 or 6005-T5 alloy and temper with provisions for mechanical interlocking of muntin-mullion and perimeter. Width of I-beam shall be no less than 7/16".
2. I-beam Thermal break: Minimum 1", thermoset fiberglass composite.

C. Laminate Adhesive

1. Heat and pressure resin type adhesive engineered for structural sandwich panel use, with minimum 25-years field use. Adhesive shall pass testing requirements specified by the International Code Council "Acceptance Criteria for Sandwich Panel Adhesives".
2. Minimum tensile strength of 750 PSI when the panel assembly is tested by ASTM C 297 after two exposures to six cycles each of the aging conditions prescribed by ASTM D 1037.
3. Minimum shear strength of the panel adhesive by ASTM D 1002 after exposure to four separate conditions:

a. 50% Relative Humidity at 68° F: 540 PSI
b. 182° F: 100 PSI
c. Accelerated Aging by ASTM D 1037 at room temperature: 800 PSI
d. Accelerated Aging by ASTM D 1037 at 182° F: 250 PSI

2.3 PANEL CONSTRUCTION

A. Provide sandwich panels of flat fiberglass reinforced translucent face sheets laminated to a grid core of mechanically interlocking I-beams. The adhesive bonding line shall be straight, cover the entire width of the I-beam and have a neat, sharp edge.

1. Thickness: 2-3/4"
2. Light transmission: 20%
3. Solar heat gain coefficient 0.28.
4. Panel U-factor by NFRC certified laboratory: 2-3/4" thermally broken grid 0.23 "u".
5. Complete insulated panel system shall have NFRC certified U-factor of 0.28.
6. Grid pattern: Nominal size 12" x 24" shoji pattern.

B. Standard panels shall deflect no more than 1.9" at 30 PSF in 10' 0" span without a supporting frame by ASTM E 72.

C. Standard panels shall withstand 1200° F fire for minimum one hour without collapse or exterior flaming.

D. Thermally broken panels: Minimum Condensation Resistance Factor of 80 by AAMA 1503 measured on the bond line.

2.4 BATTENS AND PERIMETER CLOSURE SYSTEM

A. Closure system: Thermally broken extruded aluminum 6063-T6 and 6063-T5 alloy and temper clamp-tite screw type closure system.

B. Sealing tape: Manufacturer's standard, pre-applied to closure system at the factory under controlled conditions.

C. Fasteners: 300 series stainless steel screws for aluminum closures, excluding final fasteners to the building.

D. Finish:

1. Manufacturer's factory applied finish, which meets the performance requirements of AAMA 2604. Color to be selected from manufacturer's full range of standard colors.

PART 3- EXECUTION

3.1 EXAMINATION

A. Installer shall examine substrates, supporting structure and installation conditions.

A. Do not proceed with panel installation until unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Metal Protection:

1. Where aluminum will contact dissimilar metals, protect against galvanic action by painting contact surfaces with primer or by applying sealant or tape recommended by manufacturer for this purpose.
2. Where aluminum will contact concrete, masonry or pressure treated wood, protect against corrosion by painting contact surfaces with bituminous paint or method recommended by manufacturer.

3.3 INSTALLATION

A. Install the panel system in accordance with the manufacturer's installation recommendations and approved shop drawings.

1. Anchor component parts securely in place by permanent mechanical attachment system.
2. Accommodate thermal and mechanical movements.
3. Set perimeter framing in a full bed of sealant compound, or with joint fillers or gaskets to provide weather-tight construction.

B. Install joint sealants at perimeter joints and within the panel system in accordance with manufacturer's installation instructions.

3.4 CLEANING

A. Clean the panel system inside and outside, immediately after installation.

B. Refer to manufacturer's written recommendations.

END OF SECTION 08452

SECTION 08511 - ALUMINUM WINDOWS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes aluminum windows for exterior locations to match existing type, dimensions and finish color.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: Include plans, elevations, sections, hardware, accessories, insect screens, operational clearances, and details of installation, including anchor, flashing, and sealant installation.

C. Samples: For each exposed product and for each color specified, 2 by 4 inches (50 by 100 mm) in size.

D. Product Schedule: For aluminum windows. Use same designations indicated on Drawings.

1.3 INFORMATIONAL SUBMITTALS

A. Product test reports.

B. Sample warranties.

1.4 QUALITY ASSURANCE

A. Mockups: Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

1.5 WARRANTY

A. Manufacturer's Warranty: Manufacturer agrees to repair or replace aluminum windows that fail in materials or workmanship within specified warranty period.

1. Warranty Period:

a. Window: 10 years from date of Substantial Completion.
b. Glazing Units: 10 years from date of Substantial Completion.
c. Aluminum Finish: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis-of-Design Product: Subject to compliance with requirements, provide Kawneer North America, AA4325 Ultra Thermal, or comparable product by one of the following:

1. EFCO Corporation; a Pella company.
2. TRACO.
3. YKK AP America Inc.

2.2 WINDOW PERFORMANCE REQUIREMENTS

A. Product Standard: AAMA/WDMA/CSA 101/I.S.2/A440.

1. Minimum Performance Class: CW
2. Minimum Performance Grade: FW-AW90.

B. Thermal Transmittance: NFRC 100 maximum whole-window U-factor of 0.60 Btu/sq. ft. x h x deg F (3.43 W/sq. m x K).

C. Solar Heat-Gain Coefficient (SHGC): NFRC 200 maximum whole-window SHGC of 0.40.

D. Condensation-Resistance Factor (CRF): Provide aluminum windows tested for thermal performance according to AAMA 1503, showing a CRF of 45.

2.3 ALUMINUM WINDOWS

A. Operating Types: As indicated on Drawings.

B. Frames and Sashes: Thermally broken aluminum extrusions complying with AAMA/WDMA/CSA 101/I.S.2/A440.

C. Glass: Clear annealed glass, ASTM C 1036, Type 1, Class 1, q3.

1. Kind: Fully tempered where indicated on Drawings.

D. Insulating-Glass Units: ASTM E 2190.

1. Glass: ASTM C 1036, Type 1, Class 1, q3.

   a. Tint: Clear.
   b. Kind: Fully tempered where indicated on Drawings.

2. Lites: Two.
3. Filling: Fill space between glass lites with argon.
4. Low-E Coating: Sputtered on second or third surface.

E. Glazing System: Manufacturer's standard factory-glazing system that produces weathertight seal.

F. Hardware, General: Manufacturer's standard corrosion-resistant hardware sized to accommodate sash weight and dimensions.

1. Exposed Hardware Color and Finish: As selected by Architect from manufacturer's full range.

G. Projected Window Hardware:

1. Gear-Type Rotary Operators: Complying with AAMA 901 when tested according to ASTM E 405, Method A. Provide operators that function without requiring the removal of interior screens or using screen wickets.

a. Type and Style: As selected by Architect from manufacturer's full range of types and styles.

2. Hinges: Non-friction type, not less than two per sash
3. Lock: Lever handle and cam-action lock with keeper

H. Weather Stripping: Provide full-perimeter weather stripping for each operable sash unless otherwise indicated.

I. Fasteners: Noncorrosive and compatible with window members, trim, hardware, anchors, and other components.

1. Exposed Fasteners: Do not use exposed fasteners to the greatest extent possible. For application of hardware, use fasteners that match finish hardware being fastened.

2.4 ACCESSORIES

A. Subsills: Thermally broken, extruded-aluminum subsills in configurations indicated on Drawings.

B. Column Covers: Extruded-aluminum profiles in sizes and configurations indicated on Drawings.

C. Interior Trim: Extruded-aluminum profiles in sizes and configurations indicated on Drawings.

D. Panning Trim: Extruded-aluminum profiles in sizes and configurations indicated on Drawings.

E. Receptor System: Two-piece, snap-together, thermally broken, extruded-aluminum receptor system that anchors windows in place.

2.5 INSECT SCREENS

A. General: Fabricate insect screens to integrate with window frame. Provide screen for each operable exterior sash. Screen wickets are not permitted.

1. Type and Location: Full, inside for project-out sashes.

B. Aluminum Frames: Complying with SMA 1004 or SMA 1201.

C. Glass-Fiber Mesh Fabric: 18-by-14 (1.1-by-1.4-mm) or 18-by-16 (1.0-by-1.1-mm) mesh complying with ASTM D 3656.

1. Mesh Color: Manufacturer's standard.

2.6 FABRICATION

A. Fabricate aluminum windows in sizes indicated. Include a complete system for assembling components and anchoring windows.

B. Glaze aluminum windows in the factory.

C. Weather strip each operable sash to provide weathertight installation.

D. Provide weep holes and internal passages to conduct infiltrating water to exterior.

E. Provide water-shed members above side-hinged sashes and similar lines of natural water penetration.

F. Provide mullions and cover plates, matching window units, complete with anchors for support to structure and installation of window units. Allow for erection tolerances and provide for movement of window units due to thermal expansion and building deflections, as indicated. Provide mullions and cover plates capable of withstanding design wind loads of window units.

G. Complete fabrication, assembly, finishing, hardware application, and other work in the factory to greatest extent possible. Disassemble components only as necessary for shipment and installation.

2.7 ALUMINUM FINISHES

A. Anodic Finish: Class I complying with AAMA 611.

1. Color: Clear. Provide manufacturer's color selections for approval by Architect.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Comply with manufacturer's written instructions for installing windows, hardware, accessories, and other components. For installation procedures and requirements not addressed in manufacturer's written instructions, comply with installation requirements in ASTM E 2112.

B. Install windows level, plumb, square, true to line, without distortion or impeding thermal movement, anchored securely in place to structural support, and in proper relation to wall flashing and other adjacent construction to produce weathertight construction.

C. Install windows and components to drain condensation, water penetrating joints, and moisture migrating within windows to the exterior.

D. Separate aluminum and other corrodible surfaces from sources of corrosion or electrolytic action at points of contact with other materials.

E. Adjust operating sashes and hardware for a tight fit at contact points and weather stripping for smooth operation and weathertight closure.

F. Clean exposed surfaces immediately after installing windows. Avoid damaging protective coatings and finishes. Remove excess sealants, glazing materials, dirt, and other substances.

G. Remove and replace glass that has been broken, chipped, cracked, abraded, or damaged during construction period.

END OF SECTION 08511

SECTION 08710– DOOR HARDWARE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes commercial door hardware for the following:

1. Swinging doors.
2. Sliding doors.
3. Other doors to the extent indicated.

B. Door hardware includes, but is not necessarily limited to, the following:

1. Mechanical door hardware.
2. Electromechanical door hardware, power supplies, back-ups and surge protection.
3. Cylinders specified for doors in other sections.

C. Related Sections:

1. Division 08 Section "Door Hardware Schedule".
2. Division 08 Section "Hollow Metal Doors and Frames".
3. Division 08 Section "Interior Aluminum Doors and Frames".
4. Division 08 Section "Flush Wood Doors".

D. References: Comply with the version year adopted by the Authority Having Jurisdiction.

1. ANSI A117.1 - Accessible and Usable Buildings and Facilities.
2. ICC/IBC - International Building Code.
3. NFPA 80 - Fire Doors and Windows.
4. NFPA 101 - Life Safety Code.
5. NFPA 105 - Installation of Smoke Door Assemblies.
6. State Building Codes, Local Amendments.

E. Standards: All hardware specified herein shall comply with the following industry standards:

1. ANSI/BHMA Certified Product Standards - A156 Series
2. UL10C – Positive Pressure Fire Tests of Door Assemblies

1.3 SUBMITTALS

A. Product Data: Manufacturer's product data sheets including installation details, material descriptions, dimensions of individual components and profiles, operational descriptions and finishes.

B. Door Hardware Schedule: Prepared by or under the supervision of supplier, detailing fabrication and assembly of door hardware, as well as procedures and diagrams. Coordinate the final Door Hardware Schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.

1. Format: Comply with scheduling sequence and vertical format in DHI's "Sequence and Format for the Hardware Schedule."

2. Organization: Organize the Door Hardware Schedule into door hardware sets indicating complete designations of every item required for each door or opening. Organize door hardware sets in same order as in the Door Hardware Sets at the end of Part 3. Submittals that do not follow the same format and order as the Door Hardware Sets will be rejected and subject to resubmission.

3. Content: Include the following information:

a. Type, style, function, size, label, hand, and finish of each door hardware item.
b. Manufacturer of each item.
c. Fastenings and other pertinent information.
d. Location of door hardware set, cross-referenced to Drawings, both on floor plans and in door and frame schedule.
e. Explanation of abbreviations, symbols, and codes contained in schedule.
f. Mounting locations for door hardware.
g. Door and frame sizes and materials.

4. Submittal Sequence: Submit the final Door Hardware Schedule at earliest possible date, particularly where approval of the Door Hardware Schedule must precede fabrication of other work that is critical in the Project construction schedule. Include Product Data, Samples, Shop Drawings of other work affected by door hardware, and other information essential to the coordinated review of the Door Hardware Schedule.

C. Keying Schedule: Prepared under the supervision of the Owner, separate schedule detailing final keying instructions for locksets and cylinders in writing. Include keying system explanation, door numbers, key set symbols, hardware set numbers and special instructions. Owner to approve submitted keying schedule prior to the ordering of permanent cylinders.

D. Operating and Maintenance Manuals: Provide manufacturers operating and maintenance manuals for each item comprising the complete door hardware installation in quantity as required in Division 01, Closeout Submittals. The manual to include the name, address, and contact information of the manufacturers providing the hardware and their nearest service representatives. The final copies delivered after completion of the installation test to include "as built" modifications made during installation, checkout, and acceptance.

E. Warranties and Maintenance: Special warranties and maintenance agreements specified in this Section.

1.4 QUALITY ASSURANCE

A. Manufacturers Qualifications: Engage qualified manufacturers with a minimum 5 years of documented experience in producing hardware and equipment similar to that indicated for this Project and that have a proven record of successful in-service performance.

B. Installer Qualifications: Installers, trained by the primary product manufacturers, with a minimum 3 years documented experience installing both standard and electrified builders hardware similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.

C. Door Hardware Supplier Qualifications: Experienced commercial door hardware distributors with a minimum 5 years documented experience supplying both mechanical and electromechanical hardware installations comparable in material, design, and extent to that indicated for this Project. Supplier recognized as a factory direct distributor in good standing by the manufacturers of the primary materials with a warehousing facility in Project's vicinity. Supplier to have on staff a certified Architectural Hardware Consultant (AHC) available during the course of the Work to consult with Contractor, Architect, and Owner concerning both standard and electromechanical door hardware and keying.

1. Scheduling Responsibility: Preparation of door hardware and keying schedules.

D. Source Limitations: Obtain each type and variety of Door Hardware specified in this Section from a single source, qualified supplier unless otherwise indicated.

1. Electrified modifications or enhancements made to a source manufacturer's product line by a secondary or third party source will not be accepted.

2. Provide electromechanical door hardware from the same manufacturer as mechanical door hardware, unless otherwise indicated.

E. Regulatory Requirements: Comply with NFPA 70, NFPA 80, NFPA 101 and ANSI A117.1 requirements and guidelines as directed in the model building code including, but not limited to, the following:

1. NFPA 70 "National Electrical Code", including electrical components, devices, and accessories listed and labeled as defined in Article 100 by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

2. Where indicated to comply with accessibility requirements, comply with Americans with Disabilities Act (ADA), "Accessibility Guidelines for Buildings and Facilities (ADAAG)," ANSI A117.1 as follows:

a. Handles, Pulls, Latches, Locks, and other Operating Devices: Shape that is easy to grasp with one hand and does not require tight grasping, tight pinching, or twisting of the wrist.

b. Door Closers: Comply with the following maximum opening-force requirements indicated:

1) Interior Hinged Doors: 5 lbf applied perpendicular to door.
2) Fire Doors: Minimum opening force allowable by authorities having jurisdiction.

c. Thresholds: Not more than 1/2 inch high. Bevel raised thresholds with a slope of not more than 1:2.

3. NFPA 101: Comply with the following for means of egress doors:

a. Latches, Locks, and Exit Devices: Not more than 15 lbf to release the latch. Locks shall not require the use of a key, tool, or special knowledge for operation.

b. Thresholds: Not more than 1/2 inch high.

4. Fire-Rated Door Assemblies: Provide door hardware for assemblies complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated, based on testing according to NFPA 252 (neutral pressure at 40" above sill) or UL-10C.

a. Test Pressure: Positive pressure labeling.

F. Each unit to bear third party permanent label demonstrating compliance with the referenced standards.

G. Keying Conference: Conduct conference to comply with requirements in Division 01 Section "Project Meetings." Keying conference to incorporate the following criteria into the final keying schedule document:

1. Function of building, purpose of each area and degree of security required.
2. Plans for existing and future key system expansion.
3. Requirements for key control storage and software.
4. Installation of permanent keys, cylinder cores and software.
5. Address and requirements for delivery of keys.

H. Pre-Submittal Conference: Conduct coordination conference in compliance with requirements in Division 01 Section "Project Meetings" with attendance by representatives of Supplier(s), Installer(s), and Contractor(s) to review proper methods and the procedures for receiving, handling, and installing door hardware.

1. Prior to installation of door hardware, conduct a project specific training meeting to instruct the installing contractors' personnel on the proper installation and adjustment of their respective products. Product training to be attended by installers of door hardware (including electromechanical hardware) for aluminum, hollow metal and wood doors. Training will include the use of installation manuals, hardware schedules, templates and physical product samples as required.
2. Inspect and discuss electrical roughing-in, power supply connections, and other preparatory work performed by other trades.

3. Review sequence of operation narratives for each unique access controlled opening.
4. Review and finalize construction schedule and verify availability of materials.
5. Review the required inspecting, testing, commissioning, and demonstration procedures

I. At completion of installation, provide written documentation that components were applied to manufacturer's instructions and recommendations and according to approved schedule.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Inventory door hardware on receipt and provide secure lock-up and shelving for door hardware delivered to Project site. Do not store electronic access control hardware, software or accessories at Project site without prior authorization.

B. Tag each item or package separately with identification related to the final Door Hardware Schedule, and include basic installation instructions with each item or package.

C. Deliver, as applicable, permanent keys, cylinders, cores, access control credentials, software and related accessories directly to Owner via registered mail or overnight package service. Instructions for delivery to the Owner shall be established at the "Keying Conference".

1.6 COORDINATION

A. Templates: Obtain and distribute to the parties involved templates for doors, frames, and other work specified to be factory prepared for installing standard and electrified hardware. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing hardware to comply with indicated requirements.

B. Door Hardware and Electrical Connections: Coordinate the layout and installation of scheduled electrified door hardware and related access control equipment with required connections to source power junction boxes, low voltage power supplies, detection and monitoring hardware, and fire and detection alarm systems.

C. Door and Frame Preparation: Related Division 08 Sections (Steel, Aluminum and Wood) doors and corresponding frames are to be prepared, reinforced and pre-wired (if applicable) to receive the installation of the specified electrified, monitoring, signaling and access control system hardware without additional in-field modifications.

1.7 WARRANTY

A. General Warranty: Reference Division 01, General Requirements. Special warranties specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.

B. Warranty Period: Written warranty, executed by manufacturer(s), agreeing to repair or replace components of standard and electrified door hardware that fails in materials or workmanship

within specified warranty period after final acceptance by the Owner. Failures include, but are not limited to, the following:

1. Structural failures including excessive deflection, cracking, or breakage.
2. Faulty operation of the hardware.
3. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
4. Electrical component defects and failures within the systems operation.

C. Standard Warranty Period: One year from date of Substantial Completion, unless otherwise indicated.

D. Special Warranty Periods:

1. Ten years for mortise locks and latches.
2. Five years for exit hardware.
3. Twenty five years for manual surface door closers.
4. Two years for electromechanical door hardware.

1.8 MAINTENANCE SERVICE

A. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions as needed for Owner's continued adjustment, maintenance, and removal and replacement of door hardware.

B. Continuing Service: Beginning at Substantial Completion, and running concurrent with the specified warranty period, provide continuous (6) months full maintenance including repair and replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper door opening operation. Provide parts and supplies as used in the manufacture and installation of original products.

PART 2 - PRODUCTS

2.1 SCHEDULED DOOR HARDWARE

A. General: Provide door hardware for each door to comply with requirements in Door Hardware Sets and each referenced section that products are to be supplied under.

1. Designations: Requirements for quantity, item, size, finish or color, grade, function, and other distinctive qualities of each type of door hardware are indicated in the Door Hardware Sets at the end of Part 3. Products are identified by using door hardware designations, as follows:

a. Named Manufacturer's Products: Product designation and manufacturer are listed for each door hardware type required for the purpose of establishing requirements. Manufacturers' names are abbreviated in the Door Hardware Schedule.

B. Substitutions: Requests for substitution and product approval for inclusive mechanical and electromechanical door hardware in compliance with the specifications must be submitted in writing and in accordance with the procedures and time frames outlined in Division 01, Substitution Procedures. Approval of requests is at the discretion of the architect, owner, and their designated consultants.

2.2 HANGING DEVICES

A. Hinges: ANSI/BHMA A156.1 certified butt hinges with number of hinge knuckles as specified in the Door Hardware Sets.

1. Quantity: Provide the following hinge quantity, unless otherwise indicated:

   a. Two Hinges: For doors with heights up to 60 inches.
   b. Three Hinges: For doors with heights 61 to 90 inches.
   c. Four Hinges: For doors with heights 91 to 120 inches.
   d. For doors with heights more than 120 inches, provide 4 hinges, plus 1 hinge for every 30 inches of door height greater than 120 inches.

2. Hinge Size: Provide the following, unless otherwise indicated, with hinge widths sized for door thickness and clearances required:

   a. Widths up to 3'0": 4-1/2" standard or heavy weight as specified.
   b. Sizes from 3'1" to 4'0": 5" standard or heavy weight as specified.

3. Hinge Weight and Base Material: Unless otherwise indicated, provide the following:

   a. Exterior Doors: Heavy weight, non-ferrous, ball bearing or oil impregnated bearing hinges unless Hardware Sets indicate standard weight.
   b. Interior Doors: Standard weight, steel, ball bearing or oil impregnated bearing hinges unless Hardware Sets indicate heavy weight.

4. Hinge Options: Comply with the following where indicated in the Hardware Sets or on Drawings:

   a. Non-removable Pins: Provide set screw in hinge barrel that, when tightened into a groove in hinge pin, prevents removal of pin while door is closed; for the following applications:

      1) Out-swinging exterior doors.
      2) Out-swinging access controlled doors.
      3) Out-swinging lockable doors.

5. Acceptable Manufacturers:

   a. Hager Companies (HA).
   b. McKinney Products (MK).

B. Continuous Geared Hinges: ANSI/BHMA A156.26 certified continuous geared hinge with minimum 0.120-inch thick extruded 6060 T6 aluminum alloy hinge leaves and a minimum overall width of 4 inches. Hinges are non-handed, reversible and fabricated to template screw locations. Provide concealed flush mount (with or without inset), full surface, or half surface, in standard and heavy duty models, as specified in the Hardware Sets. Concealed continuous hinges to be U.L. listed for use on up to and including 90 minute rated door installations and U.L. listed for windstorm components where applicable. Factory cut hinges for door size and provide with removable service power transfer panel where indicated at electrified openings.

1. Acceptable Manufacturers:

   a. McKinney Products (MK).
   b. Pemko Manufacturing (PE).

2.3 DOOR OPERATING TRIM

A. Flush Bolts and Surface Bolts: ANSI/BHMA A156.3 and A156.16, Grade 1, certified automatic, self-latching, and manual flush bolts and surface bolts. Manual flush bolts to be furnished with top rod of sufficient length to allow bolt location approximately six feet from the floor. Furnish dust proof strikes for bottom bolts. Surface bolts to be minimum 8" in length and U.L. listed for labeled fire doors and U.L. listed for windstorm components where applicable. Provide related accessories (mounting brackets, strikes, coordinators, etc.) as required for appropriate installation and operation.

1. Acceptable Manufacturers:

   a. Door Controls International (DC).
   b. Rockwood Manufacturing (RO).
   c. Trimco (TC).

B. Door Push Plates and Pulls: ANS/BHMA A156.6 certified door pushes and pulls of type and design specified below or in the Hardware Sets. Coordinate and provide proper width and height as required where conflicting hardware dictates.

1. Push/Pull Plates: Minimum .050 inch thick, size as indicated in hardware sets, with square corners and beveled edges, secured with exposed screws unless otherwise indicated.
2. Door Pull and Push Bar Design: Size, shape, and material as indicated in the hardware sets. Minimum clearance of 2 1/2-inches from face of door unless otherwise indicated.
3. Offset Pull Design: Size, shape, and material as indicated in the hardware sets. Minimum clearance of 2 1/2-inches from face of door and offset of 90 degrees unless otherwise indicated.
4. Fasteners: Provide manufacturer's designated fastener type as indicated in Hardware Sets.

   a. Acceptable Manufacturers:

      1) Rockwood Manufacturing (RO).
      2) Trimco (TC).

2.4 CYLINDERS AND KEYING

A. General: Cylinder manufacturer to have minimum (10) years experience designing secured master key systems and have on record a published security keying system policy.

B. Source Limitations: Obtain each type of keyed cylinder and keys from the same source manufacturer as locksets and exit devices, unless otherwise indicated.

C. Cylinders: Original manufacturer cylinders complying with the following:

1. Mortise Type: Threaded cylinders with rings and straight- or clover-type cam.
2. Rim Type: Cylinders with back plate, flat-type vertical or horizontal tailpiece, and raised trim ring.
3. Bored-Lock Type: Cylinders with tailpieces to suit locks.
4. Mortise and rim cylinder collars to be solid and recessed to allow the cylinder face to be flush and be free spinning with matching finishes.
5. Keyway: Manufacturer's Standard.

D. Keying System: Each type of lock and cylinders to be factory keyed. Conduct specified "Keying Conference" to define and document keying system instructions and requirements. Furnish factory cut, nickel-silver large bow permanently inscribed with a visual key control number as directed by Owner. Incorporate decisions made in keying conference, and as follows:

1. Master Key System: Cylinders are operated by a change key and a master key.
2. Grand Master Key System: Cylinders are operated by a change key, a master key, and a grand master key.
3. Great-Grand Master Key System: Cylinders are operated by a change key, a master key, a grand master key, and a great-grand master key.
4. Existing System: Master key or grand master key locks to Owner's existing system.
5. Keyed Alike: Key all cylinders to same change key.

E. Key Quantity: Provide the following minimum number of keys:

1. Top Master Key: One (1)
2. Change Keys per Cylinder: Two (2)
3. Master Keys (per Master Key Group): Two (2)
4. Grand Master Keys (per Grand Master Key Group): Two (2)
5. Construction Keys (where required): Ten (10)
6. Construction Control Keys (where required): Two (2)
7. Permanent Control Keys (where required): Two (2)

F. Construction Keying: Provide construction master keyed cylinders or temporary keyed construction cores where specified. Provide construction master keys in quantity as required by project Contractor. Replace construction cores with permanent cores. Furnish permanent cores for installation as directed under specified "Keying Conference".

G. Key Registration List: Provide keying transcript list to Owner's representative in the proper format for importing into key control software.

H. Key Control Cabinet: Provide a key control system including envelopes, labels, and tags with self-locking key clips, receipt forms, 3-way visible card index, temporary markers, permanent markers, and standard metal cabinet. Key control cabinet shall have expansion capacity of 150% of the number of locks required for the project.

1. Acceptable Manufacturers:

a. Lund Equipment (LU).
b. MMF Industries (MM).
c. Telkee (TK).

I. Key Control Software: Provide one network version of "Key Wizard" branded key management software package that includes one year of technical support and upgrades to software at no charge. Provide factory key system formatted for importing into "Key Wizard" software.

2.5 MECHANICAL LOCKS AND LATCHING DEVICES

A. Mortise Locksets, Grade 1 (Heavy Duty): ANSI/BHMA A156.13, Series 1000, Operational Grade 1 certified mortise locksets furnished in the functions as specified in the Hardware Sets. Locksets to be manufactured with a corrosion resistant, stamped 12 gauge minimum formed steel case and be field-reversible for handing without disassembly of the lock body. Lockset trim (including knobs, levers, escutcheons, roses) to be the product of a single manufacturer. Furnish with standard 2 3/4" backset, 3/4" throw anti-friction stainless steel latchbolt, and a full 1" throw stainless steel bolt for deadbolt functions.

1. Acceptable Manufacturers:

a. Corbin Russwin Hardware (RU) – ML2000 Series.
b. Sargent Manufacturing (SA) – 8200 Series.
c. Yale Locks and Hardware (YA) – 8800FL Series.

B. Lock Trim Design: As specified in Hardware Sets.

2.6 AUXILIARY LOCKS

A. Mortise Deadlocks, Small Case: ANSI/BHMA A156.5, Grade 1, certified small case mortise type deadlocks constructed of heavy gauge wrought corrosion resistant steel. Steel or stainless steel bolts with a 1" throw and hardened steel roller pins. Deadlocks to be products of the same source manufacturer and keyway as other specified locksets.

1. Acceptable Manufacturers:

a. Corbin Russwin Hardware (RU) - DL4100 Series.
b. Sargent Manufacturing (SA) - 4870 Series.
c. Yale Locks and Hardware (YA) - 350 Series.

2.7 LOCK AND LATCH STRIKES

A. Strikes: Provide manufacturer's standard strike with strike box for each latch or lock bolt, with curved lip extended to protect frame, finished to match door hardware set, unless otherwise indicated, and as follows:

1. Flat-Lip Strikes: For locks with three-piece antifriction latchbolts, as recommended by manufacturer.
2. Extra-Long-Lip Strikes: For locks used on frames with applied wood casing trim.
3. Aluminum-Frame Strike Box: Provide manufacturer's special strike box fabricated for aluminum framing.

B. Standards: Comply with the following:

1. Strikes for Mortise Locks and Latches: BHMA A156.13.
2. Strikes for Bored Locks and Latches: BHMA A156.2.
3. Strikes for Auxiliary Deadlocks: BHMA A156.5.
4. Dustproof Strikes: BHMA A156.16.

2.8 CONVENTIONAL EXIT DEVICES

A. General Requirements: All exit devices specified herein shall meet or exceed the following criteria:

1. At doors not requiring a fire rating, provide devices complying with NFPA 101 and listed and labeled for "Panic Hardware" according to UL305. Provide proper fasteners as required by manufacturer including sex nuts and bolts at openings specified in the Hardware Sets.

2. Where exit devices are required on fire rated doors, provide devices complying with NFPA 80 and with UL labeling indicating "Fire Exit Hardware". Provide devices with the proper fasteners for installation as tested and listed by UL. Consult manufacturer's catalog and template book for specific requirements.

    a. Fire Exit Removable Mullions: Provide keyed removable mullions for use with fire exit devices complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire and panic protection, based on testing according to UL 305 and NFPA 252. Mullions to be used only with exit devices for which they have been tested.

3. Except on fire rated doors, provide exit devices with hex key dogging device to hold the pushbar and latch in a retracted position. Provide optional keyed cylinder dogging on devices where specified in Hardware Sets.

4. Flush End Caps: Provide heavy weight impact resistant flush end caps made of architectural metal in the same finish as the devices as in the Hardware Sets. Plastic end caps will not be acceptable.

5. Lever Operating Trim: Where exit devices require lever trim, furnish manufacturer's heavy duty trim with cold forged escutcheons, beveled edges, and four threaded studs for thru-bolts.

    a. Lock Trim Design: As indicated in Hardware Sets, provide finishes and designs to match that of the specified locksets. Provided free-wheeling type trim where indicated.
    b. Where function of exit device requires a cylinder, provide an interchangeable core type keyed cylinder (Rim or Mortise) as specified in Hardware Sets.

6. Vertical Rod Exit Devices: Provide and install interior surface and concealed vertical rod exit devices as Less Bottom Rod (LBR) unless otherwise indicated.

7. Narrow Stile Applications: At doors constructed with narrow stiles, or as specified in Hardware Sets, provide devices designed for maximum 2" wide stiles.

8. Dummy Push Bar: Nonfunctioning push bar matching functional push bar.

9. Rail Sizing: Provide exit device rails factory sized for proper door width application.

10. Through Bolt Installation: For exit devices and trim as indicated in Door Hardware Sets.

B. Conventional Push Rail Exit Devices (Heavy Duty): ANSI/BHMA A156.3, Grade 1 certified panic and fire exit hardware devices furnished in the functions specified in the Hardware Sets. Mounting rails to be formed from smooth stainless steel, brass or bronze architectural materials no less than 0.072" thick, with push rails a minimum of 0.062" thickness. Painted or aluminum metal rails are not acceptable. Exit device latch to be investment cast stainless steel, pullman type, with deadlock feature.

1. Acceptable Manufacturers:

    a. Corbin Russwin Hardware (RU) - ED4000 / ED5000 Series.
    b. Sargent Manufacturing (SA) - 80 Series.
    c. Yale Locks and Hardware (YA) - 7000 Series.

2.9 DOOR CLOSERS

A. All door closers specified herein shall meet or exceed the following criteria:

1. General: Door closers to be from one manufacturer, matching in design and style, with the same type door preparations and templates regardless of application or spring size. Closers to be non-handed with full sized covers including installation and adjusting information on inside of cover.

2. Standards: Closers to comply with UL-10C and UBC 7-2 for Positive Pressure Fire Test and be U.L. listed for use of fire rated doors.

3. Cycle Testing: Provide closers which have surpassed 10 million cycles in a test witnessed and verified by UL.

4. Size of Units: Comply with manufacturer's written recommendations for sizing of door closers depending on size of door, exposure to weather, and anticipated frequency of use. Where closers are indicated for doors required to be accessible to the physically handicapped, provide units complying with ANSI ICC/A117.1.

5. Closer Arms: Provide heavy duty, forged steel closer arms unless otherwise indicated in Hardware Sets.

    a. Where closers are indicated to have mechanical dead-stop, provide heavy duty arms and brackets with an integral positive stop.
    b. Where closers are indicated to have mechanical hold open, provide heavy duty units with an additional built-in mechanical holder assembly designed to hold open against normal wind and traffic conditions. Holder to be manually selectable to on-off position.
    c. Where closers are indicated to have a cushion-type stop, provide heavy duty arms and brackets with spring stop mechanism to cushion door when opened to maximum degree.
    d. Closers shall not be installed on exterior or corridor side of doors; where possible install closers on door for optimum aesthetics. Provide drop plates or other accessories as required for proper mounting.

6. Closer Accessories: Provide door closer accessories including custom templates, special mounting brackets, spacers and drop plates, and through-bolt or security type fasteners as specified in the door Hardware Sets.

B. Door Closers, Surface Mounted (Heavy Duty): ANSI/BHMA A156.4, Grade 1 surface mounted, heavy duty door closers with complete spring power adjustment, sizes 1 thru 6; and fully operational adjustable according to door size, frequency of use, and opening force. Closers to be rack and pinion type, one piece cast iron or aluminum alloy body construction, with adjustable backcheck and separate non-critical valves for closing sweep and latch speed control. Provide non-handed units standard.

1. Acceptable Manufacturers:

    a. Corbin Russwin Hardware (RU) - DC8000 Series.
    b. Sargent Manufacturing (SA) - 351 Series.
    c. Norton Door Controls (NO) - 7500 Series.
    d. Yale Locks and Hardware (YA) - 4400 Series.

C. Door Closers, Surface Mounted (Unitrol): ANSI/BHMA 156.4, Grade 1 certified surface mounted, heavy duty door closers with complete spring power adjustment, sizes 1 thru 6; and fully operational adjustable according to door size, frequency of use, and opening force. Unitrol arms to have door stop mechanism to absorb dead stop shock on arm and top hinge. Hold-open arms to have a spring loaded mechanism in addition to shock absorber assembly. Arms to be provided with rigid steel main arm and secondary arm lengths proportional to the door width.

1. Acceptable Manufacturers:

    a. Corbin Russwin Hardware (RU) - Unitrol DC8000 Series.
    b. Norton Door Controls (NO) - Unitrol 7500 Series.

c. Yale Locks and Hardware (YA) - Unitrol 4400 Series.

2.10 AUTOMATIC DOOR OPERATORS

A. General: Provide operators of size recommended by manufacturer for door size, weight, and movement; for condition of exposure; and for compliance with UL 325. Coordinate operator mechanisms with door operation, hinges, and activation devices.

1. Fire-Rated Doors: Provide door operators for fire-rated door assemblies that comply with NFPA 80 for fire-rated door components and are listed and labeled by a qualified testing agency.

B. Electrohydraulic Door Operators: Self-contained low-pressure units with rack and pinion design contained within a cast aluminum housing. Door closing speed controlled by independent hydraulic adjustment valves in the sweep and latch range of the closing cycle. Operator is to provide conventional door closer opening and closing forces unless the power operator motor is activated. Unit is to include an adjustable hydraulic backcheck valve to cushion the door speed if opened violently. Non-handed units for both push and pull side applications.

C. Brackets and Reinforcements: Manufacturer's standard, fabricated from aluminum with nonferrous shims for aligning system components.

D. Standard: Certified ANSI/BHMA A156.19.

1. Performance Requirements:

a. Opening Force if Power Fails: Not more than 15 lbf required to release a latch if provided, not more than 30 lbf required to manually set door in motion, and not more than 15 lbf required to fully open door.
b. Entrapment Protection: Not more than 15 lbf required to prevent stopped door from closing or opening.

E. Configuration: Surface mounted. Door operators to control single swinging and pair of swinging doors.

F. Operation: Power opening and spring closing operation capable of meeting ANSI A117.1 accessibility guideline. Provide time delay for door to remain open before initiating closing cycle as required by ANSI/BHMA A156.19. When not in automatic mode, door operator to function as manual door closer with fully adjustable opening and closing forces, with or without electrical power.

1. On-off switch to control power to be key switch operated.

G. Features: Operator units to have full feature adjustments for door opening and closing force and speed, backcheck, motor assist acceleration from 0 to 30 seconds, time delay, vestibule interface delay, obstruction recycle, and hold open time from 0 up to 30 seconds.

H. Provide outputs and relays on board the operator to allow for coordination of exit device latch retraction, electric strikes, magnetic locks, card readers, safety and motion sensors and specified auxiliary contacts.

I. Activation Devices: Provide activation devices in accordance with ANSI/BHMA A156.19 standard, for condition of exposure indicated and for long term, maintenance free operation under normal traffic load operation. Coordinate activation control with electrified hardware and access control interfaces. Activation switches are standard SPST, with optional DPDT availability.

J. Signage: As required by cited ANSI/BHMA A156.19 standard for the type of operator.

1. Acceptable Manufacturers:

a. Norton Door Controls (NO) - 6000 Series.

2.11 ARCHITECTURAL TRIM

A. Door Protective Trim

1. General: Door protective trim units to be of type and design as specified below or in the Hardware Sets.

2. Size: Fabricate protection plates (kick, armor, or mop) not more than 2" less than door width (LDW) on stop side of single doors and 1" LDW on stop side of pairs of doors, and not more than 1" less than door width on pull side. Coordinate and provide proper width and height as required where conflicting hardware dictates. Height to be as specified in the Hardware Sets.

3. Metal Protection Plates: ANSI/BHMA A156.6 certified metal protection plates (kick, armor, or mop), beveled on four edges (B4E), fabricated from the following.

a. Stainless Steel: 050-inch thick, with countersunk screw holes (CSK).
b. Brass or Bronze: 050-inch thick, with countersunk screw holes (CSK).
c. Laminate Plastic or Acrylic: 1/8-inch thick, with countersunk screw holes (CSK).

4. Fasteners: Provide manufacturer's designated fastener type as specified in the Hardware Sets.

5. Metal Door Edging: Door protection edging fabricated from a minimum .050-inch thick metal sheet, formed into an angle or "U" cap shapes, surface or mortised mounted onto edge of door. Provide appropriate leg overlap to account for protection plates as required. Height to be as specified in the Hardware Sets.

6. Acceptable Manufacturers:

a. Rockwood Manufacturing (RO).

2.12 DOOR STOPS AND HOLDERS

A. General: Door stops and holders to be of type and design as specified below or in the Hardware Sets.

B. Door Stops and Bumpers: ANSI/BHMA A156.16, Grade 1 certified door stops and wall bumpers. Provide wall bumpers, either convex or concave types with anchorage as indicated, unless floor or other types of door stops are specified in Hardware Sets. Do not mount floor stops where they will impede traffic. Where floor or wall bumpers are not appropriate, provide overhead type stops and holders.

1. Acceptable Manufacturers:

a. Rockwood Manufacturing (RO).

C. Overhead Door Stops and Holders: ANSI/BHMA A156.6, Grade 1 certified overhead stops and holders to be surface or concealed types as indicated in Hardware Sets. Track, slide, arm and jamb bracket to be constructed of extruded bronze and shock absorber spring of heavy tempered steel. Provide non-handed design with mounting brackets as required for proper operation and function.

1. Acceptable Manufacturers:

a. Rixson Door Controls (RF).
b. Rockwood Manufacturing (RO).
c. Sargent Manufacturing (SA).

2.13 ARCHITECTURAL SEALS

A. General: Thresholds, weatherstripping, and gasket seals to be of type and design as specified below or in the Hardware Sets. Provide continuous weatherstrip gasketing on exterior doors and provide smoke, light, or sound gasketing on interior doors where indicated. At exterior applications provide non-corrosive fasteners and elsewhere where indicated.

B. Smoke Labeled Gasketing: Assemblies complying with NFPA 105 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for smoke control ratings indicated, based on testing according to UL 1784.

1. Provide smoke labeled perimeter gasketing at all smoke labeled openings.

C. Fire Labeled Gasketing: Assemblies complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated, based on testing according to UL-10C.

1. Provide intumescent seals as indicated to meet UL10C Standard for Positive Pressure Fire Tests of Door Assemblies, and UBC 7-2, Fire Tests of Door Assemblies.

D. Sound-Rated Gasketing: Assemblies that are listed and labeled by a testing and inspecting agency, for sound ratings indicated, based on testing according to ASTM E 1408.

E. Replaceable Seal Strips: Provide only those units where resilient or flexible seal strips are easily replaceable and readily available from stocks maintained by manufacturer.

F. Acceptable Manufacturers:

1. Pemko Manufacturing (PE).

2.14 ELECTRONIC ACCESSORIES

A. Key Switches: Key switches furnished standard with stainless steel single gang face plate with a 12/24VDC bi-color LED indicator. Integral backing bracket permits integration with any 1 1/4" or 1 1/2" mortise type cylinder. Key switches available as momentary or maintained action and in narrow face plate options.

1. Acceptable Manufacturers:

a. Securitron (SU) - MK Series.

B. Door Position Switches: Door position magnetic reed contact switches specifically designed for use in commercial door applications. On recessed models the contact and magnetic housing snap-lock into a 1" diameter hole. Surface mounted models include wide gap distance design complete with armored flex cabling. Provide SPDT, N/O switches with optional Rare Earth Magnet installation on steel doors with flush top channels.

1. Acceptable Manufacturers:

a. Securitron (SU) - DPS Series.

2.15 FABRICATION

A. Fasteners: Provide door hardware manufactured to comply with published templates generally prepared for machine, wood, and sheet metal screws. Provide screws according to manufacturers recognized installation standards for application intended.

2.16 FINISHES

A. Standard: Designations used in the Hardware Sets and elsewhere indicate hardware finishes complying with ANSI/BHMA A156.18, including coordination with traditional U.S. finishes indicated by certain manufacturers for their products.

B. Provide quality of finish, including thickness of plating or coating (if any), composition, hardness, and other qualities complying with manufacturer's standards, but in no case less than specified by referenced standards for the applicable units of hardware.

C. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine scheduled openings, with Installer present, for compliance with requirements for installation tolerances, labeled fire door assembly construction, wall and floor construction, and other conditions affecting performance.

B. Notify architect of any discrepancies or conflicts between the door schedule, door types, drawings and scheduled hardware. Proceed only after such discrepancies or conflicts have been resolved in writing.

3.2 PREPARATION

A. Hollow Metal Doors and Frames: Comply with ANSI/DHI A115 series.

B. Wood Doors: Comply with ANSI/DHI A115-W series.

3.3 INSTALLATION

A. Install each item of mechanical and electromechanical hardware and access control equipment to comply with manufacturer's written instructions and according to specifications.

1. Installers are to be trained and certified by the manufacturer on the proper installation and adjustment of fire, life safety, and security products including: hanging devices; locking devices; closing devices; and seals.

B. Mounting Heights: Mount door hardware units at heights indicated in following applicable publications, unless specifically indicated or required to comply with governing regulations:

1. Standard Steel Doors and Frames: DHI's "Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames."
2. Wood Doors: DHI WDHS.3, "Recommended Locations for Architectural Hardware for Wood Flush Doors."
3. Where indicated to comply with accessibility requirements, comply with ANSI A117.1 "Accessibility Guidelines for Buildings and Facilities."
4. Provide blocking in drywall partitions where wall stops or other wall mounted hardware is located.

C. Retrofitting: Install door hardware to comply with manufacturer's published templates and written instructions. Where cutting and fitting are required to install door hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation of surface protective trim units with finishing work specified in Division 9 Sections. Do not install surface-mounted items until finishes have been completed on substrates involved.

D. Thresholds: Set thresholds for exterior and acoustical doors in full bed of sealant complying with requirements specified in Division 7 Section "Joint Sealants."

E. Storage: Provide a secure lock up for hardware delivered to the project but not yet installed. Control the handling and installation of hardware items so that the completion of the work will not be delayed by hardware losses before and after installation.

3.4 FIELD QUALITY CONTROL

A. Field Inspection: Supplier will perform a final inspection of installed door hardware and state in report whether work complies with or deviates from requirements, including whether door hardware is properly installed, operating and adjusted.

3.5 ADJUSTING

A. Initial Adjustment: Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.

3.6 CLEANING AND PROTECTION

A. Protect all hardware stored on construction site in a covered and dry place. Protect exposed hardware installed on doors during the construction phase. Install any and all hardware at the latest possible time frame.

B. Clean adjacent surfaces soiled by door hardware installation.

C. Clean operating items as necessary to restore proper finish. and provide final protection and maintain conditions that ensure door hardware is without damage or deterioration at time of owner occupancy.

3.7 DEMONSTRATION

A. Instruct Owner's maintenance personnel to adjust, operate, and maintain mechanical and electromechanical door hardware.

3.8 DOOR HARDWARE SCHEDULE

A. The hardware sets represent the design intent and direction of the owner and architect. They are a guideline only and should not be considered a detailed hardware schedule. Discrepancies, conflicting hardware and missing items should be brought to the attention of the architect with corrections made prior to the bidding process. Omitted items not included in a hardware set should be scheduled with the appropriate additional hardware required for proper application and functionality.

B. Manufacturer's Abbreviations:

1. MK - McKinney
2. RO - Rockwood
3. RU - Corbin Russwin
4. RF - Rixson
5. NO - Norton
6. PE - Pemko
7. SU - Securitron

Hardware Schedule

Set: 1.0

Doors: 1

2	Continuous Hinge	MCK-12HD x LAR	CL	MK
1	Exit Device (surface vertical rod, nightlatch)	ED4400 K157 M52 CT6B	630	RU
1	Exit Device (surface vertical rod, passage)	ED4400 M52	630	RU
3	Cylinder	1080	626	RU
2	Door Pull	BF158 Mtg-Type 12HD	US32D	RO
1	Door Closer	UNI7500H 7788	689	NO
1	Door Operator	6060	689	NO
1	Threshold	2005AT x LAR MSES25SS		PE
2	Sweep	3452CNB x LAR		PE
2	Position Switch	DPS-M-BK		SU
1	Door Switch	503 (Verify model meets conditions/requirements)		NO
1	Keyswitch	MKA		SU

Notes:
-Weatherstripping / door edge gasketing furnished by Aluminum Door/Frame supplier
-Furnish all necessary brackets/spacers and plates necessary for a complete and proper installation of hardware items listed.

Operation:
- During business hours, exit devices are dogged down to allow for manual entry via door pull and/or pressing push pad to activate auto operator.
- After hours, mortise exterior key switch deactivates push pad rendering it inoperable. Entry is via exit device lock.

Set: 2.0

Doors: 48

2	Continuous Hinge	MCK-25HD x LAR	CL	MK
1	Exit Device (surface vertical rod, storeroom)	ED5400 N959 M55 CT6B	630	RU
1	Exit Device (surface vertical rod, passage)	ED5400 M55	630	RU
2	Door Closer	UNI7500H	689	NO
2	Kickplate	K1050 8" high 4BE	US32D	RO
1	Threshold	2005AT x LAR MSES25SS		PE
1	Gasketing	2891APK (Head)		PE
1	Gasketing	290APK (Jambs)		PE
1	Rain Guard	346A X LAR		PE
2	Sweep	3452CNB x LAR		PE
2	Astragal	29324CNB x Dor Height		PE
2	Position Switch	DPS-M-BK		SU

Notes:

Set: 3.0- NOT USED

Set: 4.0

Doors: 2

2	Continuous Hinge	MCK-12HD x LAR	CL	MK
2	Dummy Bar	ED5000DB	630	RU
1	Door Closer	CLP7500T 7788	689	NO
1	Door Operator	6060	689	NO
1	Threshold	271A x LAR MSES25SS		PE
2	Sweep	18100CNB X LAR		PE
1	Door Switch	503 (Verify model meets conditions/requirements)		NO

Notes:
-Weatherstripping / door edge gasketing furnished by Aluminum Door/Frame supplier
-Furnish all necessary brackets/spacers and plates necessary for a complete and proper installation of hardware items listed.

Set: 5.0

Doors: 8

6	Hinge (heavy weight)	T4A3786 NRP 4-1/2" x 4-1/2"	US26D	MK
1	Exit Device (surface vertical rod, classroom)	ED5400 N955 M52 M55	630	RU
1	Exit Device (surface vertical rod, dummy trim)	ED5400 N950 M52 M55	630	RU
2	Cylinder	1080	626	RU
2	Surface Overhead Stop	10-036	630	RF
2	Door Closer	J7500H	689	NO
2	Silencer	608		RO

Set: 6.0

Doors: 10, 55

3	Hinge (heavy weight)	T4A3786 4-1/2" x 4-1/2"	US26D	MK
1	Exit Device (rim, classroom)	ED5200 N955 M52 CT6B	630	RU
1	Cylinder	1080	626	RU
1	Surface Overhead Stop	10-036	630	RF
1	Door Closer	J7500H	689	NO
1	Kickplate	K1050 8" high 4BE	US32D	RO
3	Silencer	608		RO

Set: 7.0

Doors: 7, 43, 38

6	Hinge	TA2714 NRP 4-1/2" x 4-1/2"	US26D	MK
2	Manual Flush Bolt	555	US26D	RO
1	Dust Proof Strike	570	US26D	RO
1	Mortise Lock (storeroom)	ML2057 NSM CT6B	630	RU
1	Mortise Lock (half dummy)	ML2050 NSM	630	RU
2	Surface Overhead Stop	10-036	630	RF
2	Silencer	608		RO

Set: 8.0

Doors: 32, 33, 41, 39

3	Hinge	TA2714 NRP 4-1/2" x 4-1/2"	US26D	MK
1	Mortise Lock (storeroom)	ML2057 NSM CT6B	630	RU
1	Door Stop	400	US26D	RO
3	Silencer	608		RO

Set: 9.0

Doors: 28, 30, 53, 49

3 Hinge	TA2714 NRP 4-1/2" x 4-1/2"	US26D	MK
1 Mortise Lock (storeroom)	ML2057 NSM CT6B	630	RU
1 Surface Overhead Stop	10-036	630	RF
3 Silencer	608		RO

Set: 10.0

Doors: 16, 19, 24, 27, 35, 36, 37, 4, 6

3 Hinge	TA2714 4-1/2" x 4-1/2"	US26D	MK
1 Mortise Lock (entrance)	ML2054 NSM CT6B	630	RU
1 Door Stop	400	US26D	RO
3 Silencer	608		RO

Set: 11.0

Doors: 12, 3, 31, 46, 47

3 Hinge	TA2714 4-1/2" x 4-1/2"	US26D	MK
1 Mortise Lock (entrance)	ML2054 NSM CT6B	630	RU
1 Surface Overhead Stop	10-036	630	RF
3 Silencer	608		RO

Set: 12.0

Doors: 34

3 Hinge	TA2714 4-1/2" x 4-1/2"	US26D	MK
1 Mortise Lock (passage)	ML2010 NSM	630	RU
1 Door Stop	400	US26D	RO
3 Silencer	608		RO

Set: 13.0

Doors: 17, 42, 45, 5, 54

3 Hinge	TA2714 4-1/2" x 4-1/2"	US26D	MK
1 Mortise Lock (passage)	ML2010 NSM	630	RU
1 Surface Overhead Stop	10-036	630	RF
3 Silencer	608		RO

Set: 14.0

Doors: 29

6 Hinge	TA2714 NRP 4-1/2" x 4-1/2"	US26D	MK
1 Manual Flush Bolt	555	US26D	RO
1 Dust Proof Strike	570	US26D	RO
1 Mortise Lock (classroom)	ML2055 NSM CT6B	630	RU
1 Mortise Lock (half dummy)	ML2050 NSM	630	RU
2 Surface Overhead Stop	10-036	630	RF
2 Silencer	608		RO

Set: 15.0- NOT USED

Set: 16.0

Doors: 18, 50

3 Hinge	TA2714 4-1/2" x 4-1/2"	US26D	MK
1 Mortise Lock (classroom)	ML2055 NSM CT6B	630	RU
1 Surface Overhead Stop	10-036	630	RF
3 Silencer	608		RO

Set: 17.0

Doors: 21

3 Hinge	TA2714 4-1/2" x 4-1/2"	US26D	MK
1 Mortise Lock (privacy)	ML2060 NSM	630	RU
1 Mop Plate	K1050 6" high 4BE	US32D	RO
1 Door Stop	400	US26D	RO
3 Silencer	608		RO
1 Coat Hook	RM801	US26D	RO

Set: 18.0

Doors: 11, 44

3 Hinge	TA2714 4-1/2" x 4-1/2"	US26D	MK
1 Mortise Lock (privacy)	ML2060 NSM	630	RU
1 Surface Overhead Stop	10-036	630	RF
1 Mop Plate	K1050 6" high 4BE	US32D	RO
3 Silencer	608		RO

1 Coat Hook	RM801	US26D	RO

Set: 19.0

Doors: 13

6 Hinge (heavy weight)	T4A3786 NRP 4-1/2" x 4-1/2"	US26D	MK
2 Manual Flush Bolt	555	US26D	RO
1 Dust Proof Strike	570	US26D	RO
1 Deadbolt	DL4112 CT6B	626	RU
2 Push Plate	70C	US32D	RO
2 Pull Plate	110x70C	US32D	RO
2 Surface Overhead Stop	10-036	630	RF
2 Door Closer	7500	689	NO
2 Kickplate	K1050 8" high 4BE	US32D	RO
2 Silencer	608		RO

Set: 20.0

Doors: 22, 23

3 Hinge (heavy weight)	T4A3786 4-1/2" x 4-1/2"	US26D	MK
1 Push Plate	70C	US32D	RO
1 Pull Plate	110x70C	US32D	RO
1 Door Closer	7500	689	NO
1 Kickplate	K1050 8" high 4BE	US32D	RO
1 Mop Plate	K1050 6" high 4BE	US32D	RO
1 Door Stop	400	US26D	RO
3 Silencer	608		RO

Set: 21.0

Doors: 51, 52

3 Hinge (heavy weight)	T4A3786 4-1/2" x 4-1/2"	US26D	MK
1 Push Plate	70C	US32D	RO
1 Pull Plate	110x70C	US32D	RO
1 Surface Overhead Stop	10-036	630	RF
1 Door Closer	7500	689	NO
1 Kickplate	K1050 8" high 4BE	US32D	RO
1 Mop Plate	K1050 6" high 4BE	US32D	RO
3 Silencer	608		RO

Set: 22.0

Doors: 56

3 Hinge (heavy weight)	T4A3786 NRP 4-1/2" x 4-1/2"	US26D	MK
1 Exit Device (rim, classroom)	ED5200 N955 M52 CT6B	630	RU
1 Cylinder	1080	626	RU
1 Door Closer	(PR)7500 (Reg or P/A)	689	NO
1 Kickplate	K1050 8" high 4BE	US32D	RO
1 Door Stop	400	US26D	RO
3 Silencer	608		RO

Set: 23.0

Doors: 14, 15, 20, 25, 26

1 BiFold 4-Door Hdwe Kit	HF4/100A (size as required)		PE
2 Bi Fold Pull	RM1300-6 x Type 1	US32	RO

Set: 24.0

Doors: 57

1 Bypass Door Hardware		HBP200A (size as required)		PE
2	Flush Pull	94Px94L	US32D	RO

Set: 25.0

Doors: 40

1 Continuous Hinge	CFM SLF-HD1 x Dr Ht		PE
1 Exit Device (rim, nightlatch, cd)	16 43 64 AD8504	US32D	SA
2 Core	DG1 6300	US15	SA
1 Pull-Offset	RM3411-72 x 12XHD MP	US32	RO
1 Concealed Overhead Stop	1-X36	630	RF
1 Door Closer	PR7500	689	NO
1 Threshold-T.B.	273x224AFGT MSES25SS (opening width)		PE
1 Sweep	3452CNB x Dr Width		PE

Notes:
-Weatherstripping/Door edge gasketing furnished by Aluminum Door/Frame supplier.
-Furnish all necessary brackets/spacers and plates necessary for a complete and proper installation of hardware items listed.

END OF SECTION 08710

SECTION 08800 - GLAZING

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes glazing for the following products and applications, including those specified in other Sections where glazing requirements are specified by reference to this Section:

1. Windows.
2. Interior Wood Doors with glazed openings.

1.2 ACTION SUBMITTALS

A. Product Data: For each glass product and glazing material indicated.

B. Glass Samples: For each type of glass product 12 inches square.

C. Glazing Schedule: List glass types and thicknesses for each size opening and location. Use same designations indicated on Drawings.

1.3 QUALITY ASSURANCE

A. Glazing Publications: Comply with published recommendations of glass product manufacturers and organizations below, unless more stringent requirements are indicated. Refer to these publications for glazing terms not otherwise defined in this Section or in referenced standards.
1. IGMA Publication for Insulating Glass: SIGMA TM-3000, "North American Glazing Guidelines for Sealed Insulating Glass Units for Commercial and Residential Use."

B. Safety Glazing Labeling: Where safety glazing labeling is indicated, permanently mark glazing with certification label of the SGCC or another certification agency acceptable to authorities having jurisdiction. Label shall indicate manufacturer's name, type of glass, thickness, and safety glazing standard with which glass complies.

C. Insulating-Glass Certification Program: Permanently marked either on spacers or on at least one component lite of units with appropriate certification label of IGCC.

1.4 WARRANTY

A. Manufacturer's Special Warranty on Insulating Glass: Manufacturer's standard form in which insulating-glass manufacturer agrees to replace insulating-glass units that deteriorate within specified warranty period. Deterioration of insulating glass is defined as failure of hermetic seal under normal use that is not attributed to glass breakage or to maintaining and cleaning insulating glass contrary to manufacturer's written instructions. Evidence of failure is the obstruction of vision by dust, moisture, or film on interior surfaces of glass.

1. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 GLASS PRODUCTS, GENERAL

A. Thickness: Where glass thickness is indicated, it is a minimum. Provide glass lites in thicknesses as needed to comply with requirements indicated.

B. Strength: Where float glass is indicated, provide annealed float glass, Where fully tempered glass is indicated, provide Kind FT heat-treated float glass.

C. Thermal and Optical Performance Properties: Provide glass with performance properties specified, as indicated in manufacturer's published test data, based on procedures indicated below:

1. U-Factors: Center-of-glazing values, according to NFRC 100 and based on LBL's WINDOW 5.2 computer program, expressed as Btu/sq. ft. x h x deg F (W/sq. m x K).
2. Solar Heat-Gain Coefficient and Visible Transmittance: Center-of-glazing values, according to NFRC 200 and based on LBL's WINDOW 5.2 computer program.
3. Visible Reflectance: Center-of-glazing values, according to NFRC 300.

2.2 GLASS PRODUCTS

A. Match Existing building glass type. Verify type and provide sample for architect's approval.

B. Float Glass: ASTM C 1036, Type I, Quality-Q3, Class I (clear) unless otherwise indicated.

C. Heat-Treated Float Glass: ASTM C 1048; Type I; Quality-Q3; Class I (clear) unless otherwise indicated; of kind and condition indicated.

D. Reflective-Coated Vision Glass: ASTM C 1376, coated by [pyrolytic process] [vacuum deposition (sputter-coating) process], and complying with other requirements specified.

2.3 INSULATING GLASS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Kawneer North America.

B. Insulating-Glass Units: Factory-assembled units consisting of sealed lites of glass separated by a dehydrated interspace, qualified according to ASTM E 2190, and complying with other requirements specified.

1. Sealing System: Dual seal.
2. Spacer: Manufacturer's standard spacer material to match existing windows.

C. Soft Compression Gaskets: Extruded or molded, closed-cell, integral-skinned EPDM gaskets complying with ASTM C 509, Type II, black; of profile and hardness required to maintain watertight seal.

1. Application: Use where soft compression gaskets will be compressed by inserting dense compression gaskets on opposite side of glazing or pressure applied by means of pressure-glazing stops on opposite side of glazing.

2.4 GLAZING SEALANTS

A. General:

1. Compatibility: Provide glazing sealants that are compatible with one another and with other materials they will contact, including glass products, seals of insulating-glass units, and glazing channel substrates, under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.
2. Suitability: Comply with sealant and glass manufacturers' written instructions for selecting glazing sealants suitable for applications indicated and for conditions existing at time of installation.

B. Glazing Sealants for Fire-Rated Glazing Products: Products that are approved by testing agencies that listed and labeled fire-resistant glazing products with which they are used for applications and fire-protection ratings indicated.

2.5 MISCELLANEOUS GLAZING MATERIALS

A. Cleaners, Primers, and Sealers: Types recommended by sealant or gasket manufacturer.

B. Setting Blocks: Elastomeric material with a Shore, Type A durometer hardness of 85, plus or minus 5.

C. Spacers: Elastomeric blocks or continuous extrusions of hardness required by glass manufacturer to maintain glass lites in place for installation indicated.

D. Edge Blocks: Elastomeric material of hardness needed to limit glass lateral movement (side walking).

2.6 MONOLITHIC-GLASS TYPES

2.7 INSULATING-GLASS TYPES

A. Glass Type: Low-e-coated, clear insulating glass.
1. Outdoor Lite: Fully tempered float glass.
2. Interspace Content: Air
3. Indoor Lite: Fully tempered float glass
4. Low-E Coating: Pyrolytic on second surface.
5. Visible Light Transmittance: 80 percent minimum.

6. Winter Nighttime U-Factor: 0.32 Btu/sq. ft. x h x deg F maximum.
7. Summer Daytime U-Factor: 0.32 Btu/sq. ft. x h x deg F maximum.
8. Solar Heat Gain Coefficient: 0.40 maximum.
9. Provide safety glazing labeling.

PART 3 - EXECUTION

3.1 GLAZING, GENERAL

A. Comply with combined written instructions of manufacturers of glass, sealants, gaskets, and other glazing materials, unless more stringent requirements are indicated, including those in referenced glazing publications.

B. Adjust glazing channel dimensions as required by Project conditions during installation to provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances.

C. Protect glass edges from damage during handling and installation. Remove damaged glass from Project site and legally dispose of off Project site. Damaged glass is glass with edge damage or other imperfections that, when installed, could weaken glass and impair performance and appearance.

D. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction testing.

E. Install setting blocks in sill rabbets, sized and located to comply with referenced glazing publications, unless otherwise required by glass manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.

F. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.

G. Provide spacers for glass lites where length plus width is larger than 50 inches.

H. Provide edge blocking where indicated or needed to prevent glass lites from moving sideways in glazing channel, as recommended in writing by glass manufacturer and according to requirements in referenced glazing publications.

3.2 TAPE GLAZING

A. Position tapes on fixed stops so that, when compressed by glass, their exposed edges are flush with or protrude slightly above sightline of stops.

B. Install tapes continuously, but not necessarily in one continuous length. Do not stretch tapes to make them fit opening.

C. Cover vertical framing joints by applying tapes to heads and sills first and then to jambs. Cover horizontal framing joints by applying tapes to jambs and then to heads and sills.

D. Place joints in tapes at corners of opening with adjoining lengths butted together, not lapped. Seal joints in tapes with compatible sealant approved by tape manufacturer.

E. Apply heel bead of elastomeric sealant.

F. Center glass lites in openings on setting blocks and press firmly against tape by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings.

G. Apply cap bead of elastomeric sealant over exposed edge of tape.

3.3 GASKET GLAZING (DRY)

A. Cut compression gaskets to lengths recommended by gasket manufacturer to fit openings exactly, with allowance for stretch during installation.

B. Insert soft compression gasket between glass and frame or fixed stop so it is securely in place with joints miter cut and bonded together at corners.

C. Installation with Drive-in Wedge Gaskets: Center glass lites in openings on setting blocks and press firmly against soft compression gasket by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer.

D. Installation with Pressure-Glazing Stops: Center glass lites in openings on setting blocks and press firmly against soft compression gasket. Install dense compression gaskets and pressure-glazing stops, applying pressure uniformly to compression gaskets. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer.

E. Install gaskets so they protrude past face of glazing stops.

3.4 SEALANT GLAZING (WET)

A. Install continuous spacers, or spacers combined with cylindrical sealant backing, between glass lites and glazing stops to maintain glass face clearances and to prevent sealant from extruding into glass channel and blocking weep systems until sealants cure. Secure spacers or spacers and backings in place and in position to control depth of installed sealant relative to edge clearance for optimum sealant performance.

B. Force sealants into glazing channels to eliminate voids and to ensure complete wetting or bond of sealant to glass and channel surfaces.

C. Tool exposed surfaces of sealants to provide a substantial wash away from glass.

3.5 CLEANING AND PROTECTION

A. Protect exterior glass from damage immediately after installation by attaching crossed streamers to framing held away from glass. Do not apply markers to glass surface. Remove nonpermanent labels and clean surfaces.

B. Protect glass from contact with contaminating substances resulting from construction operations. If, despite such protection, contaminating substances do come into contact with glass, remove substances immediately as recommended in writing by glass manufacturer.

C. Examine glass surfaces adjacent to or below exterior concrete and other masonry surfaces at frequent intervals during construction, but not less than once a month, for buildup of dirt, scum, alkaline deposits, or stains; remove as recommended in writing by glass manufacturer.

D. Remove and replace glass that is broken, chipped, cracked, or abraded or that is damaged from natural causes, accidents, and vandalism, during construction period.

END OF SECTION 08800

SECTION 09221 - NON-STRUCTURAL METAL FRAMING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Non-load-bearing steel framing systems for interior gypsum board assemblies.
2. Suspension systems for interior gypsum ceilings and soffits.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Test-Response Characteristics: Provide materials and construction identical to those tested according to ASTM E 119.

B. STC-Rated Assemblies: Provide materials and construction identical to those tested in assembly indicated according to ASTM E 90 and classified according to ASTM E 413.

2.2 FRAMING SYSTEMS

A. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content is not less than 25 percent.

B. Steel Studs and Runners: ASTM C 645. Use either steel studs and runners or dimpled steel studs and runners of equivalent minimum base-metal thickness.

1. Minimum Base-Metal Thickness: As indicated on Drawings.
2. Depth: As indicated on Drawings.

C. Slip-Type Head Joints: Where indicated, provide the following in thickness not less than indicated for studs and in width to accommodate depth of studs:

1. Double-Runner System: ASTM C 645 top runners, inside runner with 2-inch- deep flanges and fastened to studs, and outer runner sized to friction fit inside runner.

D. Flat Strap and Backing Plate: Steel sheet for blocking and bracing in length and width indicated.

1. Minimum Base-Metal Thickness: As indicated on Drawings.

E. Cold-Rolled Channel Bridging: Steel, 0.053-inch minimum base-metal thickness, with minimum 1/2-inch- wide flanges.

1. Depth: As indicated on Drawings.
2. Clip Angle: Not less than 1-1/2 by 1-1/2 inches, 0.068-inch- thick, galvanized steel.

F. Hat-Shaped, Rigid Furring Channels: ASTM C 645.

1. Minimum Base-Metal Thickness: As indicated on Drawings.
2. Depth: As indicated on Drawings.

G. Resilient Furring Channels: 1/2-inch- deep, steel sheet members designed to reduce sound transmission.

1. Configuration: Asymmetrical.

H. Cold-Rolled Furring Channels: 0.053-inch uncoated-steel thickness, with minimum 1/2-inch-(13-mm-) wide flanges.

1. Depth: As indicated on Drawings.
2. Furring Brackets: Adjustable, corrugated-edge type of steel sheet with minimum uncoated-steel thickness of 0.033 inch.
3. Tie Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.062-inch- diameter wire, or double strand of 0.048-inch- diameter wire.

I. Z-Shaped Furring: With slotted or nonslotted web, face flange of 1-1/4 inches, wall attachment flange of 7/8 inch, minimum uncoated-metal thickness of 0.018 inch, and depth required to fit insulation thickness indicated.

2.3 SUSPENSION SYSTEMS

A. Tie Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.062-inch- diameter wire, or double strand of 0.048-inch- diameter wire.

B. Hanger Attachments to Concrete:

1. Anchors: Capable of sustaining a load equal to five (5) times that imposed as determined by ASTM E 488.

a. Type: Postinstalled, expansion anchor.

2. Powder-Actuated Fasteners: Not permitted.

C. Wire Hangers: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.16 inch in diameter.

D. Flat Hangers: Steel sheet, in size indicated on Drawings.

E. Carrying Channels: Cold-rolled, commercial-steel sheet with a base-metal thickness of 0.053 inch and minimum 1/2-inch- wide flanges.

1. Depth: As indicated on Drawings.

F. Furring Channels (Furring Members):

1. Cold-Rolled Channels: 0.053-inch uncoated-steel thickness, with minimum 1/2-inch-wide flanges, 3/4 inch deep.
2. Steel Studs and Runners: ASTM C 645. Use either steel studs and runners or dimpled steel studs and runners of equivalent minimum base-metal thickness.

    a. Minimum Base-Metal Thickness: As indicated on Drawings.
    b. Depth: As indicated on Drawings.

3. Hat-Shaped, Rigid Furring Channels: ASTM C 645, 7/8 inch deep.

    a. Minimum Base-Metal Thickness: As indicated on Drawings.

4. Resilient Furring Channels: 1/2-inch- deep members designed to reduce sound transmission.

    a. Configuration: Asymmetrical.

2.4 AUXILIARY MATERIALS

A. Fasteners for Metal Framing: Of type, material, size, corrosion resistance, holding power, and other properties required to fasten steel members to substrates.

B. Isolation Strip at Exterior Walls: Provide foam gasket.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Installation Standard: ASTM C 754.

1. Gypsum Board Assemblies: Also comply with requirements in ASTM C 840 that apply to framing installation.

B. Install supplementary framing, and blocking to support fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, or similar construction.

C. Install bracing at terminations in assemblies.

D. Do not bridge building control and expansion joints with non-load-bearing steel framing members. Frame both sides of joints independently.

3.2 INSTALLING FRAMED ASSEMBLIES

A. Install framing system components according to spacings indicated, but not greater than spacings required by referenced installation standards for assembly types.

B. Where studs are installed directly against exterior masonry walls or dissimilar metals at exterior walls, install isolation strip between studs and exterior wall.

C. Install studs so flanges within framing system point in same direction.

D. Install tracks (runners) at floors and overhead supports. Extend framing full height to structural supports or substrates above suspended ceilings, except where partitions are indicated to terminate at suspended ceilings. Continue framing around ducts penetrating partitions above ceiling.

1. Slip-Type Head Joints: Where framing extends to overhead structural supports, install to produce joints at tops of framing systems that prevent axial loading of finished assemblies.
2. Door Openings: Screw vertical studs at jambs to jamb anchor clips on door frames; install runner track section (for cripple studs) at head and secure to jamb studs.
    a. Install two studs at each jamb unless otherwise indicated.
    b. Install cripple studs at head adjacent to each jamb stud, with a minimum 1/2-inch clearance from jamb stud to allow for installation of control joint in finished assembly.
    c. Extend jamb studs through suspended ceilings and attach to underside of overhead structure.
3. Other Framed Openings: Frame openings other than door openings the same as required for door openings unless otherwise indicated. Install framing below sills of openings to match framing required above door heads.
4. Fire-Resistance-Rated Partitions: Install framing to comply with fire-resistance-rated assembly indicated and support closures and to make partitions continuous from floor to underside of solid structure.
    a. Firestop Track: Where indicated, install to maintain continuity of fire-resistance-rated assembly indicated.
5. Sound-Rated Partitions: Install framing to comply with sound-rated assembly indicated.
6. Curved Partitions:
    a. Bend track to uniform curve and locate straight lengths so they are tangent to arcs.
    b. Begin and end each arc with a stud, and space intermediate studs equally along arcs. On straight lengths of no fewer than two studs at ends of arcs, place studs 6 inches (150 mm) o.c.

E. Direct Furring:

1. Screw to wood framing.
2. Attach to concrete or masonry with stub nails, screws designed for masonry attachment, or powder-driven fasteners spaced 24 inches o.c.

F. Z-Furring Members:

1. Erect insulation vertically and hold in place with Z-furring members spaced 24 inches.
2. Except at exterior corners, securely attach narrow flanges of furring members to wall with concrete stub nails, screws designed for masonry attachment, or powder-driven fasteners spaced 24 inches o.c.
3. At exterior corners, attach wide flange of furring members to wall with short flange extending beyond corner; on adjacent wall surface, screw-attach short flange of furring

channel to web of attached channel. At interior corners, space second member no more than 12 inches from corner and cut insulation to fit.

G. Installation Tolerance: Install each framing member so fastening surfaces vary not more than 1/8 inch from the plane formed by faces of adjacent framing.

3.3 INSTALLING SUSPENSION SYSTEMS

A. Install suspension system components according to spacings indicated, but not greater than spacings required by referenced installation standards for assembly types.

B. Isolate suspension systems from building structure where they abut or are penetrated by building structure to prevent transfer of loading imposed by structural movement.

C. Suspend hangers from building structure as follows:

1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structural or suspension system.

   a. Splay hangers only where required to miss obstructions and offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.

2. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with locations of hangers, install supplemental suspension members and hangers in the form of trapezes or equivalent devices.
3. Do not attach hangers to steel roof deck.
4. Do not attach hangers to permanent metal forms. Furnish cast-in-place hanger inserts that extend through forms.
5. Do not attach hangers to rolled-in hanger tabs of composite steel floor deck.
6. Do not connect or suspend steel framing from ducts, pipes, or conduit.

D. Fire-Resistance-Rated Assemblies: Wire tie furring channels to supports.

E. Seismic Bracing: Sway-brace suspension systems with hangers used for support.

F. Installation Tolerances: Install suspension systems that are level to within 1/8 inch in 12 feet measured lengthwise on each member that will receive finishes and transversely between parallel members that will receive finishes.

END OF SECTION 09221

SECTION 09290 - GYPSUM BOARD

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Interior gypsum board for walls and soffits
2. Exterior gypsum board soffits
3. Tile backing panels, moisture resistant.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Resistance-Rated Assemblies: For fire-resistance-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 119 by an independent testing agency.

B. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 90 and classified according to ASTM E 413 by an independent testing agency.

C. Low Emitting Materials: For ceiling and wall assemblies, provide materials and construction identical to those tested in assembly and complying 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 GYPSUM BOARD, GENERAL

A. Recycled Content of Gypsum Panel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.

B. Regional Materials: Gypsum panel products shall be manufactured within 500 miles (800 km) of Project site from materials that have been extracted, harvested, or recovered, as well as manufactured, within 500 miles (800 km) of Project site.

C. Regional Materials: Gypsum panel products shall be manufactured within 500 miles (800 km) of Project site.

2.3 INTERIOR GYPSUM BOARD

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Georgia-Pacific Gypsum LLC.
2. National Gypsum Company.
3. USG Corporation.

B. Gypsum Wallboard: ASTM C 1396/C 1396M.

1. Thickness: As indicated on Plans.
2. Long Edges: Tapered.

C. Gypsum Board, Type X: ASTM C 1396/C 1396M.

1. Thickness: As indicated on Plans.
2. Long Edges: Tapered.

D. Gypsum Ceiling Board: ASTM C 1396/C 1396M.

1. Thickness: As indicated on Plans.
2. Long Edges: Tapered.

E. Abuse-Resistant Gypsum Board: ASTM C 1629/C 1629M, Level 1.

1. Core: 5/8 inch (15.9 mm), Type X.
2. Long Edges: Tapered.
3. Mold Resistance: ASTM D 3273, score of 10 as rated according to ASTM D 3274.

F. Moisture- and Mold-Resistant Gypsum Board: ASTM C 1396/C 1396M. With moisture- and mold-resistant core.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include:
   a. USG; Fiberock Aqua-Tough

2. Core: 5/8 inch (15.9 mm), Type X-G.
3. Long Edges: Tapered.
4. Mold Resistance: ASTM D 3273, score of 10 as rated according to ASTM D 3274.

2.4 EXTERIOR GYPSUM BOARD

A. Gypsum Board, for exterior applications with compatible joint sealer system.

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. Georgia-Pacific Gypsum LLC; Fireguard C.
   b. National Gypsum Company; Gold Bond Fire-Shield C.
   c. USG Corporation; Firecode C Core.

2. Thickness: As required by fire-resistance-rated assembly indicated on Drawings.
3. Long Edges: Tapered.

2.5 TILE BACKING PANELS

A. Cementitious Backer Units: ANSI A118.9 and ASTM C 1278, with manufacturer's standard edges.

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. USG Corporation; FIBEROCK Tile Backerboard.

2. Thickness: As indicated.
3. Mold Resistance: ASTM D 3273, score of 10 as rated according to ASTM D 3274.

2.6 TRIM ACCESSORIES

A. Interior Trim: ASTM C 1047.

1. Material: Galvanized or aluminum-coated steel sheet, rolled zinc, plastic, or paper-faced galvanized steel sheet.

B. Exterior Trim: ASTM C 1047.

1. Material: Hot-dip galvanized steel sheet, or rolled zinc.

C. Aluminum Trim: ASTM B 221 (ASTM B 221M), Alloy 6063-T5.

2.7 JOINT TREATMENT MATERIALS

A. General: Comply with ASTM C 475/C 475M.

B. Joint Tape:

1. Interior Gypsum Board: Paper.
2. Exterior Gypsum Soffit Board: Paper.
3. Tile Backing Panels: As recommended by panel manufacturer.

C. Joint Compound for Interior and Exterior Gypsum Board: For each coat use formulation that is compatible with other compounds applied on previous or for successive coats.

2.8 AUXILIARY MATERIALS

A. Laminating Adhesive: Adhesive or joint compound recommended for directly adhering gypsum panels to continuous substrate.

1. Laminating adhesive shall have a VOC content of 50g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
2. Laminating adhesive 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. Steel Drill Screws: ASTM C 1002, unless otherwise indicated.

C. Sound Attenuation Blankets: ASTM C 665, Type I (blankets without membrane facing).

1. Recycled Content of Blankets: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.

D. Acoustical Joint Sealant: ASTM C 834. Product effectively reduces airborne sound transmission through perimeter joints and openings as demonstrated by testing according to ASTM E 90.

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. Grabber Construction Products; Acoustical Sealant GSC.
b. Pecora Corporation; AC-20 FTR.
c. USG Corporation; SHEETROCK Acoustical Sealant.

2. Acoustical joint sealant shall have a VOC content of 250g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
3. Acoustical joint sealant shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

E. Thermal Insulation: As specified in Section 072100 "Thermal Insulation."

F. Vapor Retarder: As specified in Section 072100 "Thermal Insulation."

PART 3 - EXECUTION

3.1 APPLYING AND FINISHING PANELS

A. Comply with ASTM C 840.

B. Examine panels before installation. Reject panels that are wet, moisture damaged, and mold damaged.

C. Isolate perimeter of gypsum board applied to non-load-bearing partitions at structural abutments, except floors. Provide 1/4- to 1/2-inch- (6.4- to 12.7-mm-) wide spaces at these locations and trim edges with edge trim where edges of panels are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.

D. Install trim with back flanges intended for fasteners, attach to framing with same fasteners used for panels. Otherwise, attach trim according to manufacturer's written instructions.

1. Aluminum Trim: Install in locations indicated on Drawings.
2. Control Joints: Install control joints according to ASTM C 840 and in specific locations approved by Architect for visual effect.

E. Prefill open joints and damaged surface areas.

F. Apply joint tape over gypsum board joints, except for trim products specifically indicated as not intended to receive tape.

G. Gypsum Board Finish Levels: Finish panels to levels indicated below and according to ASTM C 840:

1. Level 2: Panels not exposed to view.
2. Level 4: At panel surfaces that will be exposed to view unless otherwise indicated.

    a. Primer and its application to surfaces are specified in Section 099123 "Interior Painting."

H. Protect adjacent surfaces from drywall compound and texture finishes and promptly remove from floors and other non-drywall surfaces. Repair surfaces stained, marred, or otherwise damaged during drywall application.

I. Remove and replace panels that are wet, moisture damaged, and mold damaged.

END OF SECTION 09290

SECTION 09300 - TILING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Ceramic tile.
2. Stone thresholds.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. Samples:

1. Each type and composition of tile and for each color and finish required.
2. Assembled samples, with grouted joints, for each type and composition of tile and for each color and finish required.
3. Stone thresholds in 6-inch lengths.

1.3 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match and are from same production runs as products installed and that are packaged with protective covering and identified with labels describing contents.

1. Tile and Trim Units: Furnish quantity of full-size units equal to 3 percent of amount installed for each type, composition, color, pattern, and size indicated.

PART 2 - PRODUCTS

2.1 TILE PRODUCTS

A. ANSI Ceramic Tile Standard: Provide Standard grade tile that complies with ANSI A137.1 for types, compositions, and other characteristics indicated.

B. FloorScore Compliance: Tile for floors shall comply with requirements of FloorScore Standard.

C. Low-Emitting Materials: Tile flooring systems shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

D. Tile Type: Factory-mounted unglazed or glazed ceramic mosaic tile.

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

a. American Olean; Division of Dal-Tile International Inc.
b. Daltile; Division of Dal-Tile International Inc.
c. Interceramic.

2. Composition: Porcelain.
3. Module Size: As indicated on Drawings.
4. Thickness: 1/4 inch.
5. Face: Plain with cushion edges.
6. Surface: Smooth, without abrasive admixture.
7. Finish: As indicated on Drawings.
8. Tile Color and Pattern: As indicated on Drawings. Provide color chart for review.
9. Grout Color: As selected by Architect from manufacturer's full range.
10. Trim Units: Coordinated with sizes and coursing of adjoining flat tile where applicable and matching characteristics of adjoining flat tile. Provide shapes as follows, selected from manufacturer's standard shapes:

    a. Base Cove: Cove, module size 2 by 1 inch
    b. Wainscot Cap: Surface bullnose, module size 2 by 1 inch
    c. External Corners: Surface bullnose, module size 2 by 1 inch
    d. Internal Corners: Cove, module size 2 by 1 inch

E. Tile Type: Unglazed or Glazed paver tile.

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

    a. American Olean; Division of Dal-Tile International Inc.
    b. Daltile; Division of Dal-Tile International Inc.
    c. Interceramic.

2. Composition: Porcelain.
3. Face Size: As indicated on Drawings.
4. Thickness: As indicated on Drawings.
5. Face: As indicated on Drawings.
6. Finish: As indicated on Drawings.
7. Tile Color and Pattern: As indicated on Drawings.
8. Grout Color: As selected by Architect from manufacturer's full range.
9. Trim Units: Coordinated with sizes and coursing of adjoining flat tile where applicable and matching characteristics of adjoining flat tile. Provide shapes as follows, selected from manufacturer's standard shapes:

    a. Base Cove: Cove, module size same as adjoining flat tile.
    b. External Corners: Surface bullnose, module size same as adjoining flat tile.
    c. Internal Corners: Cove, module size same as adjoining flat tile.
    d. Tapered Transition Tile: Shape designed to effect transition between thickness of tile floor and adjoining floor finishes of different thickness, tapered to provide reduction in thickness from 1/2 to 1/4 inch across nominal 4-inch dimension.

F. Tile Type: Glazed wall tile.

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

    a. American Olean; Division of Dal-Tile International Inc.
    b. Daltile; Division of Dal-Tile International Inc.

2. Module Size: As indicated on Drawings.
3. Thickness: 5/16 inch.
4. Face: As indicated on Drawings.
5. Finish: As indicated on Drawings.
6. Tile Color and Pattern: As indicated on Drawings.
7. Grout Color: As selected by Architect from manufacturer's full range.
8. Mounting: Factory, back mounted.
9. Mounting: Pregrouted sheets of tiles factory assembled and grouted with manufacturer's standard white silicone rubber.
10. Trim Units: Coordinated with sizes and coursing of adjoining flat tile where applicable and matching characteristics of adjoining flat tile. Provide shapes as follows, selected from manufacturer's standard shapes:

    a. Base: Coved module size, same as adjoining flat tile.
    b. Wainscot Cap: Surface bullnose, module size, same as adjoining flat tile.
    c. External Corners for Thin-Set Mortar Installations: Surface bullnose, same size as adjoining flat tile.
    d. Internal Corners: Field-butted square corners. For coved base and cap use angle pieces designed to fit with stretcher shapes.

2.2 THRESHOLDS

A. General: Fabricate to sizes and profiles indicated or required to provide transition between adjacent floor finishes.

1. Bevel edges at 1:2 slope, with lower edge of bevel aligned with or up to 1/16 inch above adjacent floor surface. Finish bevel to match top surface of threshold. Limit height of threshold to 1/2 inch or less above adjacent floor surface.

B. Marble Thresholds: ASTM C 503, with a minimum abrasion resistance of 10 per ASTM C 1353 or ASTM C 241 and with honed finish.

C. Latex-Portland Cement Mortar (Thin Set): ANSI A118.4.

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. Bostik, Inc.
    b. Laticrete International, Inc.
    c. MAPEI Corporation.
    d. Summitville Tiles, Inc.

2. Prepackaged, dry-mortar mix to which only water must be added.
3. Prepackaged, dry-mortar mix combined with liquid-latex additive.

4. For wall applications, provide nonsagging mortar.

2.3 GROUT MATERIALS

A. Standard Cement Grout: ANSI A118.6.

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. Bostik, Inc.
b. Laticrete International, Inc.
c. MAPEI Corporation.
d. Summitville Tiles, Inc.

2.4 MISCELLANEOUS MATERIALS

A. Trowelable Underlayments and Patching Compounds: Latex-modified, portland cement-based formulation provided or approved by manufacturer of tile-setting materials for installations indicated.

B. Elastomeric Sealants: Comply with requirements of Section 07920 "Joint Sealants".

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions where tile will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of installed tile.

1. Verify that substrates for setting tile are firm, dry, clean, free of coatings that are incompatible with tile-setting materials including curing compounds and other substances that contain soap, wax, oil, or silicone; and comply with flatness tolerances required by ANSI A108.01 for installations indicated.

3.2 PREPARATION

A. Fill cracks, holes, and depressions in concrete substrates for tile floors installed with thin-set mortar with trowelable leveling and patching compound specifically recommended by tile-setting material manufacturer.

B. Where indicated, prepare substrates to receive waterproofing by applying a reinforced mortar bed that complies with ANSI A108.1A and is sloped 1/4 inch per foot (1:50) toward drains.

C. Blending: For tile exhibiting color variations, use factory blended tile or blend tiles at Project site before installing.

D. Field-Applied Temporary Protective Coating: If indicated under tile type or needed to prevent grout from staining or adhering to exposed tile surfaces, precoat them with continuous film of temporary protective coating, taking care not to coat unexposed tile surfaces.

3.3 INSTALLATION

A. Comply with TCA's "Handbook for Ceramic Tile Installation" for TCA installation methods specified in tile installation schedules. Comply with parts of the ANSI A108 Series "Specifications for Installation of Ceramic Tile" that are referenced in TCA installation methods, specified in tile installation schedules, and apply to types of setting and grouting materials used.

1. For the following installations, follow procedures in the ANSI A108 Series of tile installation standards for providing 95 percent mortar coverage:

   a. Tile floors in wet areas.
   b. Tile floors composed of tiles 8 by 8 inches or larger.
   c. Tile floors composed of rib-backed tiles.

B. Extend tile work into recesses and under or behind equipment and fixtures to form complete covering without interruptions unless otherwise indicated. Terminate work neatly at obstructions, edges, and corners without disrupting pattern or joint alignments.

C. Accurately form intersections and returns. Perform cutting and drilling of tile without marring visible surfaces. Carefully grind cut edges of tile abutting trim, finish, or built-in items for straight aligned joints. Fit tile closely to electrical outlets, piping, fixtures, and other penetrations so plates, collars, or covers overlap tile.

D. Provide manufacturer's standard trim shapes where necessary to eliminate exposed tile edges.

E. Jointing Pattern: Lay tile in grid pattern unless otherwise indicated. Lay out tile work and center tile fields in both directions in each space or on each wall area. Lay out tile work to minimize the use of pieces that are less than half of a tile. Provide uniform joint widths unless otherwise indicated.

F. Joint Widths: Unless otherwise indicated, install tile with the following joint widths:

1. Ceramic Mosaic Tile: 1/16 inch.
2. Glazed Wall Tile: 1/16 inch
3. Decorative Thin Wall Tile: 1/16 inch

G. Lay out tile wainscots to dimensions indicated or to next full tile beyond dimensions indicated.

H. Expansion Joints: Provide expansion joints and other sealant-filled joints, including control, contraction, and isolation joints, where indicated. Form joints during installation of setting materials, mortar beds, and tile. Do not saw-cut joints after installing tiles.

1. Where joints occur in concrete substrates, locate joints in tile surfaces directly above them.

2. Prepare joints and apply sealants to comply with requirements in Section 07920 "Joint Sealants."

I. Stone Thresholds: Install stone thresholds in same type of setting bed as adjacent floor unless otherwise indicated.

1. At locations where mortar bed (thickset) would otherwise be exposed above adjacent floor finishes, set thresholds in latex-portland cement mortar (thin set).

J. Grout Sealer: Apply grout sealer to cementitious grout joints in tile floors according to grout-sealer manufacturer's written instructions. As soon as grout sealer has penetrated grout joints, remove excess sealer and sealer from tile faces by wiping with soft cloth.

END OF SECTION 09300

SECTION 09511 - ACOUSTICAL PANEL CEILINGS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes acoustical panels and exposed suspension systems for ceilings.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples: For each exposed product and for each color and texture specified.

1.3 INFORMATIONAL SUBMITTALS

A. Product test reports.

B. Evaluation reports.

C. Field quality-control reports.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance data.

1.5 QUALITY ASSURANCE

A. Testing Agency Qualifications: Qualified according to NVLAP.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Acoustical ceiling shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

B. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Flame-Spread Index: Comply with ASTM E 1264 for Class A materials.
2. Smoke-Developed Index: 50 or less.

2.2 ACOUSTICAL PANEL CEILINGS, GENERAL

A. Low-Emitting Materials: Acoustical panel ceilings shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

B. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 50 percent.

C. Glass-Fiber-Based Panels: Made with binder containing no urea formaldehyde.

D. Acoustical Panel Standard: Comply with ASTM E 1264.

E. Metal Suspension System Standard: Comply with ASTM C 635.

F. Attachment Devices: Size for five times the design load indicated in ASTM C 635, Table 1, "Direct Hung," unless otherwise indicated. Comply with seismic design requirements.

2.3 ACOUSTICAL PANELS

A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

1. Armstrong World Industries, Inc.
2. CertainTeed Corp.
3. Chicago Metallic Corporation.
4. USG Interiors, Inc.; Subsidiary of USG Corporation.

B. Classification: See drawings

C. Color: White.

D. LR: .80 min.

E. NRC: .50 min., Type E-400 mounting according to ASTM E 795.

F. Edge/Joint Detail: Provide manufacturer's samples for architect to review.

G. Thickness: 3/4 inch.

H. Modular Size: As indicated on Drawings.

2.4 METAL SUSPENSION SYSTEM

A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

1. Armstrong World Industries, Inc.
2. CertainTeed Corp.
3. Chicago Metallic Corporation.
4. USG Interiors, Inc.; Subsidiary of USG Corporation.

B. Narrow-Face, Capped, Double-Web, Steel Suspension System: Main and cross runners roll formed from cold-rolled steel sheet; prepainted, electrolytically zinc coated, or hot-dip galvanized according to ASTM A 653/A 653M, not less than G30 (Z90) coating designation; with prefinished 9/16-inch- wide metal caps on flanges.

1. Structural Classification: Intermediate-duty system.

2. End Condition of Cross Runners: Override (stepped) or butt-edge type.
3. Face Design: Flat, flush.
4. Cap Material: Steel or aluminum cold-rolled sheet.
5. Cap Finish: Painted white.

C. Roll-Formed, Sheet-Metal Edge Moldings and Trim: Type and profile indicated or, if not indicated, manufacturer's standard moldings for edges and penetrations that comply with seismic design requirements; formed from sheet metal of same material, finish, and color as that used for exposed flanges of suspension-system runners.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install acoustical panel ceilings to comply with ASTM C 636/C 636M and seismic design requirements indicated, according to manufacturer's written instructions and CISCA's "Ceiling Systems Handbook."

B. Measure each ceiling area and establish layout of acoustical panels to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width panels at borders, and comply with layout shown on reflected ceiling plans.

1. Arrange directionally patterned acoustical panels as indicated on reflected ceiling plans.

END OF SECTION 09511

09640 ENGINEERED HARDWOOD FLOORING

PART 1 – GENERAL

1.1 SECTION INCLUDES
1. Performance Plus- Acrylic Impregnated Engineered Hardwood Flooring
2. Maintenance materials.
3. Finish moldings

1.2 RELATED SECTIONS
1. Section: 03 10 00 - Concrete Forming
2. Section: 03 30 00 - Cast-in-place Concrete
3. Section: 06 10 00 - Rough Carpentry

A. Alternates
1. Prior Approval: Unless otherwise provided for in the Contract documents, proposed product substitutions may be submitted no later than TEN (10) working days prior to the date established for receipt of bids. Acceptability of a proposed substitution is contingent upon the Architect's review of the proposal for acceptability and approved products will be set forth by the Addendum. If included in a Bid are substitute products which have not been approved by Addendum, the specified products shall be provided without additional compensation.
2. Submittals which do not provide adequate data for the product evaluation will not be considered. The proposed substitution must meet all requirements of this section, including but not necessarily limited to, the following: Single source materials suppliers (if specified in Section 1.5); flooring design, size, composition, color, and finish; Trims, Moldings, sizes; Compliance with the referenced standards.

1.3 REFERENCES
American Society for Testing and Materials (ASTM):
A. ASTM E648 –Standard Test Method for critical Radiant Flux of Floor Covering systems using a radiant heat energy sources 0.45 watts/cm^2 or greater, Class 1.
B. ASTM F1869 - Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride.
C. ASTM F710 - Practice for Preparing Concrete Floors.
D. ASTM F2170-09 Standard test method for determining relative humidity in concrete slabs using In-Situ-probes.

1.4 SUBMITTALS
A. Submit product data in accordance with Section (01 30 00) (01 33 00), including the manufacturer's installation and maintenance instructions.
B. Submit three representative samples of the Performance Plus Engineered Hardwood Flooring in the final color(s) or custom color(s), and species with Permion UV cured finish if selected by the owner or their representative.
C. Installer Certification: Submit a list of at least three installations successfully completed within the past year requiring the same general degree of installation expertise.
D. Shop Drawings: Show floor pattern layout.

1.5 QUALITY ASSURANCE

A. Installer: Shall be experienced in the wood and/or vinyl tile flooring industry and shall have a minimum of five (5) years experience in the installation of similar products.
B. Pre-Installation meeting: Conduct an on-site pre-installation meeting to verify project requirements, substrate conditions, manufacturer's installation instructions and manufacturer's warranty requirements.
C. Mock-ups: At the project site, install a job mock-up using acceptable products and manufacturer approved installation methods, including concrete substrate testing. Obtain Owner's and Consultant's acceptance of finish color, texture and workmanship standards.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver the flooring to a preferred 35-55% relative humidity job site in unopened cartons. Protect flooring from exposure to moisture. Moisture producing activities such as drywall, concrete, masonry, painting and grouting must be complete and cured prior to the delivery of wood flooring.
B. Cartons of Performance Plus Engineered Hardwood Flooring should be delivered to the site on the day of installation. No acclimation time is necessary for installing Performance Plus Engineered Hardwood Flooring.
C. Cartons of wood should be stored in dry, well ventilated storage areas or warehouses. Never store cartons of flooring outdoors. The ideal storage area environment should be kept at 35-55% relative humidity and 60-80°F . Do not store cartons of flooring directly on concrete floors.

1.7 PROJECT CONDITIONS

A. Provide permanent HVAC operation (2 week minimum) and permanent lighting prior to installation.
B. Maintain room temperature between 60-80°F and relative humidity between 35% and 55%, prior to, during and after the installation. Keep in mind that if the relative humidity drops below 35% for extended periods, the flooring may contract causing unsightly splits and gaps.
C. Do not install flooring until all other significant construction work is complete. Close spaces to traffic during the installation of the flooring and protect the surface as necessary with a breathable material after the completion of the installation.
D. Do not install flooring over concrete slabs until they are dry enough to achieve a bond with the adhesive in accordance with the manufacturer's recommended bond and moisture test.

1.8 WARRANTY

Performance Plus Engineered Hardwood Flooring offers a 10 year Limited Permion Finish Warranty and Full Lifetime Structural Integrity Warranty. Full lifetime adhesive bond warranty is also offered when using Armstrong approved recommended adhesives.

1.9 MAINTENANCE

Prior to turning the floor over to the owner, it shall be thoroughly cleaned by sweeping, vacuuming or dust mopping to remove debris, followed by cleaning with Armstrong Hardwood and Laminate Floor Cleaner.

A. Initial Care: Remove any adhesive residue or petroleum based products with the appropriate cleaner (low odor mineral spirits). Urethane adhesive should be removed with the appropriate urethane adhesive cleaner. Thoroughly clean the floor with Armstrong Hardwood and Laminate Floor Cleaner. Dampen a CLEAN cloth with the materials, do not soak. DO

NOT USE dirty mops or those that contain the residue of dust attracting compounds. Dust mop the floor as normal, misting the materials periodically while proceeding throughout the installation.

B. Routine Care (daily)-Clean the floor as needed with Armstrong Hardwood and Laminate Floor Cleaner (see above for application recommendations).
C. Periodic Care (weekly-monthly)-Dust mop the floor as recommended under daily care. Buff the floor using a medium high speed buffer (175-750 RPM) and white/buff colored buffing pads. Apply Armstrong Hardwood and Laminate floor cleaner to the surface in the path of the buffing machine using a misting bottle while proceeding throughout the installation.

PART 2 – PRODUCTS

2.1 MANUFACTURER
Flooring, adhesive, maintenance materials and other components shall be produced by Armstrong or certified as compatible with components produced by Armstrong.

2.2 ENGINEERED WOOD FLOORING MATERIALS
A. Species:
2. Dimensions:
Width
Thickness
See construction drawings for location provide manufacturers full range of samples for architect's selection.
Length: Variable: 9" – 48"
Wear layer thickness: 1/12"
Number of plys: 5
3. Finish: Permion commercial UV cured factory applied finish.
4. Construction: Engineered multi-ply laminated construction. Each plank to meet or exceed Hardwood Plywood Veneer Association (HPVA) Type II bond test.
7. Milling: Tongue and groove sides, end matched.
8. Fire Ratings: ASTM E648 Critical Flux of 0.45 watts/cm^2 or greater, Class 1.
B. Adhesive: Bruce Equalizer or Armstrong 57 moisture-cured adhesive.
C. Mechanical fasteners: as recommended for machine but not less than 1-3/16" in length.
D. Select Maintenance Materials: Armstrong Hardwood and Laminate Floor Cleaner.

A. Provide all available coordinating transition and molding pieces designated to meet installation application for finishing and transitioning to other floor products. Install in accordance with Armstrong's guidelines and intended use.
B. For completing minor repairs during installation provide coordinated Armstrong acrylic filler or touch-up kit that corresponds and blends with the product color.
C. For added noise reduction, sound absorption, thermal insulation, and moisture barrier provide Armstrong's S-1836 Quiet Comfort Premium Underlayment Or S-1837 Quiet Comfort Underlayment for floating Applications.
D. For completing glue down applications use Bruce Equalizer Or Armstrong 57 premium urethane adhesives.
E. For moisture remediation on concrete slabs tested with ASTM method F 1869 exceeding maximum Hardwood requirement of 3 lbs/1000 ft2/24 hr period, not to exceed 12 lbs/1000 ft2/ 24 hr Moisture Vapor Emission Rate (MVER) use Armstrong VapArrest (S-

135) Professional Moisture Retardant System. For Glue down installations over S-135 use the recommended Urethane adhesives only.
Floating installations can be installed over S-135.

PART 3: EXECUTION

3.1 EXAMINATION

A. Concrete Subfloor

1. Verify that the substrate is clean and free of laitance, loose material, grease, oil, coatings and other contaminants that will interfere with the bonding of the adhesive. Concrete surface sealers must be removed if present.
2. Verify that the substrate is flat, smooth, free from cracks, holes, and ridges and other defects impairing performance or appearance.
3. Verify that new slab cure is a minimum of 30 days, preferably 60 days.
4. Verify the concrete is visually sound and dry. Calcium Chloride Moisture Tests
5. (ASTM F1869) or Internal Relative Humidity Test (ASTM F2170-09 In-Situ Probe Test) must be performed for warranty consideration. Using Armstrong 57 or Bruce Equalizer in direct to concrete applications moisture vapor transmission must not exceed 3 lbs./1000 square feet/24 hrs, In-Situ Probe test not to exceed 75% RH. If vapor transmission rate exceeds 3 lbs/1000 square feet/24hrs and is less than 12 lbs./1000 square feet/24hrs or RH is excess of 75%. Apply Armstrong VapArrest Moisture Retardant System as directed.
6. Concrete Alkalinity: Verify that PH levels of the concrete are 5-9 (ASTM F710).

B. Wood Subfloors

1. Must be dry, clean, structurally sound, flat to within 3/16" in 10 ft., well nailed and/or glued, free of voids and with flat joint alignment.
2. The wood subflooring materials should not exceed 13% moisture content. Using a reliable wood moisture meter, check the moisture content of the subfloor.
3. Ensure that all nail heads are set flush with or below surface.
4. Must be sanded smooth to remove varnish, high edges, chips, or other contaminants. Use thick 5/8" (16mm) or 3/4" (19mm) APA-CDX grade underlayment plywood or equivalent.
5. Allow 1/8"-1/4" (3,2-6,4mm) expansion space between sheets with staggered joints. Leave 3/4" (19mm) minimum expansion space at all vertical obstructions.

C. All Subfloors

1. Coordinate work with that of other trades prior to installation so that no discrepancies exist with the installation of doors, frames, saddles, floor drains or any materials that would interfere in any other way.
2. Notify Architect of moisture test results and any unsatisfactory conditions. Do not begin installation until unsatisfactory conditions have been corrected. Beginning the installation means that the substrate and job site conditions have been accepted as suitable. Failure to call attention to defects or imperfections will be construed as acceptance and approval of the sub-floor. Installation indicates acceptance of substrates with regard to conditions existing at the time of installation.

3.2 PREPARATION

A. Scour all concrete surfaces, except when using floating method, using 3 ½ open coat (20 grit) sand paper.

B. Sweep and vacuum substrate, and ensure that surface is free of oil, grease, wax, dust, or any other foreign substances.
C. Use Armstrong S-194 Patch, Underlayment and Embossing Leveler with S-195 Latex Underlayment Additive to patch cracks, holes and depressions of small areas. Sand and/or scour patched areas smooth after material is cured. Use only quality materials and/or products, which do not contain gypsum.
D. If approved self-leveling underlayments are used, they must dry sufficiently (run moisture test) and be sanded smooth before installing floor. Armstrong is not responsible for strength, adhesion, or general performance of underlayments as proper compounding and preparation of subsurface is the responsibility of the installer.

3.3 INSTALLATION

NOTE: A Mechanical Fastener, direct-bond glue or floating installation must be specified. Complete installation instructions for all types of installations are included in each carton of hardwood flooring or at Armstrong.com

A. Floating floor will utilize Armstrong Quiet Comfort or Armstrong Quiet Comfort Premium foam underlayment and Armstrong 99 Hardwood & Laminate Flooring Adhesive.
B. Follow manufacturer's installation instructions supplied in each carton of material.
C. Spread adhesive using recommended trowel per manufacturer's instructions.
D. Always install while adhesive is still wet.
E. Spread adhesive only over surface that can be finished within working time of the adhesive.
F. It is extremely important to remove excess adhesive using low odor mineral spirits while the adhesive is still fresh. Cured adhesive cannot be removed.
G. Scribe, cut and fit to permanent fixtures, columns, walls, partitions, pipes, outlets and built-in furniture and cabinets leaving the manufacturer's required expansion space. Install the flooring with adhesives, tools and procedures in strict accordance with the manufacturer's written instructions. Follow the recommended adhesive trowel notching, open times and working times. If mechanical fastening the flooring follow the correct fastener and staples as provide in the manufacturer's instructions.
H. Install trim, molding and transition strips per manufacturer's installation instructions.

3.4 PROTECTION

Protect finished floor from abuse by other trades using heavy kraft paper or equivalent. Keep traffic out of spaces and areas where flooring is being installed until adhesive has set. Light foot traffic after 10-12 hours. Normal traffic after 24 hours.

A. Preventive Maintenance
Mats at all entrances help keep dirt and moisture from being tracked in. Mats should be slip-resistant with a backing that is breathable and will not discolor the floor. Vacuum, sweep or dust mop regularly. Never damp mop with water as it may permanently damage the floor. Use Armstrong Hardwood and Laminate Floor Cleaner to remove spills or spots. For stubborn spots, use low odor mineral spirits. Satisfactory performance of wood floors is greatly influenced by its environmental conditions. A temperature of 70°F (21°C) and relative humidity between 35% and 50% is ideal. Humidifiers can be used during the drier times to eliminate cracks that can be caused by excessive drying of wood. Dehumidifiers or air conditioners can be used to prevent wood floors from buckling by reducing high humidity levels.

As with all hardwood flooring, it is important to properly clean and maintain wood floors to prevent substances, including but not limited to water, food and grease, from making the floor slippery.

B. Water Spots
Minerals or chemicals in water may cause spotting when water from spills evaporates. These spots can be removed with a soft cloth dampened with Armstrong Hardwood and Laminate Floor Cleaner or white vinegar.

C. Scratches
For light scratches or color loss use Armstrong Touchup kit or Acrylic filler. Repairs may also be made by replacing individual boards.

D. Rubber Heel Marks, Crayon, Gum or Asphalt Deposits
Dampen a clean cloth with Mineral Spirits and rub to remove.

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TB-401 05/06

END OF SECTION 09640

SECTION 09651 - RESILIENT TILE FLOORING AND WALL BASE

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. Vinyl composition floor tile.
2. Resilient wall base and accessories.

1.3 SUBMITTALS

A. Product Data: For each type of product specified.

B. Samples for Verification: Full-size tiles of each different color and pattern of resilient floor tile specified, showing the full range of variations expected in these characteristics. Provide manufaturers full color range for review by architect.

C. Maintenance Data: For resilient floor tile to include in the maintenance manuals specified in Division 1.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: Engage an experienced installer to perform work of this Section who has specialized in installing resilient products similar to those required for this Project and with a record of successful in-service performance.

B. Source Limitations: Obtain each type, color, and pattern of product specified from one source with resources to provide products of consistent quality in appearance and physical properties without delaying the Work.

C. Fire-Test-Response Characteristics: Provide products with the following fire-test-response characteristics as determined by testing identical products per test method indicated below by a testing and inspecting agency acceptable to authorities having jurisdiction.

1. Critical Radiant Flux: 0.45 W/sq. cm or greater when tested per ASTM E 648.
2. Smoke Density: Maximum specific optical density of 450 or less when tested per ASTM E 662.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to Project site in manufacturer's original, unopened cartons and containers, each bearing names of product and manufacturer, Project identification, and shipping and handling instructions.

B. Store products in dry spaces protected from the weather, with ambient temperatures maintained between 10 and 32 deg C.

C. Store tiles on flat surfaces.

D. Move products into spaces where they will be installed at least 48 hours before installation, unless longer conditioning period is recommended in writing by manufacturer.

1.6 PROJECT CONDITIONS

A. Maintain a temperature of not less than 21 deg C or more than 35 deg C in spaces to receive products for at least 48 hours before installation, during installation, and for at least 48 hours after installation, unless manufacturer's written recommendations specify longer time periods. After postinstallation period, maintain a temperature of not less than 13 deg C or more than 35 deg C.

B. Do not install products until they are at the same temperature as the space where they are to be installed.

C. Install tiles and accessories after other finishing operations, including painting, have been completed.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Products: Resilient tile products that may be incorporated into the Work are named below. Use of manufacturer's product designating patterns and colors is not intended to limit use of equivalent products from other manufacturers. In addition to being subject to compliance with requirements, any proposed substitution shall match named products for texture, pattern, and color. Failure to meet such visual requirements, as evaluated by the Contracting Officer, shall be sufficient reason for rejection.

2.2 RESILIENT TILE

A. Vinyl Composition Floor Tile: Products complying with ASTM F 1066, Composition 1 (nonasbestos formulated), 300 mm x 300 mm x 3 mm thick.

B. Patterns and colors: As noted on Drawings.

2.3 RESILIENT WALL BASE

A. Products complying with FS SS-W-40, Type I, 100 mm high, with exterior and interior preformed corners as required to make a complete system. Provide coved bottom wall base at locations receiving resilient floor tile or carpet.

B. Patterns and colors: As noted on Drawings.

2.4 INSTALLATION ACCESSORIES

A. Trowelable Leveling and Patching Compounds: Latex-modified, portland-cement-based formulation provided or approved by flooring manufacturer for applications indicated.

B. Adhesives: Water-resistant type recommended by manufacturer to suit resilient products and substrate conditions indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions where installation of resilient products will occur, with Installer present, for compliance with manufacturer's requirements. Verify that substrates and conditions are satisfactory for resilient product installation and comply with requirements specified.

B. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. General: Comply with resilient product manufacturer's written installation instructions for preparing substrates indicated to receive resilient products.

B. Use trowelable leveling and patching compounds, according to manufacturer's written instructions, to fill cracks, holes, and depressions in substrates.

C. Remove coatings, including curing compounds, and other substances that are incompatible with flooring adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by manufacturer. Do not use solvents.

D. Broom and vacuum clean substrates to be covered immediately before product installation. After cleaning, examine substrates for moisture, alkaline salts, carbonation, or dust. Do not proceed with installation until unsatisfactory conditions have been corrected.

E. Apply concrete slab primer, if recommended by flooring manufacturer, prior to applying adhesive. Apply according to manufacturer's directions.

3.3 TILE INSTALLATION

A. General: Comply with tile manufacturer's written installation instructions.

1. Lay out tiles from center marks established with principal walls, discounting minor offsets, so tiles at opposite edges of room are of equal width. Adjust as necessary to avoid using cut widths that equal less than one-half of a tile at perimeter. Lay tiles square with room axis, unless otherwise indicated.

B. Match tiles for color and pattern by selecting tiles from cartons in the same sequence as manufactured and packaged, if so numbered. Cut tiles neatly around all fixtures. Discard broken, cracked, chipped, or deformed tiles. Lay tiles with grain running in one direction.

C. Scribe, cut, and fit tiles to butt neatly and tightly to vertical surfaces and permanent fixtures, including built-in furniture, cabinets, pipes, outlets, edgings, door frames, thresholds, and nosings.

D. Extend tiles into toe spaces, door reveals, closets, and similar openings.

E. Adhere tiles to flooring substrates using a full spread of adhesive applied to substrate to comply with tile manufacturer's written instructions, including those for trowel notching, adhesive mixing, and adhesive open and working times.

1. Provide completed installation without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, and other surface imperfections.

F. Hand roll tiles according to tile manufacturer's written instructions.

3.4 RESILIENT WALL BASE INSTALLATION

A. General: Install resilient wall base according to manufacturer's written installation instructions.

B. Apply resilient wall base to walls, columns, pilasters, casework and cabinets in toe spaces, and other permanent fixtures in rooms and areas where base is required.

1. Install wall base in lengths as long as practicable without gaps at seams and with tops of adjacent pieces aligned.
2. Tightly adhere wall base to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates.
3. Do not stretch base during installation.
4. Install premolded outside and inside corners before installing straight pieces.
5. Install resilient wall base at carpet locations after carpet is installed..

3.5 CLEANING AND PROTECTING

A. Perform the following operations immediately after installing resilient products:

1. Remove adhesive and other surface blemishes using cleaner recommended by resilient product manufacturers.
2. Sweep or vacuum floor thoroughly.
3. Do not wash floor until after time period recommended by flooring manufacturer.
4. Damp-mop floor to remove marks and soil.

B. Protect flooring against mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during the remainder of construction period. Use protection methods indicated or recommended in writing by flooring manufacturer.

1. Apply protective floor polish to floor surfaces that are free from soil, visible adhesive, and surface blemishes, if recommended in writing by manufacturer.

    a. Use commercially available product acceptable to flooring manufacturer.
    b. Coordinate selection of floor polish with Government's maintenance service.

2. Cover products installed on floor surfaces with undyed, untreated building paper until inspection for Substantial Completion.
3. Do not move heavy and sharp objects directly over floor surfaces. Place plywood or hardboard panels over flooring and under objects while they are being moved. Slide or roll objects over panels without moving panels.

C. Clean floor surfaces not more than 4 days before dates scheduled for inspections intended to establish date of Substantial Completion in each area of Project. Clean products according to manufacturer's written recommendations.

1. Before cleaning, strip protective floor polish that was applied after completing installation only if required to restore polish finish and if recommended by flooring manufacturer.
2. After cleaning, reapply polish to floor surfaces to restore protective floor finish according to flooring manufacturer's written recommendations. Coordinate with Owner's maintenance program.

END OF SECTION 09651

SECTION 09662 - RESINOUS MATRIX TERRAZZO FLOORING

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes thin-set, epoxy-resin terrazzo flooring and base.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: Include terrazzo installation requirements. Include plans, elevations, sections, component details, and attachments to other work.

C. Samples: For each exposed product and for each color and texture specified.

1.3 CLOSEOUT SUBMITTALS

A. Maintenance data.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: Engage an installer who is a contractor member of NTMA.

B. Mockups: Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

1.5 FIELD CONDITIONS

A. Environmental Limitations: Comply with manufacturer's written instructions for substrate temperature, ambient temperature, moisture, ventilation, and other conditions affecting terrazzo installation.

B. Control and collect water and dust produced by grinding operations. Protect adjacent construction from detrimental effects of grinding operations.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. NTMA Standards: Comply with NTMA's "Terrazzo Specifications and Design Guide" and with written recommendations for terrazzo type indicated unless more stringent requirements are specified.

B. FloorScore Compliance: Terrazzo floors shall comply with requirements of FloorScore Standard.

C. Low-Emitting Materials: Flooring system 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 EPOXY-RESIN TERRAZZO

A. Epoxy-Resin Terrazzo: Comply with NTMA's "Terrazzo Specifications and Design Guide" and manufacturer's written instructions for matrix and aggregate proportions and mixing.

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

   a. Crossfield Products Corp., Dex-O-Tex Division
   b. General Polymers; Sherwin Williams; Terrazzo 1100.
   c. Key Resin Company; Key Epoxy Terrazzo.
   d. Master Terrazzo Technologies LLC; Morricite.
   e. Quadrant Chemical Corporation; Quadset Epoxy Terrazzo.
   f. TEC Specialty; H.B. Fuller Construction Products Inc; Tuff-Lite Epoxy Terrazzo.
   g. Terrazzo & Marble Supply Companies; Terroxy Resin Systems.

2. Thickness: 3/8 inch nominal.
3. Mix Color and Pattern: As selected by Architect from NTMA standard-terrazzo plates

B. Materials:

1. Flexible Reinforcing Membrane: Manufacturer's resinous membrane with fiberglass scrim for substrate-crack preparation and reflective-crack reduction.
2. Primer: Manufacturer's product recommended for substrate and use indicated
3. Epoxy-Resin Matrix: Manufacturer's standard recommended for use indicate] and in color required for mix indicated.

   a. Physical Properties without Aggregates:

      1) Hardness: 60 to 85 per ASTM D 2240, Shore D.
      2) Minimum Tensile Strength: 3000 psi per ASTM D 638 for a 2-inch specimen made using a "C" die per ASTM D 412.
      3) Minimum Compressive Strength: 10,000 psi) per ASTM D 695, Specimen B cylinder.

4) Chemical Resistance: No deleterious effects by contaminants listed below after seven-day immersion at room temperature per ASTM D 1308.

a) Distilled water.
b) Mineral water.
c) Isopropanol.
d) Ethanol.
e) 0.025 percent detergent solution.
f) 1.0 percent soap solution.
g) 10 percent sodium hydroxide.
h) 10 percent hydrochloric acid.
i) 30 percent sulfuric acid.
j) 5 percent acetic acid.

b. Physical Properties with Aggregates: For resin blended with Georgia white marble, ground, grouted, and cured per requirements in NTMA's "Terrazzo Specifications and Design Guide"; comply with the following:

1) Flammability: Self-extinguishing, maximum extent of burning 1/4 inch per ASTM D 635.
2) Thermal Coefficient of Linear Expansion: 0.0025 inch/inch per deg F for temperature range of minus 12 to plus 140 deg F per ASTM D 696.

4. Aggregates: Comply with NTMA gradation standards for mix indicated and contain no deleterious or foreign matter.

a. Abrasion and Impact Resistance: Less than 40 percent loss per ASTM C 131.
b. 24-Hour Absorption Rate: Less than 0.75 percent.
c. Dust Content: Less than 1.0 percent by weight.
d. Recycled Content of Epoxy-Resin Terrazzo: Postconsumer recycled content plus one-half of preconsumer recycled content not less than percent.

5. Finishing Grout: Resin based.

2.3 STRIP MATERIALS

A. Thin-Set Divider Strips: L-type angle, 1/4 inch deep.

1. Material: In color selected from full range of industry colors.
2. Top Width: [As indicate, 1/8 inch, 1/4 inch

B. Heavy-Top Divider Strips: L-type angle in depth required for topping thickness indicated.

1. Bottom-Section Material: Galvanized steel
2. Top-Section Material: in color selected from full range of industry colors
3. Top-Section Width: 1/4 inch

C. Control-Joint Strips: Separate, double L-type angles, positioned back to back, that match material and color of divider strips and in depth required for topping thickness indicated.

D. Accessory Strips: Match divider-strip width, material, and color unless otherwise indicated. Use the following types of accessory strips as required to provide a complete installation:

1. Base-bead strips for exposed top edge of terrazzo base.
2. Edge-bead strips for exposed edges of terrazzo.
3. Nosings for terrazzo stair treads and landings.

2.4 MISCELLANEOUS ACCESSORIES

A. Strip Adhesive: Epoxy-resin adhesive recommended by adhesive manufacturer for this use.

1. Adhesives shall have a VOC content of 70 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
2. Adhesives shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

B. Strip Anchoring Devices: Provide mechanical anchoring devices or adhesives for strip materials as recommended by manufacturer and required for secure attachment to substrate.

C. Patching and Fill Material: Terrazzo manufacturer's resinous product approved and recommended by manufacturer for application indicated.

D. Joint Compound: Terrazzo manufacturer's resinous product approved and recommended by manufacturer for application indicated.

E. Resinous Matrix Terrazzo Cleaner: Chemically neutral cleaner with pH factor between 7 and 10 that is biodegradable, phosphate free, and recommended by sealer manufacturer for use on terrazzo type indicated.

F. Sealer: Slip- and stain-resistant, penetrating-type sealer that is chemically neutral; does not affect terrazzo color or physical properties; is recommended by sealer manufacturer; and complies with NTMA's "Terrazzo Specifications and Design Guide" for terrazzo type indicated.

1. Surface Friction: Not less than 0.6 according to ASTM D 2047.
2. Acid-Base Properties: With pH factor between 7 and 10.
3. Sealers shall have a VOC content of 200 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

PART 3 - EXECUTION

3.1 PREPARATION

A. Clean substrates of substances, including oil, grease, and curing compounds, that might impair terrazzo bond. Provide clean, dry, and neutral substrate for terrazzo application.

B. Concrete Slabs:

1. Provide sound concrete surfaces free of laitance, glaze, efflorescence, curing compounds, form-release agents, dust, dirt, grease, oil, and other contaminants incompatible with terrazzo.

    a. Shot-blast surfaces with an apparatus that abrades the concrete surface, contains the dispensed shot within the apparatus, and recirculates the shot by vacuum pickup.
    b. Repair damaged and deteriorated concrete according to terrazzo manufacturer's written recommendations. Install flexible reinforcing membrane at substrate cracks in areas to receive terrazzo.
    c. Use patching and fill material to fill holes and depressions in substrates according to terrazzo manufacturer's written instructions.

C. Verify that concrete substrates are dry and moisture-vapor emissions are within acceptable levels according to manufacturer's written instructions.

1. Moisture Testing: Test for moisture content by method recommended in writing by terrazzo manufacturer. Proceed with installation only after substrates pass testing.

3.2 EPOXY-RESIN TERRAZZO INSTALLATION

A. Comply with NTMA's written recommendations for terrazzo and accessory installation.

B. Place according to manufacturer's written instructions and NTMA's "Terrazzo Specifications and Design Guide."

C. Installation Tolerance: Limit variation in terrazzo surface from level to 1/4 inch in 10 feet; noncumulative.

D. Primer: Apply to terrazzo substrates according to manufacturer's written instructions.

E. Strip Materials:

1. Divider and Control-Joint Strips:

    a. Locate divider strips in locations indicated
    b. Install control-joint strips back to back directly above concrete-slab control joints
    c. Install control-joint strips with 1/4-inch gap between strips, and install sealant in gap.
    d. Install strips in adhesive setting bed without voids below strips, or mechanically anchor strips as required to attach strips to substrate, as recommended by strip manufacturer.

2. Accessory Strips: Install as required to provide a complete installation.
3. Abrasive Strips: Install with surface of abrasive strip positioned 1/16 inch higher than terrazzo surface.

F. Repair: Cut out and replace terrazzo areas that evidence lack of bond with substrate. Cut out terrazzo areas in panels defined by strips and replace to match adjacent terrazzo, or repair panels according to NTMA's written recommendations, as approved by Architect.

3.3 CLEANING AND PROTECTION

A. Cleaning:

1. Remove grinding dust from installation and adjacent areas.
2. Wash surfaces with cleaner according to NTMA's written recommendations and manufacturer's written instructions; rinse surfaces with water and allow them to dry thoroughly.

B. Sealing:

1. Seal surfaces according to NTMA's written recommendations.
2. Apply sealer according to sealer manufacturer's written instructions.

C. Protection: Provide final protection and maintain conditions, in a manner acceptable to Installer, that ensure that terrazzo is without damage or deterioration at time of Substantial Completion.

END OF SECTION 09662

SECTION 09681 - TILE CARPETING

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes modular, tufted carpet tile.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. LEED Submittals:

1. Product Data for Credit EQ 4.3:

   a. For carpet tile, documentation indicating compliance with testing and product requirements of CRI's "Green Label Plus" program.
   b. For installation adhesive, documentation including printed statement of VOC content.

2. Laboratory Test Reports for Credit EQ 4: For carpet and installation adhesives documentation indicating that products comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

C. Shop Drawings: Show the following:

1. Columns, doorways, enclosing walls or partitions, built-in cabinets, and locations where cutouts are required in carpet tiles.
2. Type of subfloor.
3. Type of installation.
4. Pattern of installation.
5. Pattern type, location, and direction.
6. Pile direction.

D. Samples: For each exposed product and for each color and texture specified.

E. Sustainability: Provide the Statement of the Achievement Level the carpet has attained for Gold, 52 to 70 points, based on specific Sustainable Attribute Performance for all product stages according to ANSI/NSF 140.

1.4 INFORMATIONAL SUBMITTALS

A. Product test reports.

B. Sample warranty.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance data.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer who is certified by the International Certified Floorcovering Installers Association at the Commercial II certification level.

B. Fire-Test-Response Ratings: Where indicated, provide carpet tile identical to those of assemblies tested for fire response according to NFPA 253 by a qualified testing agency.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Comply with CRI 104.

1.8 FIELD CONDITIONS

A. Comply with CRI 104 for temperature, humidity, and ventilation limitations.

1.9 WARRANTY

A. Special Warranty for Carpet Tiles: Manufacturer agrees to repair or replace components of carpet tile installation that fail in materials or workmanship within specified warranty period.

1. Warranty does not include deterioration or failure of carpet tile due to unusual traffic, failure of substrate, vandalism, or abuse.
2. Failures include, but are not limited to, more than 10 percent edge raveling, snags, runs, dimensional stability, excess static discharge, loss of tuft bind strength, loss of face fiber, and delamination.
3. Warranty Period: 5 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 CARPET TILE: See drawings for locations and specification.

A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

1. Mannington Commercial.

B. Color: As selected by Architect from manufacturer's full range, see Finish Schedule.

C. Pattern: As indicated on Finish Schedule

D. Fiber Content: Provide samples for architect's review and approval. TBD.

E. Fiber Type:

F. Pile Characteristic: Based on sample.

G. Yarn Twist: Based on sample

H. Yarn Count: Based on sample.

I. Density: Based on sample – Approval.

J. Pile Thickness: .118 inches for finished carpet tile.

K. Stitches: 9.8 per inch.

L. Gage: TBD. Based on sample approval.

M. Surface Pile Weight: 21oz./sq. yd.

N. Total Weight: based on sample.

O. Primary Backing/Backcoating: Manufacturer's standard composite materials.

P. Secondary Backing: Manufacturer's standard material.

Q. Backing System:

R. Size: 24 by 24 inches.

S. Applied Soil-Resistance Treatment: Manufacturer's standard material.

T. Antimicrobial Treatment: Manufacturer's standard material.

U. Performance Characteristics: As follows:

1. Appearance Retention Rating: Heavy traffic, 3.0 minimum according to ASTM D 7330.
2. Dry Breaking Strength: Not less than 100 lbf according to ASTM D 2646.
3. Tuft Bind: Not less than 3 lbf according to ASTM D 1335.
4. Delamination: Not less than 3.5 lbf/in. according to ASTM D 3936.
5. Dimensional Tolerance: Within 1/32 inch of specified size dimensions, as determined by physical measurement.
6. Dimensional Stability: 0.2 percent or less according to ISO 2551 (Aachen Test).
7. Resistance to Insects: Comply with AATCC 24.
8. Colorfastness to Crocking: Not less than 4, wet and dry, according to AATCC 165.

9. Colorfastness to Light: Not less than 4 after 40 AFU (AATCC fading units) according to AATCC 16, Option E.
10. Antimicrobial Activity: Not less than 2-mm halo of inhibition for gram-positive bacteria, not less than 1-mm halo of inhibition for gram-negative bacteria, and no fungal growth, according to AATCC 174.
11. Electrostatic Propensity: Less than 3.5 kV according to AATCC 134.
12. Emissions: Provide carpet tile that complies with testing and product requirements of CRI's "Green Label Plus" program.
13. Emissions: Provide carpet tile that complies with the 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 INSTALLATION ACCESSORIES

A. Trowelable Leveling and Patching Compounds: Latex-modified, hydraulic-cement-based formulation provided or recommended by carpet tile manufacturer.

B. Adhesives: Water-resistant, mildew-resistant, nonstaining, pressure-sensitive type to suit products and subfloor conditions indicated, that complies with flammability requirements for installed carpet tile and is recommended by carpet tile manufacturer for releasable installation.

1. Adhesives shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
2. Adhesives shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

PART 3 - EXECUTION

3.1 INSTALLATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for maximum moisture content, alkalinity range, installation tolerances, and other conditions affecting carpet tile performance. Examine carpet tile for type, color, pattern, and potential defects.

B. Concrete Subfloors: Verify that concrete slabs comply with ASTM F 710.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

D. Preparation: Comply with CRI 104, Section 6.2, "Site Conditions; Floor Preparation," and with carpet tile manufacturer's written installation instructions for preparing substrates indicated to receive carpet tile installation.

E. Installation: Comply with CRI 104, Section 14, "Carpet Modules," and with carpet tile manufacturer's written installation instructions.

F. Installation Method: As recommended in writing by carpet tile manufacturer, Glue down; install every tile with full-spread, releasable, pressure-sensitive adhesive. Maintain dye lot integrity. Do not mix dye lots in same area.

G. Cut and fit carpet tile to butt tightly to vertical surfaces, permanent fixtures, and built-in furniture including cabinets, pipes, outlets, edgings, thresholds, and nosings. Bind or seal cut edges as recommended by carpet tile manufacturer.

H. Extend carpet tile into toe spaces, door reveals, closets, open-bottomed obstructions, removable flanges, alcoves, and similar openings.

I. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on finish flooring as marked on subfloor. Use nonpermanent, nonstaining marking device.

J. Install pattern parallel to walls and borders.

K. Perform the following operations immediately after installing carpet tile:

1. Remove excess adhesive, seam sealer, and other surface blemishes using cleaner recommended by carpet tile manufacturer.
2. Remove yarns that protrude from carpet tile surface.
3. Vacuum carpet tile using commercial machine with face-beater element.

L. Protect installed carpet tile to comply with CRI 104, Section 16, "Protecting Indoor Installations."

END OF SECTION 09681

SECTION 09690 - ACCESS FLOORING

PART 1 - GENERAL

1.1 Section Includes

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

B. Work of this section includes, but is not limited to: access floor panels, floor coverings, understructure and various electrical, data and communication accessories.

1.2A Related Sections

A. Concrete sealer shall be compatible with pedestal adhesive, see Division 3.

B. Provide "Grounding and Bonding for Electrical Systems" for connection to ground of access flooring understructure. Note: The electrical engineer or contractor shall determine requirements for grounding and the electrical contractor shall provide the necessary labor and materials to electrically connect the access flooring to the building ground if it is required.

1.3 Environmental Conditions for Storage and Installation

A. Area to receive and store access floor materials shall be enclosed and maintained at ambient temperatures between 35° to 95° F and relative humidity levels between 20 to 80%. All floor panels shall be stored at ambient temperatures between 50° to 90° F for at least 24 hours before installation begins. All areas of installation shall be enclosed and maintained at ambient temperature between 50° to 90° F and at relative humidity levels between 20% to 80% and shall remain within these environmental limits throughout occupancy.

1.4 References

A. CISCA (Ceilings & Interior Systems Construction Association) - "Recommended Test Procedures for Access Floors" shall be used as a guideline when presenting load performance product information.

1.5 Performance Certification

A. Product tests shall be witnessed and certified by independent engineering and testing laboratory based in the U.S. with a minimum of five years experience testing access floor components in accordance CISCA "Recommended Test Procedures for Access Floors".

1.6 Country-of-Origin and Product Marking

A. Access floor materials shall comply with the provisions outlined in FAR Subpart 25.2 – Buy American Act – Construction Materials.

B. Floor panels shall be permanently marked with manufacturer's name, product identification, manufacturing date and country-of-origin. Removable Product ID stickers are not acceptable.

1.7 Performance Requirements

A. Design Load: Panel supported on actual understructure system shall be capable of supporting a point load of 1250 lbs applied on a one square inch area at any location on the panel without experiencing permanent set as defined by CISCA. The loading method used to determine design (allowable) load shall be in conformance with CISCA Concentrated Load test method but with panel tested on actual understructure instead of steel blocks.

B. Safety Factor: Panel supported on actual understructure system shall withstand a point load of no less than (2) two times the design load rating on a one square inch area anywhere on the panel without failure when tested in accordance with CISCA A/F, Section 2 "Ultimate Loading". Failure is defined as the point at which the system will no longer accept the load.

C. Ultimate Load: Panel supported on actual understructure system shall be capable of supporting a point load of at least 2500 lbs applied through a load indentor on a one square inch area at any location on the panel without failure (i.e. minimum safety factor of 2) when tested in accordance with CISCA A/F, Section 2, "Ultimate Loading".

D. Rolling Load: Panel supported on actual understructure system shall be able to withstand the following rolling loads at any location on the panel without developing a local and overall surface deformation greater than 0.040 inches when tested in accordance with CISCA A/F, Section 3, "Rolling Loads". Note: wheel 1 and wheel 2 tests shall be performed on two separate panels.

CISCA Wheel 1:	Size: 3" dia x 1 13/16" wide	Load: 1125 lbs. Passes: 10
CISCA Wheel 2:	Size: 6" dia x 2" wide	Load: 875 lbs. Passes: 10,000

E. Impact Load: Panel supported on actual understructure (the system) shall be capable of supporting an impact load of 150 lbs. dropped from a height of 36 inches onto a one square inch area (using a round or square indentor) at any location on the panel when tested in accordance with CISCA A/F Section 8, "Drop Impact Load Test".

F. Panel Drop Test: Panel shall be capable of being dropped face up onto to a concrete slab from a height of 36", after which it shall continue to meet all load performance requirements as previously defined.

G. Panel Cutout: Panel with an 8" diameter interior cutout supported on actual understructure shall be capable of maintaining its design load strength with a minimum safety factor of 2 anywhere on the panel without the use of additional supports.

H. Flammability: System shall meet *Class A* Flame spread requirements for flame spread and smoke development. Tests shall be performed in accordance with ASTM-E84-1998, Standard Test Method for Surface Burning Characteristics for Building Materials.

I. Combustibility: All components of the access floor system shall qualify as noncombustible by demonstrating compliance with requirements of ASTM E 136, Standard Test Method for Behavior of Materials in a Vertical Tube Furnace at 750 deg C.

J. Recycled Content: Panel and understructure system shall be required to have a minimum post-consumer recycled content of 18% and a minimum total recycled content of 49%

K. Axial Load: Pedestal support assembly shall provide a minimum 6000 lb. axial load without permanent deformation when tested in accordance with CISCA A/F, Section 5, "Pedestal Axial Load Test.".

L. Overturning Moment: Pedestal support assembly shall provide an average overturning moment of 1000 in-lbs. when glued to a clean, sound, uncoated concrete surface when tested in accordance with CISCA A/F, Section 6, "Pedestal Overturning Moment Test".. ICBO number for the specific system or structural calculations shall be required attesting to the lateral stability of the system under seismic conditions.

1.8 Design Requirements:

A. Access floor system, where indicated on the design documents, shall consist of modular and removable fully encased cementitious filled welded steel panels fastened onto, and supported by, adjustable height pedestal assemblies. Pedestal head and panel corner design must provide a positive location and lateral engagement of the panel to the understructure support system without the use of fasteners.

B. Panel shall be easily removed by one person with a suction cup lifting device and shall be interchangeable except where cut for special conditions.

C. Quantities, finished floor heights (FFH) and location of accessories shall be as specified on the contract drawings.

1.9A Submittals for Review

A. Detail sheets, for each proposed product type, which provide the necessary information to describe the product and its performance.

B. Test reports, certified by an independent testing laboratory with a minimum of five years experience testing access floor components in accordance CISCA Recommended Test Procedures, certifying that component parts perform as specified.

1.9B Submittals for Information

A. Manufacturer's installation instructions and guidelines.

B. Manufacturer's Owner Manual outlining recommended care and maintenance procedures.

PART 2 - PRODUCTS

2.1 Manufacturers

A. Access floor system shall be as manufactured by Tate Access Floors, Inc. and shall consist of the ConCore® 1250 access floor panel supported by PosiLock understructure system.

B. Alternative products shall meet or exceed all requirements as indicated herein and must receive prior written approval by the architect or designer.

C. Access floor manufacture shall be ISO9001:2000 certified demonstrating it has a robust and well documented quality management system with continual improvement goals and strategies.

D. Access floor manufacturer's facilities shall be ISO14001:2004 certified demonstrating that they maintain an environmental management system.

E. Access floor manufacturer's facilities shall be OHSAS 18001:2007 certified demonstrating that they maintain an Occupational Health and Safety Management system.

2.2 Support Components

Pedestals:

A. Pedestal assemblies shall be corrosive resistant, all steel welded construction, and shall provide an adjustment range of +/- 1" for finished floor heights 6" or greater.

B. Pedestal assemblies shall provide a means of leveling and locking the assembly at a selected height, which requires deliberate action to change height setting and prevents vibration displacement.

C. Pedestal head shall be designed with locating tabs and integral shape to interface with the panel for positive lateral retention and positioning without fasteners. Note: This allows the floor to be installed during the construction process without screws so that access by other related trades can be accomplished quickly and easily. It also enables the user to have a mixed installation of fastened and unfastened panels within the same installation.

D. Hot dip galvanized steel pedestal head shall be welded to a threaded rod which includes a specially designed adjusting nut. The nut shall provide location lugs to engage the pedestal base assembly, such that deliberate action is required to change the height setting.

E. Threaded rod shall provide a specially designed anti-rotation device, such that when the head assembly is engaged in the base assembly, the head cannot freely rotate (for FFH of 6" or greater). Note: This prevents the assembly from inadvertently losing its leveling adjustment when panels are removed from the installation during use.

F. Hot dip galvanized pedestal base assembly shall consist of a formed steel plate with no less than 16 inches of bearing area, welded to a 7/8" square steel tube and shall be designed to engage the head assembly.

2.3 Panel Components

Floor Panels:

A. Panels shall consist of a top steel sheet welded to a formed steel bottom pan filled internally with a lightweight cementitious material. Mechanical or adhesive methods for attachment of the steel top and bottom sheets are unacceptable.

B. Cementitious fill material shall be totally encased within the steel welded shell except where cut for special conditions. Note: This greatly reduces the potential for dust in the environment from exposed cement materials.

C. Panel shall have an electrically conductive epoxy paint finish.

D. Corner of panel shall have a locating tab and integral shape design to interface with the pedestal head for positive lateral retention and positioning with or without fasteners.

E. Fastening of panels to pedestal heads shall be accomplished by the use of a machine screw which is specially designed to be self capturing within the body of the panel. Note: This prevents the inadvertent loss of panel fastening screws when accessing the underfloor space and potential damage to objects by screws which extend beyond the depth of the panel.

F. Top surface of the panel shall have an option for four positioning location holes to engage positioning buttons on the PosiTile® carpet tile for precise matching of the carpet tile to the panel.

G. Fit between the pedestal head, panel, and screw shall enable an installation with an average panel to panel gap of 0.015".

2.4 Accessories

A. Provide manufacturer's standard steps, ramps, fascia plate, perimeter support, and grommets where indicated on the contract drawings.

B. Provide 5% spare floor panels and 20 square feet of understructure systems for each type used in the project for maintenance stock. Deliver to project in manufacturer's standard packaging clearly marked with the contents.

C. Provide 2 panel lifting devices.

D. When applicable provide manufacturer's standard underfloor air systems components (including grilles and diffusers) where indicated on the contract drawings.

2.5 Finishes

A. Carpet tile: Access floor system shall be designed to accommodate a modular carpet tile (PosiTile®) that precisely matches one carpet tile to one ConCore® panel. This is accomplished utilizing four precisely located positioning buttons on the carpet tile which engage into four positioning location holes within the top surface of the access floor panel. The carpet tile's durable backing maintains dimensional stability, and holds the carpet tile flat without adhesives. Adhesives are not necessary and shall not be permitted on the Positile installation except where the carpet is cut and more than two positioners are removed.

B. Edge treatments for factory applied finishes shall be as follows:

All Other Finishes: Monolithic.

2.6 Fabrication Tolerances

A. Floor panel flatness measured on a diagonal: +/- 0.035"
B. Floor panel flatness measured along edges: +/- 0.025"
C. Floor panel width or length of required size: +/- 0.010"
D. Floor panel squareness tolerance: +/- 0.015"

PART 3 - EXECUTION

3.1 Preparation

A. Examine structural subfloor for unevenness, irregularities and dampness that would affect the quality and execution of the work. Do not proceed with installation until structural floor surfaces are level, clean, and dry as completed by others.

B. Concrete sealers, if used, shall be identified and proven to be compatible with pedestal adhesive. Verify that adhesive achieves bond to slab before commencing work.

C. Verify dimensions on contract drawings, including level of interfaces including abutting floor, ledges and doorsills.

D. The General Contractor shall provide clear access, dry subfloor area free of construction debris and other trades throughout installation of access floor system.

E. Area to receive and store access floor materials shall be enclosed and maintained at ambient temperatures between 35° to 95° F and relative humidity levels between 20 to 80%. At least 24 hrs. before installation begins, all floor panels shall be stored at ambient temperatures between 50° to 90° F and relative humidity levels between 20% to 80% and shall remain within these environmental limits throughout occupancy.

3.2 Installation

A. Pedestal locations shall be established from approved shop drawings so that mechanical and electrical work can be installed without interfering with pedestal installation.

B. Installation of access floor shall be coordinated with other trades to maintain the integrity of the installed system. All traffic on access floor shall be controlled by access floor installer. No traffic but that of access floor installers shall be permitted on any floor area for 24 hours to allow the pedestal adhesive to set. Access floor panels shall not be removed by other trades for 72 hours after their installation.

C. Floor system and accessories shall be installed under the supervision of the manufacturer's authorized representative and according to manufacturer's recommendations.

D. No dust or debris producing operations by other trades shall be allowed in areas where access floor is being installed to ensure proper bonding of pedestals to subfloor.

E. Access floor installer shall keep the subfloor broom clean as installation progresses.

F. Partially complete floors shall be braced against shifting to maintain the integrity of the installed system where required.

G. Additional pedestals as needed shall support panels where floor is disrupted by columns, walls, and perimeter cutouts.

H. Understructure shall be aligned such that all uncut panels are interchangeable and fit snugly but do not bind when placed in alternate positions.

I. Finished floor shall be level, not varying more than 0.062" in 10 feet or 0.125" overall.

J. Inspect system prior to application of floor covering and replace any floor panels that are cracked, broken and structurally damaged and do not comply with specified requirements.

K. Installed panels shall be straight and square and spaced so that the distance from one end to the other of any line of 12 panels is not less than 24 feet and does not exceed 24' 1/8".

L. Acceptance: General contractor shall accept floor in whole or in part prior to allowing use by other trades.

M. All cable and wire openings shall be sealed with manufacturer's removable cable cutout seal or grommets.

END OF SECTION 09690

SECTION 09771 - WOOD VENEER WALL PANELS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

Drawings and general conditions of Contract, including General and Supplementary Conditions and Divisions-1 Specification sections apply to work of this section.

1.2 SUMMARY

A. Section Includes:
   1. Wall panels and installation components.

B. Related Sections:
   1. Section 09290 - Gypsum Board

C. Alternates
   1. Prior Approval: Unless otherwise provided for in the Contract documents, proposed product substitutions may be submitted no later than TEN (10) working days prior to the date established for receipt of bids. Acceptability of a proposed substitution is contingent upon the Architect's review of the proposal for acceptability and approved products will be set forth by the Addenda. If included in a Bid are substitute products which have not been approved by Addenda, the specified products shall be provided without additional compensation.
   2. Submittals which do not provide adequate data for the product evaluation will not be considered. The proposed substitution must meet all requirements of this section, including but not neccessarily limited to, the following: Single source materials suppliers (if specified in Section 1.5); panel design, size, composition, color, and finish; installation system component profiles and sizes; compliance with the referenced standards.

1.3 REFERENCES

A. Test Methods:
   1. ASTM C 423 Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method.
   2. ASTM E 84 Standard Test Method for Surface Burning Characteristics of Building Materials
   3. ASTM E 90 Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions.
   4. CAN/ULC S102 Standard Test Method for Surface Burning Characteristics of Building Materials.
   5. California Special Environmental Requirements Specification Section 01350 Protocol: Standard Practice for Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chamber CA/DHS/EHLB/R-174

1.4 SUBMITTALS

A. Product Data: Submit manufacturer's technical data for each type of wall panel required.

B. Samples: Minimum 3 inch x 6 inch samples of specified wall panel.

C. Certifications: Manufacturer's certifications that products comply with specified requirements, including laboratory reports showing compliance with specified tests and standards.

D. Shop Drawings: Submit shop drawings showing how panels are to be laid out on the walls, details of trim members and width of panels. Width of panels and location of vertical seams are critical.

1.5 QUALITY ASSURANCE

A. Single-Source Responsibility: Provide acoustical panel units and installation components by a single manufacturer.

B. Fire Performance Characteristics: Identify wall components with appropriate markings of applicable testing and inspecting organization.
   1. Surface Burning Characteristics: As follows, tested per ASTM E 84
      a. Flame Spread: 75 or less
      b. Smoke Developed: 450 or less

C. Emissions Levels: Where indicated in Part 2, Products, the product has been tested per California Special Environmental Requirements Protocol.

D. Applicable LEED Credits:
   a. Credit MR 4.1, 4.2 Recycled Content
   b. Credit MR 5.1, 5.2 Regional Materials (*dependent upon project location)*
   c. Credit EQ 4.4 Low-Emitting Materials, Composite Wood

E. Coordination of Work: Coordinate wall work with installers of related work including, but not limited to building insulation, gypsum board, light fixtures, mechanical systems, electrical systems, and sprinklers.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver wall panels to project site in original, unopened packages and store them in a fully enclosed space where they will be protected against damage from moisture, direct sunlight, surface contamination, and other causes.

B. The wood veneer panels should not be stored in spaces where the temperature or humidity conditions vary greatly from the temperatures and conditions that will be normal in the occupied space. The temperature should be between 50 degrees F and 86 degrees F and relative humidity should not fall below 25 percent or exceed 55 percent.

C. Before installing wall panels, permit them to reach room temperature and a stabilized moisture content.
D. Handle wall panels carefully to avoid chipping edges or damaged units in any way.

1.7 PROJECT CONDITIONS

A. Space Enclosure:

Wood veneer wall panel materials should be permitted to reach room temperature and have a stabilized moisture content for a minimum of 72 hours before installation.

The wood veneer panels should not be stored or installed in spaces where the temperature or humidity conditions vary greatly from the temperatures and conditions that will be normal in the occupied space.

As interior finish products, the wood veneer panels are designed for installation in temperature conditions between 50 degrees F and 86 degrees F, in spaces where the building is enclosed and HVAC systems are functioning and will be in continuous operation. Relative humidity should not fall below 25 percent or exceed 55 percent.

1.8 WARRANTY

A. Wall Panel: Submit a written warranty executed by the manufacturer, agreeing to repair or replace acoustical panels that fail within the warranty period. Failures include, but are not limited to:
   1. Wall Panels: Manufacturer's defects

B. Warranty Period:
   1. all panels: One (1) year 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 the requirements of the Contract Documents.

1.9 MAINTENANCE

A. Extra Materials: Deliver extra materials to Owner. Furnish extra materials described below that match products installed. Packaged with protective covering for storage and identified with appropriate labels.
   1. Wall Panels: Furnish quanity of full-size units equal to 5.0 percent of amount installed.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Wall Panels:
   1. Armstrong World Industries, Inc.

2.2 WALL PANELS

A. Wall Panels: Provide manufacturers full range of panel types for review and approval by architect.

B. Wall Panel Accessories: Provide accessories to compliment fit and finish of wall panel system.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Do not proceed with installation until all wet work such as concrete, terrazzo, plastering and painting has been completed and thoroughly dried out, unless expressly permitted by manufacturer's printed recommendations.

3.2 PREPARATION

A. Measure each wall area and establish layout of acoustical units to balance border widths at opposite edges of each wall. Coordinate panel layout with mechanical and electrical fixtures.

3.3 INSTALLATION

a. Install wall panels by attaching the panels to an existing wall per the manufacturer's instructions LA-297244, and in accordance with the authorities having jurisdiction.

b. Attachment of panels to the wall will include the use of internal splines (included).

3.4 ADJUSTING AND CLEANING

A. Replace damaged and broken panels.

END OF SECTION 09771

SECTION 09912 - INTERIOR PAINTING

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes surface preparation and the application of paint systems on interior substrates:

1. Concrete.
2. Concrete masonry units (CMU).
3. Galvanized metal.
4. Aluminum (not anodized or otherwise coated).
5. Wood.
6. Gypsum board.
7. Plaster.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product. Include preparation requirements and application instructions.

B. Samples: For each type of paint system and in each color.

C. Product List: For each product indicated. Include printout of current "MPI Approved Products List" for each product category specified in Part 2, with the proposed product highlighted.

1.3 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials from the same product run,that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Paint: 5 percent, but not less than 1 gal. of each material and color applied.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to products listed in other Part 2 articles for the paint category indicated.

2.2 PAINT, GENERAL

A. MPI Standards: Provide products that comply with MPI standards indicated and that are listed in its "MPI Approved Products List."

B. Material Compatibility:

1. Provide materials for use within each paint system that are compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
2. For each coat in a paint system, provide products recommended in writing by manufacturers of topcoat for use in paint system and on substrate indicated.

C. VOC Content: Products shall comply with VOC limits of authorities having jurisdiction and, for interior paints and coatings applied at Project site, the following VOC limits, exclusive of colorants added to a tint base, when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

1. Flat Paints and Coatings: 50 g/L.
2. Nonflat Paints and Coatings: 150 g/L.
3. Dry-Fog Coatings: 400 g/L.
4. Primers, Sealers, and Undercoaters: 200 g/L.
5. Anticorrosive and Antirust Paints Applied to Ferrous Metals: 250 g/L.
6. Zinc-Rich Industrial Maintenance Primers: 340 g/L.
7. Pretreatment Wash Primers: 420 g/L.
8. Floor Coatings: 100 g/L.
9. Shellacs, Clear: 730 g/L.
10. Shellacs, Pigmented: 550 g/L.

D. Low-Emitting Materials: Interior 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."

E. Colors: As selected by Architect from manufacturer's full range.

2.3 BLOCK FILLERS

A. Block Filler, Latex, Interior/Exterior:

1. Benjamin-Moore

2.4 PRIMERS/SEALERS

A. Primer Sealer, Interior, Institutional Low Odor/VOC:

1. Benjamin-Moore.

2.5 WATER-BASED PAINTS

A. Latex, Interior, Institutional Low Odor/VOC, Semi-Gloss and flat:

1. Benjamin-Moore.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

B. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:

1. Concrete: 12 percent.
2. Masonry (Clay and CMU): 12 percent.
3. Wood: 15 percent.
4. Gypsum Board: 12 percent.
5. Plaster: 12 percent.

C. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers.

D. Proceed with coating application only after unsatisfactory conditions have been corrected.

1. Application of coating indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Comply with manufacturer's written instructions and recommendations in "MPI Manual" applicable to substrates indicated.

B. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.

1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.

C. Clean substrates of substances that could impair bond of paints, including dust, dirt, oil, grease, and incompatible paints and encapsulants.

1. Remove incompatible primers and reprime substrate with compatible primers or apply tie coat as required to produce paint systems indicated.

3.3 APPLICATION

A. Apply paints according to manufacturer's written instructions and to recommendations in "MPI Manual."

B. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.

3.4 CLEANING AND PROTECTION

A. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.

B. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

END OF SECTION 09912

SECTION 10211 - TOILET COMPARTMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Metal powder coated (baked enamel) Toilet Compartments configured as Toilet Enclosures, suspended from ceiling hung pilasters, and Urinal Screens mounted to walls.
2. Metal fabrication section D5500 for ceiling hung partition pilaster hanger system.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product indicated, submit manufacturer's product data, installation details and catalog cuts for partitions, hardware and accessories.

B. Shop Drawings: Provide shop drawings of toilet enclosures and urinal screens for field measurements, fabrication, installation and erection of all parts of the work. Include, plans, elevations, sections, details, and attachments to other work. Verify that field measurements are as indicated on shop drawings. Advise manufacturer of any changes.

C. Samples for each exposed product and for each color and texture specified.

D. Manufacturer's installation instructions: Provide details of hardware locations and drilling dimensions.

1.3 INFORMATIONAL SUBMITTALS

A. Provide Product certificates.

1.4 CLOSEOUT SUBMITTALS

A. Provide Maintenance data.

1.5 QUALITY ASSURANCE

A. Surface-Burning Characteristics: As determined by testing identical products according to ASTM E 84, or another standard acceptable to authorities having jurisdiction, by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Flame-Spread Index: 25 or less.
2. Smoke-Developed Index: 450 or less.

B. Regulatory Requirements: Comply with applicable provisions in Accessibility Guidelines for Buildings and Facilities" and ICC/ANSI A117.1 for toilet compartments designated as accessible.

C. Source: Provide partitions and screens which are the products of one manufacturer.

D. Coordination: Coordinate related work such as concealed blocking to ensure proper location and quantity.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Steel Sheet: Commercial steel sheet for exposed applications; mill phosphatized and selected for smoothness.
1. Hot-Dip Galvanized: ASTM A 653/A 653M, hot-dip galvanized

B. Zamac chome-plating: ASTM B 86.commercial zinc-alloy die castings.

2.2 METAL POWDER COATED (BAKED ENAMEL) COMPARTMENT UNITS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Knickerbocker Partition Corporation.
2. All American Metal Corp.
3. American Sanitary Partition Corporation.
4. Ampco, Inc.
5. Bradley Corporation; Mills Partitions.
6. Flush Metal Partition Corp.
7. General Partitions Mfg. Corp.
8. Global Steel Products Corp.
9. Hadrian Manufacturing Inc.
10. Accurate Partitions Corporation.
11. Metpar Corp.
12. Rockville Partitions Incorporated.
13. Sanymetal; a Crane Plumbing company.
14. Shanahan's Limited.
15. Weis-Robart Partitions, Inc.

B. Toilet-Enclosure Style: Ceiling hung anchorage.

C. Entrance-Screen Style: Ceiling hung anchorage.

D. Urinal-Screen Style: Wall hung anchorage with integral flanges.

E. Pilasters, ceiling hung anchorage: Shall be 1-1/4" thick, constructed of two sheets of 20 gauge bonderdized, galvanized steel. Sheets to be formed and cemented under pressure to a vermin-proof honeycomb core. Formed sheets shall be welded together at intervals around the entire perimeter to ensure a rigid one-piece integral unit. All edges shall be bound with an 18 gauge interlocking molding, welded and ground smooth at corners. Pilasters, when set in place, shall be securely anchored to overhead carrying member (overhead members to be furnished, installed and drilled by general contractor) by means of 3/8" diameter cadmium plated bolts through a one-piece channel integrally welded to the pilaster. This entire assembly to be concealed with a 3" high stainless steel plinth, secured in place with concealed clips.

F. Door, Urinal Screen and Panel Construction: Constructed of two sheets of (20 Gauge- panels, 22 gauge doors) bonderized, galvanized steel. Sheets to be formed and cemented under pressure lamination to a vermin-proof honeycomb core. Formed sheets to be welded together at intervals around the entire perimeter to ensure a rigid one-piece integral unit. All edges shall be bound with a 20 gauge interlocking molding. Panel and urinal screens to have corrosion resisting corner clips Exposed surfaces shall be free of pitting, seam marks, roller marks, stains, discolorations, telegraphing of core material, or other imperfections.

1. Core Material: Manufacturer's standard sound-deadening honeycomb of resin-impregnated kraft paper in thickness required to provide finished thickness of 1 inch for doors and panels and 1-1/4 inches for pilasters.
2. Grab-Bar Reinforcement: Provide concealed internal reinforcement for grab bars mounted on units.
3. Tapping Reinforcement: Provide concealed reinforcement for tapping (threading) at locations where machine screws are used for attaching items to units.

G. Urinal-Screen Construction:
1. Integral-Flange, Wall-Hung Urinal Screen: Similar to panel construction, with integral full-height flanges for wall attachment, and maximum 1-1/4 inches thick.
2. Wedge-Shaped, Wall-Hung Urinal Screen: Similar to panels, V-shaped, fabricated for concealed wall attachment, and maximum 6 inches wide at wall and minimum 1 inch wide at protruding end.

H. Facing Sheets and Closures: Stainless-steel sheet of nominal thicknesses standard with manufacturer:

I. Pilaster Sleeves (Caps): Stainless-steel sheet, not less than 3 inches high, finished to match hardware.

J. Urinal-Screen Post: Manufacturer's standard post design of 1-3/4-inch- square, aluminum tube with satin finish; with shoe and sleeve (cap) matching that on the pilaster.

K. Brackets (Fittings):

1. Stirrup Type: Ear or U-brackets; stainless steel

L. Finish: All surfaces shall have a powder coated, synthetic baked enamel, highly mar and alkali-resisting finish. Finish to be one color selected from Manufacturer's standard color chart Protect exposed surfaces from damage by application of strippable, temporary protective covering before shipment and remove upon completion of installation.

2.3 ACCESSORIES

A. Hardware, Fittings and Accessories: Manufacturer's standard design, heavy-duty operating hardware and accessories.

1. Material: Chrome plated Zamac.
2. Hinges: Spring activated non-rising hinges. Top hinge pivot door bracket to be recessed and inset into edge of door, approximately 2" below top with a pivot pin, operating on a self-lubricating bushing mounted within the door structure, supported both above and below the pivot bracket. Operation of door shall be controlled by opposing cams under spring tension, mounted on a fixed vertical pintle. Hinges to be adjustable to permit door to rest at any angle, or to hold door open or closed when not latched. Hinges shall operate without raising or lowering the door on a fixed horizontal plain.. Hinge bracket and stops shall have clamp flanges to transmit the strain of door closing to the pilaster. All hardware shall be heavy on-piece, non-ferrous, "Zamac" casting, heavily chrome plated. Hinge stop and keeper, pilaster and panel brackets shall be thru-bolted with sex bolts having theft –resistant heads.
3. Latch and Keeper: Unit designed for emergency access and with combination rubber-faced door strike and keeper. Each door shall be equipped with a stop and keeper, and concealed latch, featuring a latch cover which permits access to the compartment in case of an emergency. Handicap door to be equipped with lever handle. Provide units that comply with ADA regulatory requirements for accessibility at compartments designated as accessible
4. Coat Hook: Manufacturer's standard combination hook and rubber-tipped bumper, sized to prevent in-swinging door from hitting compartment-mounted accessories.
5. Door Bumper: Manufacturer's standard rubber-tipped bumper at out-swinging doors and entrance-screen doors.
6. Door Pull: Manufacturer's standard unit at out-swinging doors that complies with regulatory requirements for accessibility. Provide units on both sides of doors at compartments designated as ADA accessible.

B. Anchorages and Fasteners: Manufacturer's standard exposed fasteners of Zamac chrome-plated finish with theft-resistant-type heads. Provide sex-type bolts for through-bolt applications. For concealed anchors, use rust-resistant, protective-coated steel.

2.4 FABRICATION

A. Ceiling-Hung Units: Provide manufacturer's standard corrosion-resistant anchoring assemblies with leveling adjustment nuts at pilasters for connection to structural support above finished ceiling. Provide assemblies that support pilasters from structure without transmitting load to finished ceiling. Provide sleeves (caps) at tops of pilasters to conceal anchorage. Deliver materials and products in unopened factory labeled packages. Store and handle in strict compliance with manufacturer's instructions and recommendations. Protect from all possible damage Inspect cartons at time of delivery and advise carrier of any damage immediately.

B. Urinal-Screen Panels: Provide manufacturer's standard corrosion-resistant anchoring assemblies with leveling adjustment at tops and bottoms of panels. Provide sleeves (caps) at top and bottom to conceal anchorage.

C. Door Size and Swings: Unless otherwise indicated, provide 24-inch- wide, in-swinging doors for standard toilet compartments and 36-inch- wide, out-swinging doors with a minimum 32-inch- wide, clear opening for compartments designated as accessible.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General: Comply with manufacturer's written installation instructions. Install units rigid, straight, level, and plumb. Secure units in position in accordance with manufacturer's instructions and recommended anchoring devices.

B. Clearances: Maintain manufacturer's recommended spacing between wall and panels and between wall and pilasters. Maximum 1/2 inch between pilasters and panels; 1 inch between panels and walls.

C. Stirrup Brackets: Secure panels to walls and to pilasters with no fewer than two brackets attached near top and bottom of panel. Locate wall brackets so holes for wall anchors occur in masonry or tile joints. Align brackets at pilasters with brackets at walls.

D. Attach panels and pilasters to brackets with theft resistant one-way thru-bolted screws.

E. Equip each door with hinges, concealed lock, coat hook and bumper, door strike and keepers. Outswing doors shall have a door pull and wall bumper.

3.2 ADJUSTMENT

A. Hardware Adjustment: Adjust and lubricate hardware according to hardware manufacturer's written instructions for proper operation to work easily, smoothly and correctly. Set hinges on in-swinging doors to hold doors open at an angle 30 degrees to pilaster from closed position when unlatched. Set hinges on out-swinging doors to return doors to fully closed position.

B. Adjust and align hardware to uniform clearance at vertical edge of doors, not exceeding 3/16 inch gap.

END OF SECTION 10211

SECTION 10280 - TOILET, BATH, AND LAUNDRY ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Public-use washroom accessories.
2. Warm-air dryers.
3. Underlavatory guards.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. Product Schedule: Indicating types, quantities, sizes, and installation locations by room of each accessory required.

1. Identify locations using room designations indicated.
2. Identify products using designations indicated.

1.3 INFORMATIONAL SUBMITTALS

A. Warranty: Sample of special warranty.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance data.

1.5 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

1.6 WARRANTY

A. Special Mirror Warranty: Manufacturer's standard form in which manufacturer agrees to replace mirrors that develop visible silver spoilage defects and that fail in materials or workmanship within specified warranty period.

1. Warranty Period: 15 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PUBLIC-USE WASHROOM ACCESSORIES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

B. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

1. American Specialties, Inc.
2. Bobrick Washroom Equipment, Inc.
3. Bradley Corporation.

C. Toilet Tissue (Jumbo-Roll) Dispenser: See plumbing accessory schedule on drawings.

2.2 MATERIALS

A. Stainless Steel: ASTM A 666, Type 304, No. 4 finish (satin), 0.0312-inch minimum nominal thickness, unless otherwise indicated.

B. Steel Sheet: ASTM A 366/A 366M, 0.0359-inch minimum nominal thickness.

C. Galvanized Steel Sheet: ASTM A 653/A 653M, G60 (Z180).

D. Chromium Plating: ASTM B 456, Service Condition Number SC 2 (moderate service).

E. Baked-Enamel Finish: Factory-applied, gloss-white, baked-acrylic-enamel coating.

F. Mirror Glass: ASTM C 1036, Type I, Class 1, Quality q2, nominal 6.0 mm thick, with silvering, electroplated copper coating, and protective organic coating complying with FS DD-M-411.

G. Galvanized Steel Mounting Devices: ASTM A 153/A 153M, hot-dip galvanized after fabrication.

H. Fasteners: Screws, bolts, and other devices of same material as accessory unit, tamper and theft resistant when exposed, and of galvanized steel when concealed.

I. Keys: Provide universal keys for internal access to accessories for servicing and resupplying. Provide minimum of six keys to Owner's representative.

2.3 WARM-AIR DRYERS

A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

1. American Specialties, Inc.
2. Bobrick Washroom Equipment, Inc.
3. Bradley Corporation.
4. Excel Dryer Corporation.

2.4 UNDERLAVATORY GUARDS

A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

1. Plumberex Specialty Products, Inc.
2. Truebro by IPS Corporation.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install accessories according to manufacturers' written instructions, using fasteners appropriate to substrate indicated and recommended by unit manufacturer. Install units level, plumb, and firmly anchored in locations and at heights indicated.

B. Grab Bars: Install to withstand a downward load of at least 250 lbf (1112 N), when tested according to ASTM F 446.

END OF SECTION 10280

SECTION 12360 - SIMULATED STONE COUNTERTOPS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Solid-surface-material countertops and backsplashes.
2. Quartz agglomerate countertops.

1.2 ACTION SUBMITTALS

A. Product Data: For countertop and back splash materials

B. Shop Drawings: For countertops. Show materials, finishes, edge and backsplash profiles, methods of joining, and cutouts for plumbing fixtures.

C. Samples: For each type of material exposed to view. Provide for approval by Architect.

PART 2 - PRODUCTS

2.1 SOLID-SURFACE-MATERIAL COUNTERTOPS

A. Countertops: Corian solid surface manufactured in maximum size of 144"x30"x1/2". See plan for quantity and locations for use in windowsills.

2.2 QUARTZ AGGLOMERATE COUNTERTOPS

A. Countertops: DuPont Zodiaz Quartz Agglomerate manufactured in maximum sizes 63"x 120"x1-1/8". and 63"x120"x 3/4". See plan for quantity and locations for use in Reception Desk and Kitchen countertop.

B. Backsplashes: 3/4-inch thick, quartz agglomerate

2.3 COUNTERTOP MATERIALS

A. Certified Wood Materials: Fabricate countertops with wood and wood-based products produced from wood obtained from forests certified by an FSC-accredited certification body to comply with FSC STD-01-001, "FSC Principles and Criteria for Forest Stewardship."

B. Composite Wood and Agrifiber Products: Provide products that 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," including 2004 Addenda.

C. Particleboard: ANSI A208.1, made with binder containing no urea formaldehyde.

D. Plywood: Exterior softwood plywood complying with DOC PS 1, Grade C-C Plugged, touch sanded.

E. Adhesives: Adhesives shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

1. Colors and Patterns: As selected by Architect from manufacturer's full range.

F. Solid Surface Material: Homogeneous solid sheets of filled plastic resin complying with ANSI SS1.

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. DuPont.
   b. Avonite Surfaces
   c. E. I. du Pont de Nemours and Company.
   d. Formica Corporation.
   e. LG Chemical, Ltd.
   f. Meganite Inc.
   g. Samsung Chemical USA, Inc.
   h. Swan Corporation (The).
   i. Transolid, Inc.
   j. Wilsonart International.

2. Provide template for sink cut-out in countertop.
3. Colors and Patterns: As selected by Architect from manufacturer's full range.

G. Quartz Agglomerate: Solid sheets consisting of quartz aggregates bound together with a matrix of filled plastic resin and complying with the "Physical Characteristics of Materials" Article of ANSI SS1.

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. DuPont.
   b. Cambria.
   c. Cosentino USA.
   d. E. I. du Pont de Nemours and Company.
   e. LG Chemical, Ltd.
   f. Meganite Inc.
   g. Samsung Chemical USA, Inc.
   h. Technistone USA, Inc.
   i. Transolid, Inc.

2. Colors and Patterns: As selected by Architect from manufacturer's full range.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Fasten countertops by screwing through corner blocks of base units into underside of countertop. Align adjacent surfaces and, using adhesive in color to match countertop, form seams to comply with manufacturer's written instructions. Carefully dress joints smooth, remove surface scratches, and clean entire surface.

END OF SECTION 12360

SECTION 12484 - FLOOR MATS AND FRAMES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Roll-up vinyl and aluminum-tread rail hinged floor mats.
2. Vinyl resilient mats.
5. Carpet-type mats.

1.2 SUBMITTALS

A. Product Data: For each product indicated.

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other Work.

1. Verify recesses and openings in substrates by field measurements before fabrication and indicate measurements on Shop Drawings.

C. Samples: 12-inch- square assembled sections of floor mats, frame members, and tread rails with selected tread surface showing each type of metal finish and color of exposed floor mats, tread rails, frames, and accessories required.

D. Maintenance data.

1.3 QUALITY ASSURANCE

A. Accessibility Requirements: Comply with "Americans with Disabilities Act (ADA), Accessibility Guidelines for Buildings and Facilities (ADAAG)" ICC A117.1 and requirements of authorities having jurisdiction.

PART 2 - PRODUCTS

2.1 FLOOR MATS AND FRAMES

A. Mat Graphics: With custom inlaid or woven-in graphic as indicated.

B. Roll-up Vinyl Rail Hinged Mats: Vinyl-acrylic tread rails with slotted or perforated hinges.

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Balco, Inc.
    b. Construction Specialties, Inc.
    c. Durable Corporation.
    d. Pedimat

3. Hinge Material: Aluminum.
4. Tread Rail Modules: 1-1/2 inch wide by 3/8 inch .
5. Tread Inserts: 1/4-inch- high, 28-oz./sq. yd. weight, level-cut, nylon-pile, fusion-bonded carpet].

C. Roll-up Aluminum Rail Hinged Mats: Extruded-aluminum tread rails sitting on continuous vinyl cushions.

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. AFCO-USA.
    b. Arden Architectural Specialties, Inc.
    c. Balco, Inc.
    d. Cactus Mat Manufacturing Co.
    e. Construction Specialties, Inc.
    f. Crowder, K. N. Mfg. Inc.
    g. J. L. Industries, Inc.
    h. KADEE Industries, Inc.
    i. Mats Incorporated.
    j. Musson, R. C. Rubber Co. (The).
    k. Pawling Corporation.
    l. Reese Enterprises, Inc.
    m. Pedimat

3. Aluminum Finish: Clear anodized
4. Hinge Material: Aluminum
5. Tread Rail Modules: 1-1/2 inch by 3/8 inch thick.
6. Tapered Flexible Edges: Vinyl edge-frame members, not less than 1-1/2 inches wide, attached to mat at all 4 edges, with welded mitered corners.
7. Tapered Rigid Frame: Extruded-aluminum frame members, not less than 1-1/2 inches wide, with mitered corners and finish to match tread-slat extrusions.

2.2 FABRICATION

A. Floor Mats: Shop fabricate units to the greatest extent possible.

1. If not otherwise indicated, provide single unit for each mat installation; do not exceed manufacturer's recommended maximum sizes for units that are removed for maintenance and cleaning.
2. Where joints in mats are necessary, space symmetrically and away from normal traffic lanes.
3. Miter corner joints in framing elements with hairline joints or provide prefabricated corner units without joints.

B. Recessed Metal Mat Frames: Size and style to fit floor mat type specified, for permanent recessed installation, complete with corner pins or reinforcement and anchorage devices.

1. Fabricate edge-frame members in single lengths or, where frame dimensions exceed maximum available lengths, provide minimum number of pieces possible, with hairline joints equally spaced and pieces spliced together by straight connecting pins.

C. Corrosion Protection: Coat surfaces of aluminum frames that will contact cementitious material with manufacturer's standard protective coating.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install recessed mat frames to comply with manufacturer's written instructions. Set mat tops at height recommended by manufacturer for most effective cleaning action; coordinate top of mat surfaces with bottom of doors that swing across mats to provide clearance between door and mat.

1. For installation in terrazzo flooring areas, provide allowance for grinding and polishing of terrazzo without grinding surface of recessed frames. Coordinate with other trades as required.
2. Install necessary shims, spacers, and anchorages for proper location and secure attachment of frames.
3. Install grout and fill around frames and, if required to set mat tops at proper elevations, in recesses under mats. Finish grout and fill smooth and level. Comply with requirements specified in Division 3 for grout and fill.

B. Install surface-type units coordinated with entrance locations and traffic patterns.

1. Anchor fixed surface-type frame members to floor with devices spaced as recommended by manufacturer.

C. Protection: After completing frame installation and concrete work, provide temporary filler of plywood or fiberboard in recesses and cover frames with plywood protective flooring. Maintain until Substantial Completion.

END OF SECTION 12484

SECTION 12494 - ROLLER SHADES

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Room darkening roller shades.

1.2 RELATED SECTIONS

A. Section 06100 - Rough Carpentry: Wood blocking and grounds for mounting roller shades and accessories.

B. Section 09260 - Gypsum Board Assemblies: Coordination with gypsum board assemblies for installation of shade pockets, closures and related accessories.

C. Section 09510 - Acoustical Ceilings: Coordination with acoustical ceiling systems for installation of shade pockets, closures and related accessories.

1.3 REFERENCES

A. ASTM G 21 - Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi.

B. NFPA 701 - Fire Tests for Flame-Resistant Textiles and Films.

1.4 SUBMITTALS

A. Submit under provisions of Section 01300.

B. Manufacturer's product data sheets on each product to be used, including:

1. Preparation instructions and recommendations.
2. Styles, material descriptions, dimensions of individual components, profiles, features, finishes and operating instructions.
3. Storage and handling requirements and recommendations.
4. Mounting details and installation methods.

C. Shop Drawings: Plans, elevations, sections, product details, installation details, operational clearances, wiring diagrams and relationship to adjacent work.

1. Prepare shop drawings on Autocad format using base sheets provided electronically by the Architect.

D. Window Treatment Schedule: For all roller shades. Use same room designations as indicated on the Drawings and include opening sizes and key to typical mounting details.

E. Selection Samples: For each finish product specified, one set of shade cloth options and aluminum finish color samples representing manufacturer's full range of available colors and patterns.

F. Verification Samples: For each finish product specified, one complete set of shade components, unassembled, demonstrating compliance with specified requirements. Shadecloth sample and aluminum finish sample as selected. Mark face of material to indicate interior faces.

G. Maintenance Data: Methods for maintaining roller shades, precautions regarding cleaning materials and methods, instructions for operating hardware and controls.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Obtain roller shades through one source from a single manufacturer with a minimum of twenty years experience in manufacturing products comparable to those specified in this section.

B. Installer Qualifications: Installer trained and certified by the manufacturer with a minimum of ten years experience in installing products comparable to those specified in this section.

C. Fire-Test-Response Characteristics: Passes NFPA 701 small and large-scale vertical burn. Materials tested shall be identical to products proposed for use.

D. Anti-Microbial Characteristics: 'No Growth' per ASTM G 21 results for fungi ATCC9642, ATCC 9644, ATCC9645.

E. Mock-Up: Provide a mock-up (manual shades only) of one roller shade assembly for evaluation of mounting, appearance and accessories.

1. Locate mock-up in window designated by Architect.
2. Do not proceed with remaining work until mock-up is accepted by Architect.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver shades in factory-labeled packages, marked with manufacturer and product name, fire-test-response characteristics, and location of installation using same room designations indicated on Drawings and in the Window Treatment Schedule.

1.7 PROJECT CONDITIONS

A. Environmental Limitations: Install roller shades after finish work including painting is complete and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

1.8 WARRANTY

A. Roller Shade Hardware and Chain Warranty: Manufacturer's standard non-depreciating twenty-five year limited warranty.

B. Standard Shadecloth: Manufacturer's standard twenty-five year warranty.

C. Roller Shade Motors and Motor Control Systems: Manufacturer's standard non-depreciating five year warranty.

D. Roller Shade Installation: One year from date of Substantial Completion, not including scaffolding, lifts or other means to reach inaccessible areas.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis of Design product: Subject to compliance with requirements provide MechoShade Systems, Inc., which is located at: 42-03 35th St. ; Long Island City, NY 11101; Tel: 718-729-2020; Email: _ jeanethp@mechoshade.com; Web: www.mechoshade.com

B. Substitutions: Not permitted.

2.2 ROLLER SHADE TYPES

MANUAL SHADE OPERATION

SHADE CLOTH

A. Room Darkening Shadecloth: MechoShade Systems, Inc., ThermoVeil 0700 series, blackout material, washable and colorfast laminated and embossed vinyl coated fabric, 0.012 inches thick blackout material and weighing 0.81 lbs. per square yard, with a minimum of 62 threads per square inch.

2.3 SHADE BAND

A. Shade Bands: Construction of shade band includes the fabric, the hem weight, hem-pocket, shade roller tube, and the attachment of the shade band to the roller tube. Sewn hems and open hem pockets are not acceptable.

1. Hem Pockets and Hem Weights: Fabric hem pocket with RF-welded seams (including welded ends) and concealed hem weights. Hem weights shall be of appropriate size and weight for shade band. Hem weight shall be continuous inside a sealed hem pocket. Hem pocket construction and hem weights shall be similar, for all shades within one room.

2. Shade Band and Shade Roller Attachment:
   a. Use extruded aluminum shade roller tube of a diameter and wall thickness required to support shade fabric without excessive deflection. Roller tubes less than 1.55 inch in diameter for manual shades, and less than 2.55 inches for motorize shades are not acceptable.
   b. Provide for positive mechanical engagement with drive / brake mechanism.
   c. Provide for positive mechanical attachment of shade band to roller tube; shade band shall be made removable / replaceable with a "snap-on" snap-off" spline mounting, without having to remove shade roller from shade brackets.
   d. Mounting spline shall not require use of adhesives, adhesive tapes, staples, and/or rivets.
   e. Any method of attaching shade band to roller tube that requires the use of: adhesive, adhesive tapes, staples, and/or rivets are not acceptable.

2.4 SHADE FABRICATION

A. Fabricate units to completely fill existing openings from head to sill and jamb-to-jamb, unless specifically indicated otherwise.

B. Fabricate shadecloth to hang flat without buckling or distortion. Fabricate with heat-sealed trimmed edges to hang straight without curling or raveling. Fabricate unguided shadecloth to roll true and straight without shifting sideways more than 1/8 inch in either direction per 8 feet of shade height due to warp distortion or weave design. Fabricate hem as follows:

1. Standard concealed hem bar.

C. Provide battens in standard shades as required to assure proper tracking and uniform rolling of the shadebands. Contractor shall be responsible for assuring the width-to-height (W:H) ratios shall not exceed manufacturer's standards or, in absence of such standards, shall be responsible for establishing appropriate standards to assure proper tracking and rolling of the shadecloth within specified standards. Battens shall be roll-formed stainless steel or tempered steel, as required.

D. For railroaded shadebands, provide seams in railroaded multi-width shadebands as required to meet size requirements and in accordance with seam alignment as acceptable to Architect. Seams shall be properly located. Furnish battens in place of plain seams when the width, height, or weight of the shade exceeds

manufacturer's standards. In absence of such standards, assure proper use of seams or battens as required to, and assure the proper tracking of the railroaded multi-width shadebands.

E. Provide battens for railroaded shades when width-to-height (W:H) ratios meet or exceed manufacturer's standards. In absence of manufacturer's standards, be responsible for proper use and placement of battens to assure proper tracking and roll of shadebands.

F. Blackout shadebands, when used in side channels, shall have horizontally mounted, roll-formed stainless steel or tempered-steel battens not more than 3 feet on center extending fully into the side channels. Battens shall be concealed in a integrally-colored fabric to match the inside and outside colors of the shadeband, in accordance with manufacturer's published standards for spacing and requirements.

1. Battens shall be roll formed of stainless steel or tempered steel and concave to match the contour of the roller tube.

2. Batten pockets shall be self-colored fabric front and back RF welded into the shadecloth. A self-color opaque liner shall be provided front and back to eliminate any see through of the batten pocket that shall not exceed 1-1/2 inches high and be totally opaque. A see-through moire effect, which occurs with multiple layers of transparent fabrics, shall not be acceptable.

2.5 COMPONENTS

A. Access and Material Requirements:

1. Provide shade hardware allowing for the removal of shade roller tube from brackets without removing hardware from opening.

2. Provide shade hardware that allows for removal and re-mounting of the shade bands without having to remove the shade tube.

3. Use only Delrin engineered plastics by DuPont for all plastic components of shade hardware. Styrene based plastics, and /or polyester, or reinforced polyester will not be acceptable.

B. Shade Brackets:

1. Provide shade hardware constructed of minimum 1/8-inch thick plated steel, or heavier, thicker, as required to support 150 percent of the full weight of each shade.

2. Provide shade hardware system that allows for field adjùstment of motor or replacement of any operable hardware component without requiring removal of brackets, regardless of mounting position (inside, or outside mount).

3. Provide shade hardware system that allows for operation of multiple shade bands offset by a maximum of 8-45 degrees from the motor axis between shade bands (4-22.5 degrees) on each side of the radial line, by a single shade motor (multi-banded shade, subject to manufacturer's design criteria).

2.6 SHADE MOTOR DRIVE SYSTEM

2.7 ACCESSORIES

A. Fascia:

1. Continuous removable extruded aluminum fascia that attaches to shade mounting brackets without the use of adhesives, magnetic strips, or exposed fasteners.

2. Fascia shall be able to be installed across two or more shade bands in one piece.

3. Fascia shall fully conceal brackets, shade roller and fabric on the tube.

4. Provide bracket / fascia end caps where mounting conditions expose outside of roller shade brackets.

5. Notching of Fascia for manual chain shall not be acceptable.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Do not begin installation until substrates have been properly prepared.

B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.2 PREPARATION

A. 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 roller shades level, plumb, square, and true according to manufacturer's written instructions, and located so shade band is not closer than 2 inches to interior face of glass. Allow proper clearances for window operation hardware.

B. Coordinate the following with the roller shade installer/dealer:

1. Contractor shall coordinate with requirements of roller shade installer/dealer, before inaccessible areas are constructed.

C. Adjust and balance roller shades to operate smoothly, easily, safely, and free from binding or malfunction throughout entire operational range.

D. Clean roller shade surfaces after installation, according to manufacturer's written instructions.

E. Engage Installer to train Owner's maintenance personnel to adjust, operate and maintain roller shade systems.

3.4 PROTECTION

A. Protect installed products until completion of project.

B. Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION 12494

SECTION 220513 - COMMON MOTOR REQUIREMENTS FOR PLUMBING EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes general requirements for single-phase and polyphase, general-purpose, horizontal, small and medium, squirrel-cage induction motors for use on ac power systems up to 600 V and installed at equipment manufacturer's factory or shipped separately by equipment manufacturer for field installation.

1.3 COORDINATION

A. Coordinate features of motors, installed units, and accessory devices to be compatible with the following:

1. Motor controllers.
2. Torque, speed, and horsepower requirements of the load.
3. Ratings and characteristics of supply circuit and required control sequence.
4. Ambient and environmental conditions of installation location.

PART 2 - PRODUCTS

2.1 GENERAL MOTOR REQUIREMENTS

A. Comply with NEMA MG 1 unless otherwise indicated.

B. Comply with IEEE 841 for severe-duty motors.

2.2 MOTOR CHARACTERISTICS

A. Duty: Continuous duty at ambient temperature of 40 deg C and at altitude of 3300 feet above sea level.

B. Capacity and Torque Characteristics: Sufficient to start, accelerate, and operate connected loads at designated speeds, at installed altitude and environment, with indicated operating sequence, and without exceeding nameplate ratings or considering service factor.

2.3 POLYPHASE MOTORS

A. Description: NEMA MG 1, Design B, medium induction motor.

B. Efficiency: Energy efficient, as defined in NEMA MG 1.

C. Service Factor: 1.15.

D. Multispeed Motors: Variable torque.

1. For motors with 2:1 speed ratio, consequent pole, single winding.
2. For motors with other than 2:1 speed ratio, separate winding for each speed.

E. Rotor: Random-wound, squirrel cage.

F. Bearings: Regreasable, shielded, antifriction ball bearings suitable for radial and thrust loading.

G. Code Letter Designation:
1. Motors Smaller than 15 HP: Manufacturer's standard starting characteristic.

2.4 POLYPHASE MOTORS WITH ADDITIONAL REQUIREMENTS

A. Motors Used with Reduced-Voltage and Multispeed Controllers: Match wiring connection requirements for controller with required motor leads. Provide terminals in motor terminal box, suited to control method.

B. Motors Used with Variable Frequency Controllers: Ratings, characteristics, and features coordinated with and approved by controller manufacturer.

1. Windings: Copper magnet wire with moisture-resistant insulation varnish, designed and tested to resist transient spikes, high frequencies, and short time rise pulses produced by pulse-width modulated inverters.
2. Energy- and Premium-Efficient Motors: Class B temperature rise; Class F insulation.
3. Inverter-Duty Motors: Class F temperature rise; Class H insulation.
4. Thermal Protection: Comply with NEMA MG 1 requirements for thermally protected motors.

C. Severe-Duty Motors: Comply with IEEE 841, with 1.15 minimum service factor.

2.5 SINGLE-PHASE MOTORS

A. Motors larger than 1/20 hp shall be one of the following, to suit starting torque and requirements of specific motor application:

1. Permanent-split capacitor.
2. Split phase.
3. Capacitor start, inductor run.
4. Capacitor start, capacitor run.

B. Bearings: Prelubricated, antifriction ball bearings or sleeve bearings suitable for radial and thrust loading.

C. Thermal Protection: Internal protection to automatically open power supply circuit to motor when winding temperature exceeds a safe value calibrated to temperature rating of motor insulation. Thermal-protection device shall automatically reset when motor temperature returns to normal range.

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 220513

SECTION 220517 - SLEEVES AND SLEEVE SEALS FOR PLUMBING PIPING

PART 1 - GENERAL

1.01 Section Includes:

A. Sleeves.

B. Sleeve-seal systems.

C. Grout.

1.02 SUBMITTALS

A. Product Data: For each type of product indicated.

PART 2 - PRODUCTS

2.01 SLEEVES

A. Cast-Iron Wall Pipes: Cast or fabricated of cast or ductile iron and equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop unless otherwise indicated.

B. Galvanized-Steel Wall Pipes: ASTM A 53/A 53M, Schedule 40, with plain ends and welded steel collar; zinc coated.

C. Galvanized-Steel-Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, zinc coated, with plain ends.

D. PVC sleeves in first paragraph below may be prohibited by fire authorities having jurisdiction.

E. PVC-Pipe Sleeves: ASTM D 1785, Schedule 40.

F. Galvanized-Steel-Sheet Sleeves: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.

2.02 SLEEVE-SEAL SYSTEMS

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 Company (The).
4) Pipeline Seal and Insulator, Inc.

Description: Modular sealing-element unit, designed for field assembly, for filling annular space between piping and sleeve.

1) Sealing Elements: NBR interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
2) Pressure Plates: Carbon steel.
3) Connecting Bolts and Nuts: Carbon steel, with corrosion-resistant coating of length required to secure pressure plates to sealing elements.

2.03 GROUT

A. Standard: ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement 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

3.01 SLEEVE INSTALLATION

A. Install sleeves for piping passing through penetrations in floors, partitions, roofs, and walls.

B. For sleeves that will have sleeve-seal system installed, select sleeves of size large enough to provide 1-inch annular clear space between piping and concrete slabs and walls. Sleeves are not required for core-drilled holes.

C. Install sleeves in concrete floors, concrete roof slabs, and concrete walls as new slabs and walls are constructed.
Cut sleeves to length for mounting flush with both surfaces.

Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches above finished floor level.

Using grout, seal the space outside of sleeves in slabs and walls without sleeve-seal system.

D. Install sleeves for pipes passing through interior partitions.

Cut sleeves to length for mounting flush with both surfaces.
Install sleeves that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation.
Seal annular space between sleeve and piping or piping insulation; use joint sealants appropriate for size, depth, and location of joint.

3.02 SLEEVE-SEAL-SYSTEM INSTALLATION

A. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at service piping entries into building.

B. Select type, size, and number of sealing elements required for piping material and size and for sleeve ID or hole size. Position piping in center of sleeve. Center piping in penetration, assemble sleeve-seal system components, and install in annular space between piping and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make a watertight seal.

3.03 SLEEVE AND SLEEVE-SEAL SCHEDULE

A. Use sleeves and sleeve seals for the following piping-penetration applications:

B. Exterior Concrete Walls above Grade for Piping Smaller Than NPS 6: Galvanized-steel-pipe sleeves.

C. Exterior Concrete Walls below Grade for Piping Smaller Than NPS 6: Galvanized-steel-pipe sleeves with sleeve-seal system. Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.

D. Concrete Slabs-on-Grade for Piping Smaller Than NPS 6: Galvanized-steel-pipe sleeves with sleeve-seal system. Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.

Concrete Slabs above Grade for Piping Smaller Than NPS 6: Galvanized-steel-pipe sleeves.

Interior Partitions for Piping Smaller Than NPS 6: Galvanized-steel-pipe sleeves.

END OF SECTION 15403

SECTION 220518 - ESCUTCHEONS FOR PLUMBING PIPING

PART 1 - GENERAL

1.01 Section Includes:

A. Escutcheons.
B. Floor plates.

1.02 SUBMITTALS

Product Data: For each type of product indicated.

PART 2 - PRODUCTS

2.01 ESCUTCHEONS

A. One-Piece, Cast-Brass Type: With polished, chrome-plated and rough-brass finish and setscrew fastener.

B. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with chrome-plated finish and spring-clip fasteners.

2.02 FLOOR PLATES

One-Piece Floor Plates: Cast-iron flange with holes for fasteners.

PART 3 - EXECUTION

3.01 INSTALLATION

Install escutcheons for piping penetrations of walls, ceilings, and finished floors. Install escutcheons with ID to closely fit around pipe, tube, and insulation of piping and with OD that completely covers opening. Escutcheons schedule:

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, chrome-plated finish.

C. Insulated Piping: One-piece, stamped-steel type.

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 Wall and Floor Penetrations in Finished Spaces: One-piece, stamped-steel type.
F. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece, cast-brass type with polished, chrome-plated finish.

G. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece, stamped-steel type.
H. Bare Piping in Unfinished Service Spaces: One-piece, cast-brass type with rough-brass finish.

I. Bare Piping in Unfinished Service Spaces: One-piece, stamped-steel type.

J. Bare Piping in Equipment Rooms: One-piece, cast-brass type with rough-brass finish.
K. Bare Piping in Equipment Rooms: One-piece, stamped-steel type.

Install floor plates for piping penetrations of equipment-room floors.

Install floor plates with ID to closely fit around pipe, tube, and insulation of piping and with OD that completely covers opening. One-piece, floor-plate type.

3.02 FIELD QUALITY CONTROL

Replace broken and damaged escutcheons and floor plates using new materials.

END OF SECTION 15404

SECTION 220523 - GENERAL-DUTY VALVES FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Brass ball valves.
2. Bronze ball valves.
3. Bronze swing check valves.
4. Iron swing check valves.
5. Iron gate 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.
3. Division 1 Section 01340 "Identification".

1.3 DEFINITIONS

A. CWP: Cold working pressure.

B. NBR: Acrylonitrile-butadiene, Buna-N, or nitrile rubber.

C. NRS: Nonrising stem.

D. OS&Y: Outside screw and yoke.

E. RS: Rising stem.

F. 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 ends.
3. Set ball 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.

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. Valves in Insulated Piping: With 2-inch stem extensions and the following features:

1. 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.

E. Valve-End Connections:

1. Valve solder-joint connections are common in smaller sizes of plumbing piping. Soldering and brazing methods used to achieve required pressure-temperature ratings

may damage internal valve parts. Special installation requirements for soldered valves may make threaded valves more cost-effective.

2. Solder Joint: With sockets according to ASME B16.18.
3. Threaded: With threads according to ASME B1.20.1.

2.2 BRASS BALL VALVES

A. Two-Piece, Full-Port, Brass Ball Valves with Brass 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. Jamesbury; a subsidiary of Metso Automation.
    d. Milwaukee Valve Company.
    e. NIBCO INC.

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: Brass.
    i. Ball: Chrome-plated brass.
    j. Port: Full.

2.3 BRONZE BALL VALVES

A. Two-Piece, Full-Port, Bronze Ball Valves with Bronze 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. American Valve, Inc.
    b. Conbraco Industries, Inc.; Apollo Valves.
    c. Crane Co.; Crane Valve Group; Crane Valves.
    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.
c. CWP Rating: 600 psig.
d. Body Design: Two piece.
e. Body Material: Bronze.
f. Ends: Threaded.
g. Seats: PTFE or TFE.
h. Stem: Bronze.
i. Ball: Chrome-plated brass.
j. Port: Full.

2.4 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. American Valve, Inc.
b. Crane Co.; Crane Valve Group; Crane Valves.
c. Milwaukee Valve Company.
d. NIBCO INC.
e. 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.

2.5 IRON SWING CHECK VALVES

A. Class 125, Iron Swing Check Valves with Metal Seats:

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. Legend Valve.
c. Milwaukee Valve Company.
d. NIBCO INC.
e. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

2. Description:

a. Standard: MSS SP-71, Type I.
b. CWP Rating: 200 psig.
c. Body Design: Clear or full waterway.
d. Body Material: ASTM A 126, gray iron with bolted bonnet.
e. Ends: Flanged.
f. Trim: Bronze.
g. Gasket: Asbestos free.

2.6 IRON GATE VALVES

A. Class 125, OS&Y, Iron Gate Valves:

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. Legend Valve.
c. Milwaukee Valve Company.
d. NIBCO INC.
e. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

2. Description:

a. Standard: MSS SP-70, Type I.
b. CWP Rating: 200 psig.
c. Body Material: ASTM A 126, gray iron with bolted bonnet.
d. Ends: Flanged.
e. Trim: Bronze.
f. Disc: Solid wedge.
g. Packing and Gasket: Asbestos free.

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. Do not attempt to repair defective valves; replace with new valves.

3.2 VALVE INSTALLATION

A. Install isolation ball valves on all domestic water branch connections.

B. Install valves with unions at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.

C. Locate valves for easy access.

D. Install valves in horizontal piping with stem at or above center of pipe.

E. Install valves in position to allow full stem movement.

F. Install check valves for proper direction of flow and as follows:

1. Swing Check Valves: In horizontal position with hinge pin level.

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 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.

B. Select valves, except wafer types, 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.

3.5 DOMESTIC, HOT- AND COLD-WATER VALVE SCHEDULE

A. Pipe NPS 2 and Smaller:

1. Bronze Valves: May be provided with solder-joint ends instead of threaded ends.
2. Ball Valves: Two piece, full port, brass or bronze with brass trim.
3. Bronze Swing Check Valves: Class 125, bronze disc.

3.6 SANITARY-WASTE VALVE SCHEDULE

A. Pipe NPS 2-1/2 and Larger:

1. Iron Valves, NPS 2-1/2 to NPS 4: May be provided with threaded ends instead of flanged ends.
2. Iron Ball Valves: Class 150.
3. Iron Swing Check Valves: Class 125, metal seats.

4. Iron Gate Valves: Class 125 OS&Y.

END OF SECTION 220523

SECTION 220529 – HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.01 Section Includes:

A. Metal pipe hangers and supports.
B. Trapeze pipe hangers.
C. Thermal-hanger shield inserts.
D. Pipe positioning systems.

1.02 DEFINITIONS

MSS: Manufacturers Standardization Society of The Valve and Fittings Industry Inc.

1.03 PERFORMANCE REQUIREMENTS

Delegated Design: Design trapeze pipe hangers and equipment supports, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

Structural Performance: Hangers and supports for plumbing piping and equipment shall withstand the effects of gravity loads and stresses within limits.

1.04 SUBMITTALS

Product Data: For each type of product indicated.

Qualification Data: For professional engineer.

1.05 QUALITY ASSURANCE

A. Structural Steel Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

A. Pipe Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.

PART 2 - PRODUCTS

2.01 METAL PIPE HANGERS AND SUPPORTS

A. Carbon-Steel Pipe Hangers and Supports:
1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
2. Galvanized Metallic Coatings: Pregalvanized or hot dipped.
3. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
4. Hanger Rods: Continuous-thread rod, nuts, and washer made of stainless steel.

B. Copper Pipe Hangers:
1. Manufacturers' catalogs indicate that copper pipe hangers are small, typically NPS 4 (DN 100) or smaller, and types available are limited.
2. Description: MSS SP-58, Types 1 through 58, copper-coated-steel, factory-fabricated components.
3. Hanger Rods: Continuous-thread rod, nuts, and washer made of stainless steel.

2.02 TRAPEZE PIPE HANGERS

C. Trapeze pipe hanger in paragraph below requires calculating and detailing at each use.

D. Description: MSS SP-69, Type 59, shop- or field-fabricated pipe-support assembly made from structural carbon-steel shapes with MSS SP-58 carbon-steel hanger rods, nuts, saddles, and U-bolts.

2.03 THERMAL-HANGER SHIELD INSERTS

E. 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. Carpenter & Paterson, Inc.
2. Clement Support Services.
3. National Pipe Hanger Corporation.
4. Pipe Shields, Inc.; a subsidiary of Piping Technology & Products, Inc.
5. Piping Technology & Products, Inc.
6. Value Engineered Products, Inc.

F. Insulation-Insert Material for Cold Piping: ASTM C 552, Type II cellular glass with 100-psig or ASTM C 591, Type VI, Grade 1 polyisocyanurate with 125-psig minimum compressive strength and vapor barrier.

G. Insulation-Insert Material for Hot Piping: ASTM C 552, Type II cellular glass with 100-psig or ASTM C 591, Type VI, Grade 1 polyisocyanurate with 125-psig minimum compressive strength.

H. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.

I. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.

J. Insert Length: Extend 2 inches beyond sheet metal shield for piping operating below ambient air temperature.

2.04 FASTENER SYSTEMS

K. 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.

L. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated steel anchors, for use in hardened portland cement concrete; with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

2.05 MISCELLANEOUS MATERIALS

A. Structural Steel: ASTM A 36/A 36M, carbon-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

3.01 HANGER AND SUPPORT INSTALLATION

A. Metal 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 the building structure.

B. Trapeze pipe hanger in first paragraph below requires calculating and detailing at each use.

C. Metal 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 for individual pipe hangers.
2. Field fabricate from ASTM A 36/A 36M, carbon-steel shapes selected for loads being supported. Weld steel according to AWS D1.1/D1.1M.

D. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.

E. Fastener System Installation:

1. Verify suitability of fasteners in two subparagraphs below for use in lightweight concrete or concrete slabs less than 4 inches thick.
2. 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.
3. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.

F. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.

G. 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.

H. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and to not exceed maximum pipe deflections allowed by ASME B31.9 for building services piping.

I. Insulated Piping:
1. Specify parts in first three subparagraphs below as galvanized or painted, as required. Other materials are available in place of wooden blocks.
2. 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 allowed by ASME B31.9 for building services piping.
3. Install MSS SP-58, Type 39, protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.
4. High-compressive-strength inserts may permit use of shorter shields or shields with less arc span. Revise first subparagraph below to suit Project.
5. Install MSS SP-58, Type 40, protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.
6. Shield Dimensions for Pipe: Not less than the following:
   NPS 1/4 to NPS 3-1/2: 12 inches long and 0.048 inch thick.
7. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

3.02 METAL FABRICATIONS

A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers.

B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.

3.03 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.

3.04 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 a minimum dry film thickness of 2.0 mils.

B. Touchup: 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.

3.05 HANGER AND SUPPORT SCHEDULE

A. Specific hanger and support requirements are 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 carbon-steel pipe hangers and supports and metal framing systems and attachments for general service applications.

F. Use copper-plated pipe hangers and copper or stainless-steel attachments for copper piping and tubing.

G. Use padded hangers for piping that is subject to scratching.

H. Use thermal-hanger shield inserts for insulated piping and tubing.

I. 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 4.

2. Steel Pipe Clamps (MSS Type 4): For suspension of cold and hot pipes NPS 1/2 to NPS 4 if little or no insulation is required.
3. 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.
4. Adjustable, Swivel Split- or Solid-Ring Hangers (MSS Type 6): For suspension of noninsulated, stationary pipes NPS 3/4 to NPS 4.
5. Adjustable, Steel Band Hangers (MSS Type 7): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
6. Adjustable Band Hangers (MSS Type 9): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
7. Adjustable, Swivel-Ring Band Hangers (MSS Type 10): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 4.
8. Split Pipe Ring with or without Turnbuckle Hangers (MSS Type 11): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 4.
9. Extension Hinged or Two-Bolt Split Pipe Clamps (MSS Type 12): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 3.
10. U-Bolts (MSS Type 24): For support of heavy pipes NPS 1/2 to NPS 4.

J. 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 24.
2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers NPS 3/4 to NPS 24 if longer ends are required for riser clamps.

K. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joist construction, to attach to top flange of structural shape.
2. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of channels, or angles.
3. C-Clamps (MSS Type 23): For structural shapes.
4. 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.

L. 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.

M. Comply with MSS SP-69 for trapeze pipe-hanger 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.

END OF SECTION 15402

SECTION 220548

VIBRATION AND SEISMIC CONTROLS FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Isolation pads.
2. Isolation mounts.
3. Restrained elastomeric isolation mounts.
4. Freestanding and restrained spring isolators.
5. Housed spring mounts.
6. Elastomeric hangers.
7. Spring hangers.
8. Spring hangers with vertical-limit stops.
9. Pipe riser resilient supports.
10. Resilient pipe guides.
11. Seismic snubbers.
12. Restraining braces and cables.

1.3 DEFINITIONS

A. IBC: International Building Code.

B. ICC-ES: ICC-Evaluation Service.

C. OSHPD: Office of Statewide Health Planning and Development for the State of California.

1.4 PERFORMANCE REQUIREMENTS

A. Seismic-Restraint Loading:

1. Site Class as Defined in the IBC: D.
2. Assigned Seismic Use Group or Building Category as Defined in the IBC: II.

a. Component Importance Factor: 1.0.
b. Component Response Modification Factor: 1.5.
c. Component Amplification Factor: 1.0.

3. Design Spectral Response Acceleration at Short Periods (0.2 Second): 25%.
4. Design Spectral Response Acceleration at 1-Second Period: 8.6%.

1.5 SUBMITTALS

A. Product Data: For the following:

1. Include rated load, rated deflection, and overload capacity for each vibration isolation device.
2. Illustrate and indicate style, material, strength, fastening provision, and finish for each type and size of seismic-restraint component used.

    a. Tabulate types and sizes of seismic restraints, complete with report numbers and rated strength in tension and shear as evaluated by an evaluation service member of ICC-ES or an agency acceptable to authorities having jurisdiction.
    b. Annotate to indicate application of each product submitted and compliance with requirements.
3. Qualification Data: For professional engineer.

4. For each vibration isolation and seismic-restraint device: Include design calculations and details for selecting vibration isolators and seismic restraints complying with performance requirements, design criteria, and analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.6 QUALITY ASSURANCE

A. Comply with seismic-restraint requirements in the IBC unless requirements in this Section are more stringent.

B. Seismic-restraint devices shall have horizontal and vertical load testing and analysis and shall bear anchorage preapproval OPA number from OSHPD, preapproved by ICC-ES, or preapproved by another agency acceptable to authorities having jurisdiction, showing maximum seismic-restraint ratings. Ratings based on independent testing are preferred to ratings based on calculations. If preapproved ratings are not available, submittals based on independent testing are preferred. Calculations (including combining shear and tensile loads) to support seismic-restraint designs must be signed and sealed by a qualified professional engineer.

PART 2 - PRODUCTS

2.1 SEISMIC-RESTRAINT DEVICES

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. Amber/Booth Company, Inc.
2. California Dynamics Corporation.
3. Cooper B-Line, Inc.; a division of Cooper Industries.
4. Hilti, Inc.

5. Kinetics Noise Control.
6. Loos & Co.; Cableware Division.
7. Mason Industries.
8. TOLCO Incorporated; a brand of NIBCO INC.
9. Unistrut; Tyco International, Ltd.

B. General Requirements for Restraint Components: Rated strengths, features, and applications shall be as defined in reports by an evaluation service member of ICC-ES or an agency acceptable to authorities having jurisdiction.

1. Structural Safety Factor: Allowable strength in tension, shear, and pullout force of components shall be at least four times the maximum seismic forces to which they will be subjected.

C. Channel Support System: MFMA-3, shop- or field-fabricated support assembly made of slotted steel channels with accessories for attachment to braced component at one end and to building structure at the other end and other matching components and with corrosion-resistant coating; and rated in tension, compression, and torsion forces.

D. Restraint Cables: ASTM A 603 galvanized-steel cables with end connections made of steel assemblies with thimbles, brackets, swivel, and bolts designed for restraining cable service; and with a minimum of two clamping bolts for cable engagement.

E. Hanger Rod Stiffener: Steel tube or steel slotted-support-system sleeve with internally bolted connections to hanger rod.

F. Resilient Isolation Washers and Bushings: One-piece, molded, oil- and water-resistant neoprene, with a flat washer face.

2.2 FACTORY FINISHES

A. Finish: Manufacturer's standard prime-coat finish ready for field painting.

B. Finish: Manufacturer's standard paint applied to factory-assembled and -tested equipment before shipping.

1. Powder coating on springs and housings.
2. All hardware shall be galvanized. Hot-dip galvanize metal components for exterior use.
3. Baked enamel or powder coat for metal components on isolators for interior use.
4. Color-code or otherwise mark vibration isolation and seismic-control devices to indicate capacity range.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and equipment to receive vibration isolation and seismic-control devices for compliance with requirements for installation tolerances and other conditions affecting performance.

B. Examine roughing-in of reinforcement and cast-in-place anchors to verify actual locations before installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 APPLICATIONS

A. Multiple Pipe Supports: Secure pipes to trapeze member with clamps approved for application by an evaluation service member of ICC-ES or an agency acceptable to authorities having jurisdiction.

B. Hanger Rod Stiffeners: Install hanger rod stiffeners where indicated or scheduled on Drawings to receive them and where required to prevent buckling of hanger rods due to seismic forces.

3.3 VIBRATION-CONTROL AND SEISMIC-RESTRAINT DEVICE INSTALLATION

A. Piping Restraints:

1. Comply with requirements in MSS SP-127.
2. Space lateral supports a maximum of 40 feet o.c., and longitudinal supports a maximum of 80 feet o.c.
3. Brace a change of direction longer than 12 feet.

B. Install seismic-restraint devices using methods approved by an evaluation service member of ICC-ES or an agency acceptable to authorities having jurisdiction providing required submittals for component.

C. Attachment to Structure: If specific attachment is not indicated, anchor bracing to structure at flanges of beams, at upper truss chords of bar joists, or at concrete members.

3.4 ACCOMMODATION OF DIFFERENTIAL SEISMIC MOTION

A. Install flexible connections in piping where they cross seismic joints, where adjacent sections or branches are supported by different structural elements, and where the connections terminate with connection to equipment that is anchored to a different structural element from the one supporting the connections as they approach equipment. Comply with requirements in Division 22 Section "Domestic Water Piping" for piping flexible connections.

3.5 ADJUSTING

A. Adjust isolators after piping system is at operating weight.

B. Adjust limit stops on restrained spring isolators to mount equipment at normal operating height. After equipment installation is complete, adjust limit stops so they are out of contact during normal operation.

C. Adjust active height of spring isolators.

D. Adjust restraints to permit free movement of equipment within normal mode of operation.

END OF SECTION 220548

SECTION 220553 - IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Pipe labels.
2. Equipment and Valves sign.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

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 PIPE IDENTIFICATION SIGNS

A. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction.

B. Pipe identification signs shall be fabricated of acrylic plastic suitable for outdoor installation. Signs shall be resistant to corrosive chemicals or color fading from exposure to heat or sunlight.

C. Pipe identification signs shall conform to the requirements of ANSI A13.1-1981 for overall size, lettering size and length of color field. Legends and colors shall be as specified. All signs shall incorporate direction of flow arrows and pipe sizes (i.e. 6-inch). The service abbreviation shall be shown on the signs.

D. Pipe identification signs shall be "Setmark" pipe markers as manufactured by Seton Nameplate Corp., or equal.

E. Pipeline signs, and finish coats of paint for pipelines and equipment shall be coded as in the Schedule of the Section 01340-1

2.2 EQUIPMENT, VALVES AND APPURTENANCE IDENTIFICATION

A. Identification signs shall be coded as in the Schedule of the Section 01340-1.

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

Install or permanently fasten labels on each major item of mechanical equipment. 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." The color of the final coats of paint shall be color coded.

B. Stenciled Pipe Label Option: Stenciled labels may be provided instead of manufactured pipe labels, at Installer's option. Install stenciled pipe labels with painted, color-coded bands or rectangles, complying with ASME A13.1, on each piping system.

1. Identification Paint: Use for contrasting background.
2. Stencil Paint: Use for pipe marking.

C. Identification signs for piping shall be located along straight line runs at intervals not to exceed 30 feet and 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, and similar access points that permit view of concealed piping.
5. Spaced at maximum intervals of 50 feet along each run. Reduce intervals to 25 feet in areas of congested piping.
6. On piping above removable acoustical ceilings. Omit intermediately spaced labels.

D. Direction-of-flow arrows shall be located at intervals not to exceed 15 feet and near valves, branches, junction points and changes in direction or where required for clarity. All piping identifications signs shall be placed so as to be easily visible from operating locations.

E. Identification signs and arrows on piping shall be mounted parallel and tangent to the pipe and valves by fastening with screws, plastic or fiber washers, threaded brackets and banding straps and seals. Screws and brackets shall be stainless steel with 5/16 – 18 American Standard Coarse Threads; bands shall be 25 gage stainless steel, ¾ inch wide spring type retainers or straps shall not be permitted. All attachment and bolting devices shall be of type 304 stainless steel. Where pipe is insulated, the Contractor shall use care in mounting the signs so as to prevent the banding straps from crushing the insulation.

F. The mounting assembly shall be Steelbinder No. 0011-SS-4 strapping unit as manufactured by A.J. Gerrard & Co., Melrose Park, Ill.; Independent Metal Strap Co., Inc., Roslyn, N.Y., or equal.

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 similar roughing-in connections of end-use fixtures and units. List tagged valves in a valve schedule.

B. See Section 01340 Identification for equipment, valves and appurtenance tag installation.

END OF SECTION 220553

SECTION 220719 - PLUMBING PIPING INSULATION

PART 1 - GENERAL

1.01 Section Includes insulating the following plumbing piping services:

Domestic hot-water piping.

Domestic cold-water piping.

Supplies and drains for handicap-accessible lavatories and sinks.

1.02 SUBMITTALS

Product Data: For each type of product indicated.

1.03 QUALITY ASSURANCE

A. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products according to ASTM E 84 by a testing 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 agency.

Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.

B. Comply with the following applicable standards and other requirements specified for miscellaneous components:

Supply and Drain Protective Shielding Guards: ICC A117.1.

PART 2 - PRODUCTS

2.01 INSULATION MATERIALS

A. Comply with requirements in "Piping Insulation Schedule, General," "Indoor Piping Insulation 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. Cellular Glass: Inorganic, incombustible, foamed or cellulated glass with annealed, rigid, hermetically sealed cells. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
1. Products: Pittsburgh Corning Corporation; Foamglas.
2. Block Insulation: ASTM C 552, Type I.
3. Special-Shaped Insulation: ASTM C 552, Type III.
4. Preformed Pipe Insulation without Jacket: Comply with ASTM C 552, Type II, Class 1.
5. Preformed Pipe Insulation with Factory-Applied ASJ: Comply with ASTM C 552, Type II, Class 2.
6. Factory fabricate shapes according to ASTM C 450 and ASTM C 585.

G. Flexible Elastomeric Insulation: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type I for tubular materials.

Manufacturer:

Aeroflex USA, Inc.; Aerocel.
Armacell LLC; AP Armaflex.
K-Flex USA; Insul-Lock, Insul-Tube, and K-FLEX LS.

H. Mineral-Fiber, Preformed Pipe Insulation:

Manufacturer:

Fibrex Insulations Inc.; Coreplus 1200.
Johns Manville; Micro-Lok.
Knauf Insulation; 1000-Degree Pipe Insulation.
Manson Insulation Inc.; Alley-K.
Owens Corning; Fiberglas Pipe Insulation.

1. Type I, 850 Deg F Materials: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 547, Type I, Grade A. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

2.02 INSULATING CEMENTS

Mineral-Fiber, Hydraulic-Setting Insulating and Finishing Cement: Comply with ASTM C 449.

Products: Ramco Insulation, Inc.; Ramcote 1200 and Quik-Cote.

2.03 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. Cellular-Glass Adhesive: Two-component, thermosetting urethane adhesive containing no flammable solvents, with a service temperature range of minus 100 to plus 200 deg F.

Products: Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 81-84.

1. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
2. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

C. Flexible Elastomeric Adhesive: Comply with MIL-A-24179A, Type II, Class I.

Products:

Aeroflex USA, Inc.; Aeroseal.
Armacell LLC; Armaflex 520 Adhesive.
Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-75.
K-Flex USA; R-373 Contact Adhesive.

1. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
2. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

D. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.

Products:

Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-127.
Eagle Bridges - Marathon Industries; 225.
Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-60/85-70.
Mon-Eco Industries, Inc.; 22-25.

1. For indoor applications, adhesive shall have a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
2. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

E. PVC Jacket Adhesive: Compatible with PVC jacket.

Products:

Dow Corning Corporation; 739, Dow Silicone.
Johns Manville; Zeston Perma-Weld, CEEL-TITE Solvent Welding Adhesive.
P.I.C. Plastics, Inc.; Welding Adhesive.
Speedline Corporation; Polyco VP Adhesive.

1. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2. Adhesive 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."

2.04 MASTICS

A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-PRF-19565C, Type II.

For indoor applications, use mastics that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

B. Vapor-Barrier Mastic: Water based; suitable for indoor use on below-ambient services.
1. Products:
Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 30-80/30-90.
Vimasco Corporation; 749.
2. Water-Vapor Permeance: ASTM E 96/E 96M, 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, 58 percent by volume and 70 percent by weight.
5. Color: White.

C. Breather Mastic: Water based; suitable for indoor and outdoor use on above-ambient services.

1. Products:

Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-10.
Eagle Bridges - Marathon Industries; 550.
Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 46-50.
Mon-Eco Industries, Inc.; 55-50.
Vimasco Corporation; WC-1/WC-5.

2. Water-Vapor Permeance: ASTM F 1249, 1.8 perms at 0.0625-inch dry film thickness.
3. Service Temperature Range: Minus 20 to plus 180 deg F.
4. Solids Content: 60 percent by volume and 66 percent by weight.
5. Color: White.

2.05 SEALANTS

A. Joint Sealants:

1. Joint Sealants for Cellular-Glass Products:

Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-76.
Eagle Bridges - Marathon Industries; 405.
Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 30-45.

Mon-Eco Industries, Inc.; 44-05.
Pittsburgh Corning Corporation; Pittseal 444.

2. Materials shall be compatible with insulation materials, jackets, and substrates.
3. Permanently flexible, elastomeric sealant.
4. Service Temperature Range: Minus 100 to plus 300 deg F.
5. Color: White or gray.
6. For indoor applications, sealants shall have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
7. Sealants shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

B. ASJ Flashing Sealants and PVC Jacket Flashing Sealants:

1. Products:

Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 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, sealants shall have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
7. Sealants shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

2.06 FACTORY-APPLIED JACKETS

Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:
ASJ: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C 1136, Type I.

2.07 FIELD-APPLIED FABRIC-REINFORCING MESH

Woven Polyester Fabric: Approximately 1 oz./sq. yd. with a thread count of 10 strands by 10 strands/sq. in., in a Leno weave, for pipe.

Products:

Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; Mast-A-Fab.
Vimasco Corporation; Elastafab 894.

2.08 FIELD-APPLIED JACKETS

A. Field-applied jackets shall comply with ASTM C 921, Type I, unless otherwise indicated.

B. PVC Jacket: High-impact-resistant, UV-resistant PVC complying with ASTM D 1784, Class 16354-C; thickness as scheduled; roll stock ready for shop or field cutting and forming. Thickness is indicated in field-applied jacket schedules.

1. Products:

Johns Manville; Zeston.
P.I.C. Plastics, Inc.; FG Series.
Proto Corporation; LoSmoke.
Speedline Corporation; SmokeSafe.

2. Adhesive: As recommended by jacket material manufacturer.
3. Color: White.
4. Factory-fabricated fitting covers to match jacket if available; otherwise, field fabricate.

Shapes: 45- and 90-degree, short- and long-radius elbows, tees, valves, flanges, unions, reducers, end caps, soil-pipe hubs, traps, mechanical joints, and P-trap and supply covers for lavatories.

2.09 TAPES

A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136.

1. Products:

ABI, Ideal Tape Division; 428 AWF ASJ.
Avery Dennison Corporation, Specialty Tapes Division; Fasson 0836.
Compac Corporation; 104 and 105.
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:

ABI, Ideal Tape Division; 370 White PVC tape.
Compac Corporation; 130.
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.

2.10 SECUREMENTS

C. Aluminum Bands: ASTM B 209, Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch thick, 1/2 inch wide with wing seal or closed seal.

Products:

ITW Insulation Systems; Gerrard Strapping and Seals.
RPR Products, Inc.; Insul-Mate Strapping and Seals.

D. Staples: Outward-clinching insulation staples, nominal 3/4-inch- wide, stainless steel or Monel.

E. Wire: 0.080-inch nickel-copper alloy or 0.062-inch soft-annealed, galvanized steel.

Manufacturers: C & F Wire.

2.11 PROTECTIVE SHIELDING GUARDS

A. Protective Shielding Pipe Covers:

Manufacturers:

Engineered Brass Company.
McGuire Manufacturing.
Truebro; a brand of IPS Corporation.
Zurn Industries, LLC; Tubular Brass Plumbing Products Operation.

Description: Manufactured plastic wraps for covering plumbing fixture hot- and cold-water supplies and trap and drain piping. Comply with Americans with Disabilities Act (ADA) requirements.

B. Protective Shielding Piping Enclosures:

Manufacturers:

Truebro; a brand of IPS Corporation.
Zurn Industries, LLC; Tubular Brass Plumbing Products Operation.

Description: Manufactured plastic enclosure for covering plumbing fixture hot- and cold-water supplies and trap and drain piping. Comply with ADA requirements.

PART 3 - EXECUTION

3.01 PREPARATION

A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

B. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless-steel surfaces, use demineralized water.

3.02 GENERAL INSTALLATION REQUIREMENTS

A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of piping including fittings, valves, and specialties.

B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of 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 4 inches o.c.

a. For below-ambient services, apply vapor-barrier mastic over staples.

4. Cover joints and seams with tape, according to insulation material manufacturer's written instructions, 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.

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.

P. 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.

3.03 PENETRATIONS

A. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.

B. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions. Use fire-resistive joint sealers.

3.04 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, and Unions:

1. Install insulation over fittings, valves, strainers, 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 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. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic for below-ambient services and a breather mastic for above-ambient services. Reinforce the mastic with fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.
8. For services not specified to receive a field-applied jacket except for flexible elastomeric, install fitted PVC cover over elbows, tees, strainers, valves, and unions. Terminate ends with PVC end caps. Tape PVC covers to adjoining insulation facing using PVC tape.
9. Stencil or 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, sensors, switches, and transmitters on insulated pipes. 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.

D. Install removable insulation covers at locations indicated. Installation shall conform to the following:

1. Make removable union insulation from sectional pipe insulation of same thickness as that on adjoining pipe. Install same insulation jacket as adjoining pipe insulation.
2. When union covers are made from sectional pipe insulation, extend insulation from union long at least two times the insulation thickness over adjacent pipe insulation on each side of union. Secure cover in place with stainless-steel or aluminum bands. Select band material compatible with insulation and jacket.
3. Construct removable valve insulation covers in same manner as for flanges, except divide the two-part section on the vertical center line of valve body.
4. When covers are made from block insulation, make two halves, each consisting of mitered blocks wired to stainless-steel fabric. Secure this wire frame, with its attached insulation, to flanges with tie wire. Extend insulation at least 2 inches over adjacent pipe insulation on

each side of valve. Fill space between flange or union cover and pipe insulation with insulating cement. Finish cover assembly with insulating cement applied in two coats. After first coat is dry, apply and trowel second coat to a smooth finish.

5. Unless a PVC jacket is indicated in field-applied jacket schedules, finish exposed surfaces with a metal jacket.

3.05 INSTALLATION OF CELLULAR-GLASS INSULATION

E. Insulation Installation on Straight Pipes and Tubes:
1. Secure each layer of 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 services, secure laps with outward clinched staples at 6 inches o.c.
4. For insulation with factory-applied jackets on below-ambient services, do not staple longitudinal tabs. Instead, secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.

F. Insulation Installation on Pipe Fittings and Elbows:
1. Install preformed sections of same material as straight segments of pipe insulation when available. Secure according to manufacturer's written instructions.
2. When preformed sections of insulation are not available, install mitered sections of cellular-glass insulation. Secure insulation materials with wire or bands.

G. Insulation Installation on Valves and Pipe Specialties:
1. Install preformed sections of cellular-glass insulation to valve body.
2. 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.

3.06 INSTALLATION OF FLEXIBLE ELASTOMERIC INSULATION

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 Fittings and Elbows:
Install mitered sections of pipe insulation.
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.

C. Insulation Installation on Valves and Pipe Specialties:
Install preformed valve covers manufactured of same material as pipe insulation when available.
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.
Install insulation to flanges as specified for flange insulation application.
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.

3.07 INSTALLATION OF MINERAL-FIBER PREFORMED PIPE INSULATION

Insulation Installation on Straight Pipes and Tubes:

A. Secure each layer of preformed pipe insulation to pipe with wire or bands and tighten bands without deforming insulation materials.

B. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.

C. For insulation with factory-applied jackets on above-ambient surfaces, secure laps with outward clinched staples at 6 inches o.c.

D. For insulation with factory-applied jackets on below-ambient surfaces, do not staple longitudinal tabs. Instead, secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.

Insulation Installation on Pipe Fittings and Elbows:

A. Install preformed sections of same material as straight segments of pipe insulation when available.

B. 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.

Insulation Installation on Valves and Pipe Specialties:

A. Install preformed sections of same material as straight segments of pipe insulation when available.

B. When preformed sections are not available, install mitered sections of pipe insulation to valve body.

C. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.

3.08 FIELD-APPLIED JACKET INSTALLATION

A. Where PVC jackets are indicated, install with 1-inch overlap at longitudinal seams and end joints. Seal with manufacturer's recommended adhesive.

Apply two continuous beads of adhesive to seams and joints, one bead under lap and the finish bead along seam and joint edge.

3.09 FINISHES

A. Insulation with ASJ, Glass-Cloth, or Other Paintable Jacket Material.

B. Flat Acrylic Finish: Two finish coats over a primer that is compatible with jacket material and finish coat paint. Add fungicidal agent to render fabric mildew proof.

C. Finish Coat Material: Interior, flat, latex-emulsion size.

D. Flexible Elastomeric Thermal Insulation: After adhesive has fully cured, apply two coats of insulation manufacturer's recommended protective coating.

3.10 FIELD QUALITY CONTROL

Perform tests and inspections.

Tests and Inspections:

A. Inspect pipe, fittings, strainers, and valves, 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.

B. All insulation applications will be considered defective Work if sample inspection reveals noncompliance with requirements.

3.11 PIPING INSULATION SCHEDULE, GENERAL

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.

Items Not Insulated: Unless otherwise indicated, do not install insulation on the following:

Chrome-plated pipes and fittings unless there is a potential for personnel injury.

3.12 INDOOR PIPING INSULATION SCHEDULE

A. Domestic Cold and Hot Water:

Cellular Glass: 1 1/2 inches thick.

Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch.

3.13 INDOOR, FIELD-APPLIED JACKET SCHEDULE

A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.

B. If more than one material is listed, selection from materials listed is Contractor's option.

C. Piping: PVC: 20 mils thick.

END OF SECTION 15411

SECTION 221116 - DOMESTIC WATER PIPING

PART 1 - GENERAL

1.01 Section Includes:

Aboveground domestic water pipes, tubes, fittings, and specialties inside the building.

1.02 SUBMITTALS

Product Data: For the following products:

A. Pipe, tube and fittings.
C. Specialty valves.
D. Dielectric fittings.
E. Shop drawings.

1.03 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.

PART 2 - PRODUCTS

2.01 PIPING MATERIALS

A. See "Writing Guide" Article in the Evaluations for a discussion of how this Section is organized and the most efficient way to edit this Section. See "Piping Materials and Standards" Article in the Evaluations for a discussion of piping materials covered by referenced standards.

B. 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.

2.02 COPPER TUBE AND FITTINGS

A. Tube in first paragraph below is available in NPS 1/8 to NPS 12.

B. Hard Copper Tube: ASTM B 88, Type L 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. Copper Unions: MSS SP-123, cast-copper-alloy, hexagonal-stock body, with ball-and-socket, metal-to-metal seating surfaces, and solder-joint or threaded ends.

4. Copper Pressure-Seal-Joint Fittings: NPS 2 and Smaller: Wrought-copper fitting with EPDM-rubber O-ring seal in each end.
5. Manufacturers:
   1) NIBCO INC.
   2) Viega; Plumbing and Heating Systems.
   3) Elkhart Products Corporation; Industrial Division.

2.03 SPECIALTY VALVES

A. Copper-Alloy Calibrated Balancing Valves.

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. NIBCO Inc.
2. TACO Incorporated.
3. Watts; a division of Watts Water Technologies, Inc; Watts Regulator Company.

Type: Ball valve with two readout ports and memory-setting indicator.
Body: Brass or bronze.
Size: Same as connected piping, but not larger than NPS 2.

B. Comply with requirements in Division 22 Section "General-Duty Valves for Plumbing Piping" for general-duty metal valves.

2.04 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. Unions in first paragraph below are available in at least NPS 1/2 to NPS 2.

C. Dielectric Unions:

1. Manufacturers:

   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.

D. Flanges in first paragraph below are available in at least NPS 1-1/2 to NPS 4.

E. Couplings in first paragraph below are available in at least NPS 1/2 to NPS 3.

F. Dielectric Couplings:

Manufacturers: Lochinvar Corporation.

Description:
Galvanized-steel coupling.
Revise pressure rating and temperature in first subparagraph below to suit Project.
Pressure Rating: 300 psig at 225 deg F.
End Connections: Female threaded.
Lining: Inert and noncorrosive, thermoplastic.

G. Nipples in paragraph below are available in at least NPS 1/2 to NPS 4.

H. Dielectric Nipples:

Manufacturers:
1. Perfection Corporation; a subsidiary of American Meter Company.
2. Precision Plumbing Products, Inc.
3. Victaulic Company.

Description:

Electroplated steel nipple complying with ASTM F 1545.
Pressure Rating: 300 psig at 225 deg F.
End Connections: Male threaded.
Lining: Inert and noncorrosive, propylene.

PART 3 - EXECUTION

3.01 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 shutoff valve immediately upstream of each dielectric fitting.

C. Install domestic water piping level with 0.25 percent slope downward toward drain and plumb.

D. Install piping concealed from view and protected from physical contact by building occupants 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, and coordinate with other services occupying that space.

G. Install piping adjacent to equipment and specialties to allow service and maintenance.

H. Install piping to permit valve servicing.

I. 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.

J. Install piping free of sags and bends.

K. Install fittings for changes in direction and branch connections.

L. Install unions in copper tubing at final connection to each piece of equipment, and specialty.

M. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Division 22 Section "Sleeves and Sleeve Seals for Plumbing Piping."

N. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Division 22 Section "Sleeves and Sleeve Seals for Plumbing Piping."

O. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Division 22 Section "Escutcheons for Plumbing Piping."

3.02 JOINT CONSTRUCTION

A. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.

B. 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:

Apply appropriate tape or thread compound to external pipe threads.
Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.

C. 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."

3.03 VALVE INSTALLATION

General-Duty Valves: Comply with requirements in Division 22 Section "General-Duty Valves for Plumbing Piping" for valve installations.

Install balancing valve with inlet and outlet shutoff valves and in locations where they can easily be adjusted.

3.04 DIELECTRIC FITTING INSTALLATION

Install dielectric fittings in piping at connections of dissimilar metal piping and tubing.

Dielectric Fittings for NPS 2 and Smaller: Use dielectric couplings or nipples.

3.05 HANGER AND SUPPORT INSTALLATION

A. Comply with requirements in Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment" for pipe hanger and support products and installation.

Vertical Piping: MSS Type 8 or 42, clamps.
Individual, Straight, Horizontal Piping Runs:

100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.

B. Support vertical piping and tubing at base.

C. Rod diameter may be reduced one size for double-rod hangers, to a minimum of 3/8 inch.

D. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:

NPS 3/4 and Smaller: 60 inches with 3/8-inch rod.

NPS 1 and NPS 1-1/4: 72 inches with 3/8-inch rod.

NPS 1-1/2 and NPS 2: 96 inches with 3/8-inch rod.

E. Install supports for vertical copper tubing every 10 feet.

F. Support piping and tubing not listed in this article according to MSS SP-69 and manufacturer's written instructions.

3.06 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. When installing piping adjacent to equipment, allow space for 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:

Water Heaters - Cold-water inlet and hot-water outlet piping in sizes indicated, but not smaller than sizes of water heater connections.
Plumbing Fixtures: Cold- and hot-water-supply piping in sizes indicated, but not smaller than that required by plumbing code.

3.07 IDENTIFICATION

Identify system components. Comply with requirements in Division 1 and Division 22 Sections "Identification" and "Identification for Plumbing Piping and Equipment" for identification materials and installation.

3.08 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Piping Inspections:

Do not enclose, cover, or put piping into operation until it has been inspected and approved by authorities having jurisdiction.
During installation, notify authorities having jurisdiction at least one working day before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction:

Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.
Final Inspection: Arrange final inspection for authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.

Reinspection: If authorities having jurisdiction find that piping will not pass tests or inspections, make required corrections and arrange for reinspection.
Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.

C. Piping Tests:

Fill domestic water piping. Check components to determine that they are not air bound and that piping is full of water.

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.

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.

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.

Repair leaks and defects with new materials and retest piping or portion thereof until satisfactory results are obtained.

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.

3.09 ADJUSTING

Perform the following adjustments before operation:

Close drain valves, hydrants, and hose bibbs.
Open shutoff valves to fully open position.
Open throttling valves to proper setting.
Remove plugs used during testing of piping and for temporary sealing of piping during installation.
Close drain valves and replace drain plugs.
Remove filter cartridges from housings and verify that cartridges are as specified for application where used and are clean and ready for use.
Check plumbing specialties and verify proper settings, adjustments, and operation.
Set field-adjustable flow set points of balancing valves.

3.010 CLEANING

A. Portions of disinfecting requirements in this article are taken from model plumbing codes; revise if requirements vary. Option in first paragraph below is for disinfection of non-potable domestic water piping.

B. Clean and disinfect potable domestic water piping as follows:

Purge new piping and parts of existing piping that have been altered, extended, or repaired before using.
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:

Flush piping system with clean, potable water until dirty water does not appear at outlets.

Fill and isolate system according to either of the following:

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.
Fill system or part thereof with water/chlorine solution with at least 200 ppm of chlorine. Isolate and allow to stand for three hours.

Flush system with clean, potable water until no chlorine is in water coming from system after the standing time.

Submit water samples in sterile bottles to authorities having jurisdiction. Repeat procedures if biological examination shows contamination.

C. Clean non-potable domestic water piping as follows:

Purge new piping and parts of existing piping that have been altered, extended, or repaired before using.
Use purging procedures prescribed by authorities having jurisdiction or; if methods are not prescribed, follow procedures described below:

Flush piping system with clean, potable water until dirty water does not appear at outlets.
Submit water samples in sterile bottles to authorities having jurisdiction. Repeat procedures if biological examination shows contamination.

D. Prepare and submit reports of purging and disinfecting activities.

E. Clean interior of domestic water piping system. Remove dirt and debris as work progresses.

3.011 PIPING SCHEDULE

A. Under-building-slab, domestic water piping, NPS 2, shall be the following: PVC, Schedule 40; socket fittings; and solvent-cemented joints.

B. Aboveground domestic building-service piping, NPS 2 1/2 and smaller, shall be the following: Hard copper tube, ASTM B 88, Type L (ASTM B 88M, Type B); copper pressure fittings; and soldered joints.

3.012 VALVE SCHEDULE

Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:

Shutoff Duty: Use ball or gate valves for piping NPS 2 and smaller.

END OF SECTION 15405

SECTION 221119 - DOMESTIC WATER PIPING SPECIALTIES

PART 1 - GENERAL

1.01 Section Includes:

1) Vacuum breakers.
2) Water- hammer arrester.
3) Balancing valves.
4) Temperature-actuated, water mixing valve.

1.02 SUBMITTALS

Product Data: For each type of product indicated.

PART 2 - PRODUCTS

2.01 VACUUM BREAKERS

A. Pipe-Applied, Atmospheric-Type Vacuum Breakers:

Available Manufacturers:
1. Ames Co.
2. Conbraco Industries, Inc.
3. FEBCO; SPX Valves & Controls.
4. Watts Industries, Inc.; Water Products Div.
5. Zurn Plumbing Products Group; Wilkins Div.

Standard: ASSE 1001.
Size: NPS 1/4 to NPS 3, as required to match connected piping.
Body: Bronze.
Inlet and Outlet Connections: Threaded.
Finish: Chrome plated.

2.06 WATER-HAMMER ARRESTERS

Manufacturers:

1. AMTROL, Inc.
2. Josam Company.
3. MIFAB, Inc.
4. Watts Drainage Products.

Standard: ASSE 1010 or PDI-WH 201.
Type: Copper tube with piston.
Size: ASSE 1010, Sizes AA and A through F, or PDI-WH 201, Sizes A through F.

2.07 BALANCING VALVES

A. Copper-Alloy Calibrated Balancing Valves:

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:

    1. Armstrong International, Inc.
    2. Hammond Valve.

2. Standard: MSS SP-110 for two-piece, copper-alloy ball valves.
3. Pressure Rating: 400-psig minimum CWP.
4. Size: NPS 2 or smaller.
5. Body: Copper alloy.
6. Port: Standard or full port.
7. Ball: Chrome-plated brass.
8. Seats and Seals: Replaceable.
9. End Connections: Solder joint or threaded.
10. Handle: Vinyl-covered steel with memory-setting device.

2.08 TEMPERATURE-ACTUATED, WATER MIXING VALVES

B. Individual-Fixture, Water Tempering Valves:

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:

    1. Conbraco Industries, Inc.
    2. Honeywell International Inc.
    3. Leonard Valve Company.
    4. Watts; a division of Watts Water Technologies, Inc.; Watts Regulator Company.
    5. Zurn Industries, LLC; Plumbing Products Group; Wilkins Water Control Products.

2. Standard: ASSE 1016, thermostatically controlled, water tempering valve.
3. Pressure Rating: 125 psig minimum unless otherwise indicated.
4. Body: Bronze body with corrosion-resistant interior components.
5. Temperature Control: Adjustable.
6. Inlets and Outlet: Threaded.
7. Finish: Rough or chrome-plated bronze.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Refer to Division 22 Sections for piping joining materials, joint construction, and basic installation requirements.

A. 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 unacceptable for this application.
3. Do not install bypass piping around backflow preventers.

B. Install water regulators with inlet and outlet shutoff valves and bypass with memory-stop balancing valve. Install pressure gages on inlet and outlet.

C. Install balancing valves in locations where they can easily be adjusted.

D. Install temperature-actuated, water mixing valves with check stops or shutoff valves on inlets and with shutoff valve on outlet.

E. Install water-hammer arresters in water piping according to PDI-WH 201.

3.02 CONNECTIONS

A. Coordinate piping installations and specialty arrangements with schematics on Drawings and with requirements specified in piping systems. If Drawings are explicit enough, these requirements may be reduced or omitted.

B. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping and specialties.

3.03 LABELING AND IDENTIFYING

A. Equipment Nameplates and Signs: Install engraved plastic-laminate equipment nameplate or sign on or near each of the following:

Pressure vacuum breakers.
Primary, thermostatic, water mixing valves.
Balancing valves.

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."

3.04 FIELD QUALITY CONTROL

A. Perform the following tests and prepare test reports:

Test each pressure vacuum breaker and 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.

3.05 ADJUSTING

Set field-adjustable temperature set points of temperature-actuated water mixing valves.

Set field-adjustable flow set points of balancing valves.

END OF SECTION 221119

SECTION 221316 - SANITARY WASTE AND VENT PIPING

PART 1 - GENERAL

1.01 Section Includes:

1) Pipe, tube, and fittings.
2) Specialty pipe fittings.

1.02 SUBMITTALS

Product Data: For each type of product indicated.

1.03 QUALITY ASSURANCE

A. Piping materials shall bear label, stamp, or other markings of specified testing agency.

PART 2 - PRODUCTS

2.01 PIPING MATERIALS

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.

2.02 HUBLESS, CAST-IRON SOIL PIPE AND FITTINGS

A. Pipe and Fittings: ASTM A 888 or CISPI 301.

B. CISPI, Hubless-Piping Couplings:

1. Manufacturers:

   ANACO-Husky.
   Dallas Specialty & Mfg. Co.
   Fernco Inc.
   MIFAB, Inc.
   Mission Rubber Company; a division of MCP Industries, Inc.
   Tyler Pipe.
2. Description: Stainless-steel corrugated shield with stainless-steel bands and tightening devices; and ASTM C 564, rubber sleeve with integral, center pipe stop.

C. Heavy-Duty, Hubless-Piping Couplings:

1. Manufacturers:

   ANACO-Husky.
   Clamp-All Corp.
   Dallas Specialty & Mfg. Co.
   MIFAB, Inc.
   Mission Rubber Company; a division of MCP Industries, Inc.
   Tyler Pipe.
2. Description: Stainless-steel shield with stainless-steel bands and tightening devices; and ASTM C 564, rubber sleeve with integral, center pipe stop.

2.03 COPPER TUBE AND FITTINGS

A. Copper DWV Tube: ASTM B 306, drainage tube, drawn temper.

B. Copper Drainage Fittings: ASME B16.23, cast copper or ASME B16.29, wrought copper, solder-joint fittings.

C. Copper Flanges: ASME B16.24, Class 150, cast copper with solder-joint end.

Flange Gasket Materials: ASME B16.21, full-face, flat, nonmetallic, asbestos-free, 1/8-inch maximum thickness unless thickness or specific material is indicated.
Flange Bolts and Nuts: ASME B18.2.1, carbon steel unless otherwise indicated.

D. Solder: ASTM B 32, lead free with ASTM B 813, water-flushable flux.

2.04 SPECIALTY PIPE FITTINGS

A. Transition Couplings:

General Requirements: Fitting or device for joining piping with small differences in OD's or of different materials. Include end connections same size as and compatible with pipes to be joined.
1. Fitting-Type Transition Couplings: Manufactured piping coupling or specified piping system fitting.
2. Unshielded, Nonpressure Transition Couplings:

Manufacturers:

Dallas Specialty & Mfg. Co.
Fernco Inc.
Mission Rubber Company; a division of MCP Industries, Inc.
Plastic Oddities; a division of Diverse Corporate Technologies, Inc.

Standard: ASTM C 1173.
Description: Elastomeric, sleeve-type, reducing or transition pattern. Include shear ring and corrosion-resistant-metal tension band and tightening mechanism on each end.
Sleeve Materials:

For Cast-Iron Soil Pipes: ASTM C 564, rubber.
For Dissimilar Pipes: ASTM D 5926, PVC or other material compatible with pipe materials being joined.
3. Shielded, Nonpressure Transition Couplings:

Manufacturers:

Cascade Waterworks Mfg. Co.
Mission Rubber Company; a division of MCP Industries, Inc.

Standard: ASTM C 1460.
Description: Elastomeric or rubber sleeve with full-length, corrosion-resistant outer shield and corrosion-resistant-metal tension band and tightening mechanism on each end.

B. Dielectric Fittings:

General Requirements: Assembly of copper alloy and ferrous materials with separating nonconductive insulating material. Include end connections compatible with pipes to be joined.
Dielectric Unions:

Manufacturers:

Capitol Manufacturing Company.
Central Plastics Company.
McDonald, A. Y. Mfg. Co.
Watts Regulator Co.; a division of Watts Water Technologies, Inc.
Wilkins; a Zurn company.

Description:

Standard: ASSE 1079.
Pressure Rating: 125 psig minimum at 180 deg F.
End Connections: Solder-joint copper alloy and threaded ferrous.

PART 3 - EXECUTION

3.01 PIPING INSTALLATION

A. 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.

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 at indicated slopes.

E. Install piping free of sags and bends.

F. Install fittings for changes in direction and branch connections.

G. 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 two 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.

H. Install soil and waste drainage and vent piping at the following minimum slopes unless otherwise indicated:

1. Horizontal Sanitary Drainage Piping: 2 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. Vent Piping: 1 percent down toward vertical fixture vent or toward vent stack.

I. 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."

J. Install aboveground copper tubing according to CDA's "Copper Tube Handbook."

K. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.

L. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."

M. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."

N. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 220518 "Escutcheons for Plumbing Piping."

3.02 JOINT CONSTRUCTION

A. 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.

B. Join hubless, cast-iron soil piping according to CISPI 310 and CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for hubless-piping coupling joints.

C. Join copper tube and fittings with soldered joints according to ASTM B 828. Use ASTM B 813, water-flushable, lead-free flux and ASTM B 32, lead-free-alloy solder.

3.03 SPECIALTY PIPE FITTING INSTALLATION

A. Transition Couplings:

Install transition couplings at joints of piping with small differences in OD's.
In Drainage Piping: Unshielded, nonpressure transition couplings.

B. Dielectric Fittings:

Install dielectric fittings in piping at connections of dissimilar metal piping and tubing.
Dielectric Fittings for NPS 2 and Smaller: Use dielectric unions.
Dielectric Fittings for NPS 2-1/2 to NPS 4: Use dielectric flanges.

3.04 HANGER AND SUPPORT INSTALLATION

A. Comply with requirements for pipe hanger and support devices and installation specified in Section 15402 "Hangers and Supports for Plumbing Piping and Equipment."

Install carbon-steel pipe hangers for horizontal piping in noncorrosive environments.
Install stainless-steel pipe hangers for horizontal piping in corrosive environments.
Install carbon-steel pipe support clamps for vertical piping in noncorrosive environments.
Install stainless-steel pipe support clamps for vertical piping in corrosive environments.
Vertical Piping: MSS Type 8 or Type 42, clamps.
Install individual, straight, horizontal piping runs
Base of Vertical Piping: MSS Type 52, spring hangers.

B. Support vertical piping and tubing at base.

C. Rod diameter may be reduced one size for double-rod hangers, with 3/8-inch minimum rods.

D. Install hangers for cast-iron soil piping with the following maximum horizontal spacing and minimum rod diameters:

NPS 1-1/2 and NPS 2: 60 inches with 3/8-inch rod.
NPS 3: 60 inches with 1/2-inch rod.
Spacing for 10-foot lengths may be increased to 10 feet. Spacing for fittings is limited to 60 inches.

E. Install supports for vertical cast-iron soil piping every 15 feet.

F. Support piping and tubing not listed above according to MSS SP-69 and manufacturer's written instructions.

3.05 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. Install test tees (wall cleanouts) in conductors near floor and floor cleanouts with cover flush with floor.
5. Comply with requirements for cleanouts and drains specified in Section 15409 "Sanitary Waste Piping Specialties."

D. Make connections according to the following unless otherwise indicated:
Install flanges, in piping NPS 2-1/2 and larger, adjacent to flanged valves and at final connection to each piece of equipment.

3.08 IDENTIFICATION

Identify exposed sanitary waste and vent piping. Comply with requirements for identification specified in Section 15422 "Identification for Plumbing Piping and Equipment."

3.09 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 10-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.

3.10 CLEANING AND PROTECTION

A. Clean interior of piping. Remove dirt and debris as work progresses.

B. Protect drains during 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.

3.11 PIPING SCHEDULE

A. Aboveground, soil and waste piping NPS 4 and smaller shall be any of the following:

1. Hubless, cast-iron soil pipe and fittings; CISPI hubless-piping couplings; and coupled joints.
2. Copper DWV tube, copper drainage fittings, and soldered joints.
3. Dissimilar Pipe-Material Couplings: Shielded, nonpressure transition couplings.

B. Aboveground, vent piping NPS 4 and smaller shall be the following:

Hubless, cast-iron soil pipe and fittings; heavy-duty hubless-piping couplings; and coupled joints.

C. Aboveground sanitary-sewage force mains NPS 2 shall be the following:

1. Galvanized-steel pipe, pressure fittings, and threaded joints.

D. Aboveground sanitary-sewage force mains NPS 3 to NPS 4 shall be any of the following:

1. Galvanized-steel pipe, pressure fittings, and threaded joints.
2. Grooved-end, galvanized-steel pipe; grooved-joint, galvanized-steel-pipe appurtenances; and grooved joints.

END OF SECTION 221316

SECTION 221319 - SANITARY WASTE PIPING SPECIALTIES

PART 1 - GENERAL

2.01 Section Includes:

1) Cleanouts.
2) Through-penetration firestop assemblies.
3) Miscellaneous sanitary drainage piping specialties.
4) Flushing materials.

2.02 SUBMITTALS

Product Data: For each type of product indicated.

2.03 QUALITY ASSURANCE

Drainage piping specialties shall bear label, stamp, or other markings of specified testing agency.

2.04 COORDINATION

Coordinate size and location of roof penetrations.

PART 2 - PRODUCTS

A. Exposed Metal Cleanouts:

1. ASME A112.36.2M, Cast-Iron Cleanouts:

   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) Josam Company.
      2) MIFAB, Inc.
      3) Smith, Jay R. Mfg. Co.
      4) Watts Drainage Products.
      5) Zurn Plumbing Products Group.

2. Size: Same as connected branch.
3. Cast-iron soil pipe with cast-iron ferrule.
4. Closure: Countersunk or raised-head cast-iron plug.

B. Cast-Iron Wall Cleanouts:

1. Standard: ASME A112.36.2M. Include wall access.

2. Size: Same as connected drainage piping.
3. Body: Hubless, cast-iron soil pipe test tee as required to match connected piping.
4. Closure: Countersunk or raised-head, drilled-and-threaded cast-iron plug.
5. Closure Plug Size: Same as cleanout size.
6. Wall Access: Round, flat, chrome-plated brass or stainless-steel cover plate with screw.
7. Wall Access: Round, nickel-bronze, copper-alloy, or stainless-steel wall-installation frame and cover.

2.01 CLEANOUTS

A. Cleanouts:

1. Available Manufacturers:

a. Josam Company; Josam Div.
b. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
c. Tyler Pipe; Wade Div.
d. Watts Drainage Products Inc.
e. Zurn Plumbing Products Group; Light Commercial Operation.
f. Josam Company; Blucher-Josam Div.

2. Standard: ASME A112.36.2M for cast-iron soil pipe with adjustable housing cleanout.
3. Size: Same as connected branch.
4. Type: Adjustable housing.
5. Body or Ferrule: Cast iron.
6. Outlet Connection: Threaded.
7. Closure: Brass plug with straight threads and gasket, Cast iron plug.
8. Adjustable Housing Material: Cast iron set-screws or other device.
9. Frame and Cover Material and Finish: Nickel-bronze, copper alloy, Painted cast iron.

2.03 THROUGH-PENETRATION FIRESTOP ASSEMBLIES

A. Through-Penetration Firestop Assemblies:

1. Manufacturers:

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.

2.04 MISCELLANEOUS SANITARY DRAINAGE PIPING SPECIALTIES

B. Sleeve Flashing Device:

1. Description: Manufactured, cast-iron fitting, with clamping device, that forms sleeve for pipe floor penetrations of floor membrane. Include galvanized-steel pipe extension in top of fitting that will extend 1 inch above finished floor and galvanized-steel pipe extension in bottom of fitting that will extend through floor slab.
2. Size: As required for close fit to riser or stack piping.

C. Stack Flashing Fittings:

1. Description: Counterflashing-type, cast-iron fitting, with bottom recess for terminating roof membrane, and with threaded or hub top for extending vent pipe.
2. Size: Same as connected stack vent or vent stack.

D. Vent Caps:

1. Description: Cast-iron body with threaded or hub inlet and vandal-proof design. Include vented hood and setscrews to secure to vent pipe.
2. Size: Same as connected stack vent or vent stack.

E. Frost-Resistant Vent Terminals:

1. Description: Manufactured or shop-fabricated assembly constructed of copper, lead-coated copper, or galvanized steel.
2. Design: To provide 1-inch enclosed air space between outside of pipe and inside of flashing collar extension, with counterflashing.

2.06 FLASHING MATERIALS

A. Lead Sheet: ASTM B 749, Type L51121, copper bearing, with the following minimum weights and thicknesses, unless otherwise indicated:

General Use: 4.0-lb/sq. ft., 0.0625-inch thickness.
Vent Pipe Flashing: 3.0-lb/sq. ft., 0.0469-inch thickness.
Burning: 6-lb/sq. ft., 0.0938-inch thickness.

B. Fasteners: Metal compatible with material and substrate being fastened.

C. Metal Accessories: Sheet metal strips, clamps, anchoring devices, and similar accessory units required for installation; matching or compatible with material being installed.

D. Solder: ASTM B 32, lead-free alloy.

E. Bituminous Coating: SSPC-Paint 12, solvent-type, bituminous mastic.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install cleanouts in aboveground 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.
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.

B. For cleanouts located in concealed piping, install cleanout wall access covers, of types indicated, with frame and cover flush with finished wall.

C. Install sleeve flashing device with each riser and stack passing through floors with waterproof membrane.

3.02 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:

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.

B. Install sheet flashing on pipes, sleeves, and specialties passing through or embedded in floors and roofs with waterproof membrane.

Pipe Flashing: Sleeve type, matching pipe size, with minimum length of 10 inches, and skirt or flange extending at least 8 inches around pipe.

Sleeve Flashing: Flat sheet, with skirt or flange extending at least 8 inches around sleeve.

Embedded Specialty Flashing: Flat sheet, with skirt or flange extending at least 8 inches 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.

F. Extend flashing up vent pipe passing through roofs and turn down into pipe, or secure flashing into cast-iron sleeve having calking recess.

3.04 CONNECTIONS

A. Comply with requirements in Section 221316 "Sanitary Waste and Vent Piping" for piping installation requirements. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to equipment to allow service and maintenance.

C. Tests and Inspections:

Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

3.05 LABELING AND IDENTIFYING

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."

3.06 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 221319

SECTION 221329 - SANITARY SEWERAGE PUMPS

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. Submersible sewage pumps.
2. Sewage-pumps basin cover.

B. Related Sections include the following:

1. Section 221429 "Sump Pumps" for applications in storm-drainage systems.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

B. Wiring Diagrams: For power, signal, and control wiring.

1.4 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. UL Compliance: Comply with UL 778 for motor-operated water pumps.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Retain shipping flange protective covers and protective coatings during storage.

B. Protect bearings and couplings against damage.

C. Comply with pump manufacturer's written rigging instructions for handling.

1.6 COORDINATION

A. Coordinate sizes and locations of concrete bases with actual equipment provided.

PART 2 - PRODUCTS

2.1 SUBMERSIBLE SEWAGE PUMPS

A. Submersible, Fixed-Position, Sewage Pumps:

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. Barnes; Crane Pumps & Systems.
   b. Bell & Gossett Domestic Pump; ITT Corporation.
   c. Goulds Pumps; ITT Corporation.
   d. Grundfos Pumps Corp.
   e. ITT Flygt Corporation.
   f. Liberty Pumps.
   g. Little Giant Pump Co.
   h. Peerless Pump, Inc.
   i. Weil Pump Company, Inc.
   j. Weinman Division; Crane Pumps & Systems.
   k. Zoeller Company.

2. Description: Factory-assembled and -tested sewage-pump unit.
3. Pump Type: Submersible, end-suction, single-stage, close-coupled, overhung-impeller, centrifugal sewage pump as defined in HI 1.1-1.2 and HI 1.3.
4. Pump Casing: Cast iron, with open inlet, legs that elevate pump to permit flow into impeller, and vertical discharge for piping connection.
5. Impeller: Statically and dynamically balanced, ASTM A 48/A 48M, Class No. 25 A cast iron, nonclog, open, or semiopen design for solids handling, and keyed and secured to shaft.
6. Pump and Motor Shaft: Stainless steel, with factory-sealed, grease-lubricated ball bearings.
7. Seal: Mechanical.
8. Motor: Hermetically sealed, capacitor-start type; with built-in overload protection; lifting eye or lug; and three-conductor, waterproof power cable of length required and with grounding plug and cable-sealing assembly for connection at pump.

   a. Motor Housing Fluid: Air.

9. Controls:

   a. Enclosure: NEMA 250, Type 1.
   b. Switch Type: Pedestal-mounted float switch with float rods and rod buttons.
   c. Automatic Alternator: Start pumps on successive cycles and start multiple pumps if one cannot handle load.
   d. Float Guides: Pipe or other restraint for floats and rods in basins of depth greater than 60 inches.
   e. High-Water Alarm: Cover-mounted, compression-probe alarm, with electric bell; 120-V ac, with transformer and contacts for remote alarm bell.

10. Controls:

    a. Enclosure: NEMA 250, Type 1 pedestal or wall-mounted.
    b. Switch Type: Mechanical-float type, in NEMA 250, Type 6 enclosures with mounting rod and electric cables.
    c. Automatic Alternator: Start pumps on successive cycles and start multiple pumps if one cannot handle load.
    d. High-Water Alarm: Rod-mounted, NEMA 250, Type 6 enclosure with mechanical-float, mercury-float, or pressure switch matching control and electric bell; 120-V ac, with transformer and contacts for remote alarm bell.

11. Control-Interface Features:

    a. Remote Alarm Contacts: For remote alarm interface.
    b. Building Automation System Interface: Auxiliary contacts in pump controls for interface to building automation system and capable of providing the following:

        1) On-off status of pump.
        2) Alarm status.

B. Capacities and Characteristics:

1. System Capacity: see pump schedule on drawing P201.
2. Number of Pumps: Two.
3. Unit Electrical Characteristics: see pump schedule on drawing P201.

2.2 SEWAGE-PUMP BASIN COVER

A. Basin Covers: Fabricate metal cover with openings having gaskets, seals, and bushings; for access to pumps, pump shafts, control rods, discharge piping, vent connections, and power cables.

1. Reinforcement: Steel or cast iron, capable of supporting foot traffic for basins installed in foot-traffic areas.
2. Cover Material: Cast iron or steel with bituminous coating.
3. Vent Size: 3 NPS.

2.3 MOTORS

A. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Section 220513 "Common Motor Requirements for Plumbing 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.

B. Motors for submersible pumps shall be hermetically sealed.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine roughing-in for plumbing piping to verify actual locations of existing sanitary drainage and vent piping connections before sewage pump installation.

3.2 INSTALLATION

A. Pump Installation Standards:

1. Comply with HI 1.4 for installation of centrifugal pumps.
2. Comply with HI 3.1-3.5 for installation of progressing-cavity sewage pumps.

B. Equipment Mounting:

1. Install progressing-cavity sewage pumps on cast-in-place concrete equipment base(s). Comply with requirements for equipment bases and foundations specified in Section 033053 "Miscellaneous Cast-in-Place Concrete."
2. Comply with requirements for vibration isolation and seismic control devices specified in Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment"
3. Comply with requirements for vibration isolation devices specified in Section 220548.13 "Vibration Controls for Plumbing Piping and Equipment."

C. Wiring Method: Comply with requirements in Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

D. Wiring within Enclosures: Bundle, lace, and train conductors 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 CONNECTIONS

A. Comply with requirements for piping specified in Section 221316 "Sanitary Waste and Vent Piping." Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to equipment to allow service and maintenance.

3.4 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.

B. Perform tests and inspections.

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.

C. Tests and Inspections:

1. Perform each visual and mechanical inspection.
2. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
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. Pumps and controls will be considered defective if they do not pass tests and inspections.

E. Prepare test and inspection reports.

3.5 STARTUP SERVICE

A. Engage a factory-authorized service representative to perform startup service.

1. Complete installation and startup checks according to manufacturer's written instructions.

3.6 ADJUSTING

A. Adjust pumps to function smoothly, and lubricate as recommended by manufacturer.

B. Adjust control set points.

3.7 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain controls and pumps.

END OF SECTION 221329

SECTION 221413 - FACILITY STORM DRAINAGE PIPING AND PIPING SPECIALTIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Pipe, tube, and fittings.
2. Specialty pipe fittings.
3. Roof drains.

1.3 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.

B. Seismic Performance: Storm drainage piping and support and installation shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated.

1.5 QUALITY ASSURANCE

A. Piping materials shall bear label, stamp, or other markings of specified testing agency.

B. Comply with NSF/ANSI 14, "Plastics Piping System Components and Related Materials," for plastic piping components.

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 HUB-AND-SPIGOT, CAST-IRON SOIL PIPE AND FITTINGS

A. Pipe and Fittings: ASTM A 74, Service classes.

B. Gaskets: ASTM C 564, rubber.

C. Calking Materials: ASTM B 29, pure lead and oakum or hemp fiber.

2.3 HUBLESS, CAST-IRON SOIL PIPE AND FITTINGS

A. Pipe and Fittings: ASTM A 888 or CISPI 301.

B. CISPI, Hubless-Piping Couplings:

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. ANACO-Husky.
   b. Dallas Specialty & Mfg. Co.
   c. Fernco Inc.
   d. Matco-Norca, Inc.
   e. MIFAB, Inc.
   f. Mission Rubber Company; a division of MCP Industries, Inc.
   g. Stant.
   h. Tyler Pipe.

2. Standards: ASTM C 1277 and CISPI 310.
3. Description: Stainless-steel corrugated shield with stainless-steel bands and tightening devices; and ASTM C 564, rubber sleeve with integral, center pipe stop.

C. Heavy-Duty, Hubless-Piping Couplings:

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. ANACO-Husky.
   b. Clamp-All Corp.
   c. Dallas Specialty & Mfg. Co.
   d. MIFAB, Inc.

e. Mission Rubber Company; a division of MCP Industries, Inc.
f. Stant.
g. Tyler Pipe.

2. Standards: ASTM C 1277 and ASTM C 1540.
3. Description: Stainless-steel shield with stainless-steel bands and tightening devices; and ASTM C 564, rubber sleeve with integral, center pipe stop.

D. Cast-Iron, Hubless-Piping Couplings:

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. MG Piping Products Company.

2. Standard: ASTM C 1277.
3. Description: Two-piece ASTM A 48/A 48M, cast-iron housing; stainless-steel bolts and nuts; and ASTM C 564, rubber sleeve with integral, center pipe stop.

2.4 DUCTILE-IRON PIPE AND FITTINGS

A. Ductile-Iron, Mechanical-Joint Piping:

1. Ductile-Iron Pipe: AWWA C151/A21.51, with mechanical-joint bell and plain spigot end unless grooved or flanged ends are indicated.
2. Ductile-Iron Fittings: AWWA C110/A21.10, mechanical-joint ductile- or gray-iron standard pattern or AWWA C153/A21.53, ductile-iron compact pattern.
3. Glands, Gaskets, and Bolts: AWWA C111/A21.11, ductile- or gray-iron glands, rubber gaskets, and steel bolts.

B. Ductile-Iron, Push-On-Joint Piping:

1. Ductile-Iron Pipe: AWWA C151/A21.51, with push-on-joint bell and plain spigot end unless grooved or flanged ends are indicated.
2. Ductile-Iron Fittings: AWWA C110/A21.10, push-on-joint ductile- or gray-iron standard pattern or AWWA C153/A21.53, ductile-iron compact pattern.
3. Gaskets: AWWA C111/A21.11, rubber.

2.5 SPECIALTY PIPE FITTINGS

A. Transition Couplings:

1. General Requirements: Fitting or device for joining piping with small differences in OD's or of different materials. Include end connections same size as and compatible with pipes to be joined.

B. Cast-Iron, Medium-Sump, General-Purpose Roof Drains:

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. Josam Company.
   b. MIFAB, Inc.
   c. Smith, Jay R. Mfg. Co.
   d. Watts Water Technologies, Inc.
   e. Zurn Plumbing Products Group; Light Commercial Products Operation.
   f.

2. Standard: ASME A112.6.4, for general-purpose roof drains.
3. Body Material: Cast iron.
4. Dimension of Body: 8- to 12-inch diameter.
5. Outlet: Bottom.
6. Underdeck Clamp.
7. Dome Material: Aluminum, Cast iron or Stainless steel.

PART 3 - EXECUTION

3.1 PIPING INSTALLATION

A. 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 from layout are approved on coordination drawings.

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 free of sags and bends.

F. Install piping to allow application of insulation.

G. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.

3.2 JOINT CONSTRUCTION

A. Hub-and-Spigot, Cast-Iron Soil Piping Gasketed Joints: Join according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for compression joints.

B. 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.

C. Hubless, Cast-Iron Soil Piping Coupled Joints: Join according to CISPI 310 and CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for hubless-piping coupling joints.

3.3 SPECIALTY PIPE FITTING INSTALLATION

A. Transition Couplings:

1. Install transition couplings at joints of piping with small differences in OD's.
2. In Drainage Piping: Unshielded, nonpressure transition couplings.

3.4 ROOF DRAIN INSTALLATION

A. Install roof drains at low points of roof areas according to roof membrane manufacturer's written installation instructions.

1. Install flashing collar or flange of roof drain to prevent leakage between drain and adjoining roofing. Maintain integrity of waterproof membranes where penetrated.
2. Install expansion joints, if indicated, in roof drain outlets.
3. Position roof drains for easy access and maintenance.

3.5 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 10-foot head of water. From 15 minutes before inspection starts until 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.

3.6 CLEANING

A. Clean interior of piping. Remove dirt and debris as work progresses.

B. Protect drains during 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.

3.7 PIPING SCHEDULE

A. Aboveground storm drainage piping NPS 6 and smaller shall be any of the following to match existing:

1. Service class, cast-iron soil pipe and fittings; gaskets; and gasketed joints.
2. Hubless, cast-iron soil pipe and fittings; CISPI, hubless-piping couplings; and coupled joints.
3. Galvanized-steel pipe, drainage fittings, and threaded joints.
4. Solid-wall ABS pipe, ABS socket fittings, and solvent-cemented joints.
5. Solid-wall PVC pipe, PVC socket fittings, and solvent-cemented joints.

END OF SECTION 221413

SECTION 221429 - SUMP PUMPS

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. Submersible sump pumps.

B. Related Section:

1. Section 221329 "Sanitary Sewerage Pumps" for effluent and sewage pumps.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

B. Wiring Diagrams: For power, signal, and control wiring.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For pumps and controls, to include in operation and maintenance manuals.

1.5 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. UL Compliance: Comply with UL 778 for motor-operated water pumps.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Retain shipping flange protective covers and protective coatings during storage.

B. Protect bearings and couplings against damage.

C. Comply with pump manufacturer's written rigging instructions for handling.

PART 2 - PRODUCTS

2.1 SUBMERSIBLE SUMP PUMPS

A. Submersible, Fixed-Position, Sump Pumps:

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. Bell & Gossett Domestic Pump; ITT Corporation.
   b. Goulds Pumps; ITT Corporation.
   c. Grundfos Pumps Corp.
   d. Liberty Pumps.
   e. Little Giant Pump Co.
   f. Weil Pump Company, Inc.
   g. Zoeller Company.
2. Description: Factory-assembled and -tested sump-pump unit.
3. Pump Type: Submersible, end-suction, single-stage, close-coupled, overhung-impeller, centrifugal sump pump as defined in HI 1.1-1.2 and HI 1.3.
4. Pump Casing: Cast iron, with strainer inlet, legs that elevate pump to permit flow into impeller, and vertical discharge for piping connection.
5. Impeller: Statically and dynamically balanced, ASTM A 48/A 48M, Class No. 25 A cast irondesign for clear wastewater handling, and keyed and secured to shaft.
6. Pump and Motor Shaft: Stainless steel with factory-sealed, grease-lubricated ball bearings.
7. Seal: Mechanical.
8. Motor: Hermetically sealed, capacitor-start type; with built-in overload protection; lifting eye or lug; and three-conductor, waterproof power cable of length required and with grounding plug and cable-sealing assembly for connection at pump.
   a. Motor Housing Fluid: Air.
9. Controls:
   a. Enclosure: NEMA 250, Type 1.
   b. Switch Type: Pedestal-mounted float switch with float rods and rod buttons.
   c. Automatic Alternator: Start pumps on successive cycles and start multiple pumps if one cannot handle load.
   d. Float Guides: Pipe or other restraint for floats and rods in basins of depth greater than 60 inches.
   e. High-Water Alarm: Cover-mounted, compression-probe alarm, with electric bell; 120-V ac, with transformer and contacts for remote alarm bell.
10. Control-Interface Features:
    a. Remote Alarm Contacts: For remote alarm interface.

b. Building Automation System Interface: Auxiliary contacts in pump controls for interface to building automation system and capable of providing the following:

1) On-off status of pump.
2) Alarm status.

2.2 SUMP PUMP CAPACITIES AND CHARACTERISTICS

A. Unit Capacity: See pump schedule on drawing P201.

B. Number of Pumps: Two.

C. Unit Electrical Characteristics: See pump schedule on drawing P201.

2.3 SUMP-PUMP BASIN COVERS

A. Basins: Factory-fabricated, watertight, sump with top flange and sidewall openings for pipe connections.

1. Material: Cast iron or Fiberglass.
2. Reinforcement: Mounting plates for pumps, fittings, and accessories.
3. Anchor Flange: Same material as or compatible with basin sump, cast in or attached to sump, in location and of size required to anchor basin in concrete slab.

B. Basin Covers: Fabricate metal cover with openings having gaskets, seals, and bushings; for access to pumps, pump shafts, control rods, discharge piping, vent connections, and power cables.

1. Reinforcement: Steel or cast iron, capable of supporting foot traffic for basins installed in foot-traffic areas.

2.4 MOTORS

A. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Section 220513 "Common Motor Requirements for Plumbing 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.

B. Motors for submersible pumps shall be hermetically sealed.

PART 3 - EXECUTION

3.1 EARTHWORK

A. Excavation and filling are specified in Section 312000 "Earth Moving."

3.2 EXAMINATION

A. Examine roughing-in for plumbing piping to verify actual locations of storm drainage piping connections before sump pump installation.

3.3 INSTALLATION

A. Pump Installation Standards: Comply with HI 1.4 for installation of sump pumps.

3.4 CONNECTIONS

A. Comply with requirements for piping specified in Section 221413 "Facility Storm Drainage Piping." Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to equipment to allow service and maintenance.

3.5 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.

B. 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.

C. Tests and Inspections:

1. Perform each visual and mechanical inspection.
2. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
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. Pumps and controls will be considered defective if they do not pass tests and inspections.

E. Prepare test and inspection reports.

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.

3.7 ADJUSTING

A. Adjust pumps to function smoothly, and lubricate as recommended by manufacturer.

B. Adjust control set points.

3.8 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain controls and pumps.

END OF SECTION 221429

SECTION 224213.13 - COMMERCIAL WATER CLOSETS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Water closets. Supports.
2. Flushometer valves.
3. Toilet seats.

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 water closets.
2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

B. Shop Drawings: Include diagrams for power, signal, and control wiring.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For flushometer valves and electronic sensors to include in operation and maintenance manuals.

1.5 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that are packaged with protective covering for storage and identified with labels describing contents.

1. Flushometer-Valve Repair Kits: Equal to 10 percent of amount of each type installed, but no fewer than six of each type.

PART 2 - PRODUCTS

2.1 WALL-MOUNTED WATER CLOSETS

A. Water Closets (P-1): Wall mounted, top spud.

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings:

   a. Manufacturer: Sloan, Model # WETS 2050.1303-1.28 ES-S TMO.

2. Bowl:

   a. Standards: ASME A112.19.2/CSA B45.1.
   b. Material: Vitreous china.
   c. Type: Siphon jet.
   d. Style: Flushometer valve.
   e. Height: Standard.
   f. Rim Contour: Elongated.
   g. Water Consumption: 1.28 gal. per flush.
   h. Spud Size and Location: NPS 1-1/2; top.

3. Flushometer Valve: Sensor operated.
4. Toilet Seat.
5. Support: Compatible with carrier model – Jay R. Smith 0210Y-M54.

   a. Standard: ASME A112.6.1M.
   b. Description: Waste-fitting assembly as required to match drainage piping material and arrangement with faceplates, couplings gaskets, and feet; bolts and hardware matching fixture.
   c. Water-Closet Mounting Height: Standard.

B. Water Closets (P-1A): Wall mounted, top spud, accessible.

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings:

   a. Manufacturer: Sloan, Model # WETS 2050.1303-1.28 ES-S TMO.

2. Bowl:

   a. Standards: ASME A112.19.2/CSA B45.1.
   b. Material: Vitreous china.
   c. Type: Siphon jet.
   d. Style: Flushometer valve.
   e. Height: Standard.
   f. Rim Contour: Elongated.
   g. Water Consumption: 1.28 gal. per flush.
   h. Spud Size and Location: NPS 1-1/2; top.

3. Flushometer Valve: Sensor operated.
4. Toilet Seat.

5. Support: Compatible with carrier model – Jay R. Smith 0210Y-M54.

    a. Standard: ASME A112.6.1M.
    b. Description: Waste-fitting assembly, as required to match drainage piping material and arrangement with faceplates, couplings gaskets, and feet; bolts and hardware matching fixture.
    c. Water-Closet Mounting Height: handicapped/elderly height according to ICC/ANSI A117.1.

2.2 FLUSHOMETER VALVES

A. Solenoid-Actuator, Flushometer Valves:

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings:

    a. Manufacturer: Sloan; Royal OPTIMA Model: 1.28 ES-S TMO.

2. Standard: ASSE 1037.
3. Minimum Flowing Pressure: 25 psig.
4. Quiet, exposed, sensor activated diaphragm type flushometer for either left or right hand supply. OPTIMA EL-1500-L Self-adaptive infrared sensor with indicator light.
5. Material: High Copper, Low Zinc Brass Castings for Dezincification Resistance.
6. Panel Finish: Chrome plated wall cover plate and die cast wall flange with vandal resistant screws.
7. Style: Exposed.
8. Actuator: Solenoid complying with UL 1951, and listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
9. Trip Mechanism: Hard-wired electronic sensor complying with UL 1951, and listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
10. Consumption: 1.28 gal. per flush.
11. Minimum Outlet: NPS 1-1/4.

2.3 TOILET SEATS

A. Toilet Seats:

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings:

    a. Manufacturing Company: Church; Model – T.B.D..

2. Standard: IAPMO/ANSI Z124.5.
3. Material: Plastic.
4. Type: Commercial.
5. Shape: Elongated rim, open front.
6. Hinge Material: Noncorroding metal.
7. Color: White.

2.4 TRANSFORMER

Manufacturer: Sloan; Model: EL-154, (120 vac/24 VAC, 50/60 Hz, 50 VA).

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 water-closet installation.

B. Examine walls and floors for suitable conditions where water closets will be installed.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Water-Closet Installation:

1. Install level and plumb according to roughing-in drawings.
2. Install floor-mounted water closets on bowl-to-drain connecting fitting attachments to piping or building substrate.
3. Install accessible, wall-mounted water closets at mounting height for handicapped/elderly, according to ICC/ANSI A117.1.

B. Support Installation:

1. Install wall-mounted, back-outlet water-closet supports with waste-fitting assembly and waste-fitting seals; and affix to building substrate.

C. Flushometer-Valve Installation:

1. Install flushometer-valve, water-supply fitting on each supply to each water closet.
2. Attach supply piping to supports or substrate within pipe spaces behind fixtures.
3. Install actuators in locations that are easy for people with disabilities to reach.

D. Install toilet seats on water closets.

E. Wall Flange and Escutcheon Installation:

1. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations and within cabinets and millwork.
2. Install deep-pattern escutcheons if required to conceal protruding fittings.
3. Comply with escutcheon requirements specified in Section 220518 "Escutcheons for Plumbing Piping."

F. Joint Sealing:

1. Seal joints between water closets and walls and floors using sanitary-type, one-part, mildew-resistant silicone sealant.
2. Match sealant color to water-closet color.
3. Comply with sealant requirements specified in Section 079200 "Joint Sealants."

3.3 CONNECTIONS

A. Connect water closets with water supplies and soil, waste, and vent piping. Use size fittings required to match water closets.

B. Comply with water piping requirements specified in Section 221116 "Domestic Water Piping."

C. Comply with soil and waste piping requirements specified in Section 221316 "Sanitary Waste and Vent Piping."

D. Where installing piping adjacent to water closets, allow space for service and maintenance.

3.4 ADJUSTING

A. Operate and adjust water closets and controls. Replace damaged and malfunctioning water closets, fittings, and controls.

B. Adjust water pressure at flushometer valves to produce proper flow.

3.5 CLEANING AND PROTECTION

A. Clean water closets and fittings with manufacturers' recommended cleaning methods and materials.

B. Install protective covering for installed water closets and fittings.

C. Do not allow use of water closets for temporary facilities unless approved in writing by Owner.

END OF SECTION 224213.13

SECTION 224213.16 - COMMERCIAL URINALS

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. Urinals.
2. Flushometer valves.

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 urinals.
2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For flushometer valves and electronic sensors to include in operation and maintenance manuals.

PART 2 - PRODUCTS

2.1 WALL-HUNG URINALS

A. Urinals (P-2): Wall hung, back outlet, washout.

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings:

a. Manufacturer: Sloan; Model: SU-7009-A.

2. Fixture:

a. Standards: ASME A112.19.2/CSA B45.1.

b. Material: Vitreous china.
c. Type: Washdown flushing action.
d. Vandal resistant strainer assembly.
e. Water Consumption: Water saving.
f. Spud Size and Location: NPS 3/4 top.
g. Outlet Size and Location: NPS 2, back.
h. Color: White.
i. Mounting hardware.
j. Integral flushing rim.

3. Flushometer Valve: Sensor operated.
4. Waste Fitting:

a. Standard: ASME A112.18.2/CSA B125.2 for coupling.
b. Size: NPS 2.

5. Support: ASME A112.6.1M, Type I, urinal carrier with fixture support plates and coupling with seal and fixture bolts and hardware matching fixture.

B. Urinals (P-2A): Wall hung, back outlet, washout, accessible.

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings:

a. Manufacturer: Sloan; Model: SU-7009-A.

2. Fixture:

a. Standards: ASME A112.19.2/CSA B45.1.
b. Material: Vitreous china.
c. Type: Washdown flushing action.
d. Vandal resistant strainer assembly.
e. Water Consumption: Water saving.
f. Spud Size and Location: NPS 3/4 top.
g. Outlet Size and Location: NPS 2, back.
h. Color: White.
i. Mounting hardware.
j. Integral flushing rim.

3. Flushometer Valve: Sensor operated. Installation conforms to ADA requirements.
4. Waste Fitting:

a. Standard: ASME A112.18.2/CSA B125.2 for coupling.
b. Size: NPS 2.

5. Support: ASME A112.6.1M, Type I, urinal carrier with fixture support plates and coupling with seal and fixture bolts and hardware matching fixture.

2.2 URINAL FLUSHOMETER VALVES

A. Solenoid-Actuator, Diaphragm Flushometer Valves:

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings:

   a. Manufacturer: Sloan; Model: 186 ES-S.

B. Standard: ASSE 1037.
   1. Quiet, Exposed, diaphragm assembly, stop seat and vacuum breaker molded from PERMEX rubber compound for chloramine resistance.
   2. Material: High Copper, low zinc brass castings for dezincification resistance.
   3. Panel Finish: Chrome plated.
   4. Adjustable tailpiece.
   5. Sweat solder adapter with cover tube and cast wall flange with set screw.
   6. Actuator: Solenoid complying with UL 1951; listed and labeled as defined in NFPA 70, by a qualified testing agency; and marked for intended location and application.
   7. Trip Mechanism: Hard-wired electronic sensor complying with UL 1951; listed and labeled as defined in NFPA 70, by a qualified testing agency; and marked for intended location and application.
   8. Consumption: 0.5 gal. per flush, dual filtered bypass diaphragm.

2.3 TRANSFORMER

Manufacturer: Sloan; Model: EL-154, (120 vac/24 VAC, 50/60 Hz, 50 VA).

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 urinal installation.

B. Examine walls and floors for suitable conditions where urinals will be installed.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Urinal Installation:

   1. Install urinals level and plumb according to roughing-in drawings.
   2. Install wall-hung, back-outlet urinals onto waste fitting seals and attached to supports.
   3. Install accessible, wall-mounted urinals at mounting height for the handicapped/elderly, according to ICC/ANSI A117.1.

B. Support Installation:

   1. Install supports, affixed to building substrate, for wall-hung urinals.
   2. Use off-floor carriers with waste fitting and seal for back-outlet urinals.
   3. Use chair-type carrier supports with rectangular steel uprights for accessible urinals.

C. Flushometer-Valve Installation:

1. Install flushometer-valve water-supply fitting on each supply to each urinal.
2. Attach supply piping to supports or substrate within pipe spaces behind fixtures.

D. Wall Flange and Escutcheon Installation:

1. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations.
2. Install deep-pattern escutcheons if required to conceal protruding fittings.
3. Comply with escutcheon requirements specified in Section 220518 "Escutcheons for Plumbing Piping."

E. Joint Sealing:

1. Seal joints between urinals and walls and floors using sanitary-type, one-part, mildew-resistant silicone sealant.
2. Match sealant color to urinal color.
3. Comply with sealant requirements specified in Section 079200 "Joint Sealants."

3.3 CONNECTIONS

A. Connect urinals with water supplies and soil, waste, and vent piping. Use size fittings required to match urinals.

B. Comply with water piping requirements specified in Section 221116 "Domestic Water Piping."

C. Comply with soil and waste piping requirements specified in Section 221316 "Sanitary Waste and Vent Piping."

3.4 ADJUSTING

A. Operate and adjust urinals and controls. Replace damaged and malfunctioning urinals, fittings, and controls.

B. Adjust water pressure at flushometer valves to produce proper flow.

3.5 CLEANING AND PROTECTION

A. Clean urinals and fittings with manufacturers' recommended cleaning methods and materials.

B. Install protective covering for installed urinals and fittings.

C. Do not allow use of urinals for temporary facilities unless approved in writing by Owner.

END OF SECTION 224213.16

SECTION 224216.13 - COMMERCIAL LAVATORIES

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. Lavatories.
2. Faucets.

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 lavatories.
2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

B. Shop Drawings: Include diagrams for power, signal, and control wiring of automatic faucets.

1.4 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Counter cutout templates for mounting of counter-mounted lavatories.

1.5 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. Faucet Washers and O-Rings: Equal to 10 percent of amount of each type and size installed.
2. Faucet Cartridges and O-Rings: Equal to 5 percent of amount of each type and size installed.

PART 2 - PRODUCTS

2.1 SINGLE STATION LAVATORY WITH FAUCET

A. Lavatory (P-3): Rectangular, SloanStone Lavatory System, accessible.

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings:

   a. Manufacturer: Sloan; Model: ELC-81000.

2. Fixture:

   a. Durable, SloanStone is stain, chemical scratch and impact resistant.
   b. Stainless steel frame supports the structure.
   c. Nominal Size: Rectangular, 30 by 18 inches.
   d. Faucet-Hole Punching: One hole.
   e. Faucet-Hole Location: Top.
   f. Color: see plumbing fixture & accessories schedule on architectural drawing A-24.
   g. Gap-free vandal resistant high strength structure.
   h. Mounting Material: Sealant.
   i. 1 1/4" Chrome Plated Brass Grid Strainer.
   j. 1 1/2" Chrome Plated 17 Gauge Brass P-trap.
   k. No visible fasteners for large Access Panel.
   l. Chrome Plated Accented overflow.
   m. Complies with ADA standards.

3. Faucet: Solid-Brass, Chrome Plated, Automatically Operated Lavatory Faucets. Mixing valve.

2.2 TRIPLE STATION LAVATORY WITH FAUCETS

A. Lavatory (P-4): Triple Station Lavatory System, Rectangular, Solid Surface, SloanStone Lavatory System, accessible.

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings:

   a. Manufacturer: Sloan; Model: ELC-83000.

2. Fixture:
   a. Countertop with integral bowls, Durable, SloanStone is stain, chemical scratch and impact resistant. Gap-free Vandal Resistant high strength structure. Access panel.
   b. Stainless steel frame supports the structure.
   c. Faucet-Hole Punching: One hole for each bowl.
   d. Faucet-Hole Location: Top.
   e. Color: see plumbing fixture & accessories schedule on architectural drawing A-24.
   f. Lavatory drains to basins.
   g. Mounting Material: Sealant.
   h. 1 1/4" Chrome Plated Brass Grid Strainer for each bowl.
   i. One ADA compliant 2" Chrome Plated 17 Gauge Brass P-trap.

j. No visible fasteners for large Access Panel.
k. Chrome Plated Accented overflow.

3. Faucet: Solid-Brass, Automatically Operated Lavatory Faucets for each bowl.

2.3 DUPLEX STATION LAVATORY WITH FAUCETS

A. Lavatory (P-4A): Duplex Station Lavatory System, Rectangular, Solid Surface, SloanStone Lavatory System, accessible.

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings:

   a. Manufacturer: Sloan; Model: ELC-82000.

2. Fixture:
   a. Countertop with integral bowls, Durable, SloanStone is stain, chemical scratch and impact resistant. Gap-free Vandal Resistant high strength structure. Access panel.
   b. Stainless steel frame supports the structure.
   c. Faucet-Hole Punching: One hole for each bowl.
   d. Faucet-Hole Location: Top.
   e. Color: see plumbing fixture & accessories schedule on architectural drawing A-24.
   f. Lavatory drains to basins.
   g. Mounting Material: Sealant.
   h. 1 1/4" Chrome Plated Brass Grid Strainer for each bowl.
   i. One ADA compliant 2" Chrome Plated 17 Gauge Brass P-trap.
   j. No visible fasteners for large Access Panel.
   k. Chrome Plated Accented overflow.

3. Faucet: Solid-Brass, Automatically Operated Lavatory Faucets for each bowl.

2.4 LAVATORY FAUCETS

A. NSF Standard: Comply with NSF/ANSI 61, "Drinking Water System Components - Health Effects," for faucet materials that will be in contact with potable water. General:

1. Standards: ASME A112.18.1M/CSA B125.1.
2. 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.
3. All wetted components – stainless steel, engineered thermoplastic, EPDM, and copper or copper alloy. All electronics sealed to IP-67.
4. Gold plated electrical contacts.
5. All serviceable components above deck. Above deck individual diagnostic indicator for battery life, solenoid condition, and power up mode.
6. Maximum Flow Rate: 0.5 gpm. Vandal resistant spray insert.
7. Spout: Rigid type.
8. Double infrared sensors with automatic setting feature.
9. Includes all mounting hardware.
10. Accessories: Splitter Model EAF-23, Extension Cable.

B. Lavatory Faucet- DIRECTOR: Automatic-type, hard-wired, electronic-sensor-operated, mixing, solid-brass valve; install on Lavatory (P-3) in Toilet # 109A.

1. Manufacturer: Sloan; Model: BASYS EFX-200-500-0100-0.
2. General: Infrared Sensor Activated Electronic Faucet, Solenoid valve housed in removable lavatory carrier that includes supply strainer. Four (4) "AA" alkaline batteries. Sensing – Active IR.
3. Voltage adapter –none.
4. Single hole installation. Mounting Type: Deck.
5. Base Plate – 4".
6. Finish – Chrome Plated.
7. Integral to spout Side Mixer.

C. Lavatory Faucet- PUBLIC: Automatic-type, hard-wired, electronic-sensor-operated, mixing, solid-brass valve.

1. Manufacturer: Sloan; Model: BASYS EFX-600-200-0010-0.
2. General: Infrared Sensor Activated Electronic Faucet, Solenoid valve housed in removable lavatory carrier that includes supply strainer. Four (4) "AA" alkaline batteries. Sensing – Active IR.
3. Voltage Adapters – Plug-in.
4. Single hole installation. Mounting Type: Deck.
5. Base Plate – None.
6. Finish – Chrome Plated.
7. Mixer – Below deck, thermostatic.

2.5 THERMOSTATIC MIXING VALVE

A. Thermostatic, water mixing valves are specified in Division 22 Section "Domestic water piping specialties.

2.6 VOLTAGE ADAPTOR

Manufacturer: Sloan; Model: 6VDC.

2.7 SUPPLY FITTINGS

A. NSF Standard: Comply with NSF/ANSI 61, "Drinking Water System Components - Health Effects," for supply-fitting materials that will be in contact with potable water.

B. Standard: ASME A112.18.1/CSA B125.1.

C. Supply Piping: Chrome-plated-brass pipe or chrome-plated copper tube matching water-supply piping size. Include chrome-plated-brass or stainless-steel wall flange.

D. Supply Stops: Chrome-plated-brass, one-quarter-turn, ball-type or compression valve with inlet connection matching supply piping.

E. Risers:

1. NPS 3/8.
2. Chrome-plated, rigid-copper-pipe and brass straight or offset tailpieces or Chrome-plated, soft-copper flexible tube or ASME A112.18.6, braided- or corrugated-stainless-steel, flexible hose riser.

2.8 WASTE FITTINGS

A. Standard: ASME A112.18.2/CSA B125.2.

B. Drain: Grid type with NPS 1-1/4 offset and straight tailpiece.

C. Trap:

1. Size: NPS 1-1/2 by NPS 1-1/4 for Single Station Lavatory and NPS 2 by NPS 1-1/2 for Triple Station Lavatory .
2. Material: Chrome-plated, two-piece, cast-brass trap and swivel elbow with 0.032-inch-thick brass tube to wall, two-piece, cast-brass trap and ground-joint swivel elbow with 0.032-inch- thick brass tube to wall or one-piece, cast-brass trap with swivel 0.029-inch-thick tubular brass wall bend and chrome-plated, brass or steel wall flange.

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 lavatory installation.

B. Examine counters and walls for suitable conditions where lavatories will be installed.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install lavatories level and plumb according to roughing-in drawings.

B. Install supports, affixed to building substrate, for wall-mounted lavatories.

C. Install accessible wall-mounted lavatories at handicapped/elderly mounting height for people with disabilities or the elderly, according to ICC/ANSI A117.1.

D. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations. Use deep-pattern escutcheons if required to conceal protruding fittings. Comply with escutcheon requirements specified in Section 220518 "Escutcheons for Plumbing Piping."

E. Seal joints between lavatories, counters, and walls using sanitary-type, one-part, mildew-resistant silicone sealant. Match sealant color to fixture color. Comply with sealant requirements specified in Section 079200 "Joint Sealants."

F. Install protective shielding pipe covers and enclosures on exposed supplies and waste piping of accessible lavatories. Comply with requirements in Section 220719 "Plumbing Piping Insulation."

3.3 CONNECTIONS

A. Connect fixtures with water supplies, stops, and risers, and with traps, soil, waste, and vent piping. Use size fittings required to match fixtures.

B. Comply with water piping requirements specified in Section 221116 "Domestic Water Piping."

C. Comply with soil and waste piping requirements specified in Section 221316 "Sanitary Waste and Vent Piping."

3.4 ADJUSTING

A. Operate and adjust lavatories and controls. Replace damaged and malfunctioning lavatories, fittings, and controls.

B. Adjust water pressure at faucets to produce proper flow.

C. Install fresh batteries in battery-powered, electronic-sensor mechanisms.

3.5 CLEANING AND PROTECTION

A. After completing installation of lavatories, inspect and repair damaged finishes.

B. Clean lavatories, faucets, and other fittings with manufacturers' recommended cleaning methods and materials.

C. Provide protective covering for installed lavatories and fittings.

D. Do not allow use of lavatories for temporary facilities unless approved in writing by Owner.

END OF SECTION 224216.13

SECTION 224216.16 - COMMERCIAL SINKS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Mop sink.
2. Sink.
3. Sink faucets.
4. Supply fittings.
5. Waste fittings.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

PART 2 - PRODUCTS

2.1 MOP SINK

A. Mop Sink (P-6): floor mounted.

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. Manufacturer: Elkay; Model: EFS2523C.

2. Fixture:

   a. #16 gauge, type 304, stainless steel floor model mop sink.
   b. Apron on three sides, top has raised rim.
   c. Exposed surfaces are polished to a lustrous satin finish.
   d. Underside is fully undercoated to prevent condensation and dampen sound.
   e. Wall hanger and LK43 drain with strainer.
   f. Shape: Rectangular.
   g. Nominal Size: 25 by 23 inches.
   h. Height: 10 inches.

3. Mounting: On floor and flush to wall.
4. Faucet: Elkay Model LKB940C, wall mounted, integral supply stops, solid brass construction, vacuum breaker.

2.2 PANTRY SINK

A. Pantry sink (P-5): Stainless steel, counter undermounted.

1. Manufacturers:
   a. Elkay Manufacturing Co.
   b. Model: ELUHAD1414

2. Fixture:

   a. Standard: ASME A112.19.3/CSA B45.4.
   b. Number of Compartments: Two.
   c. #18 gauge, type 304 nickel bearing stainless steel.
   d. Compartment:

      1) Dimensions: 16.5" x 16.5" overall. 5" bowl depth.
      2) Drain: Grid with NPS 2 drain.
      3) Drain Location: Centered in compartment.

3. Faucet mounting: Four 1.5 inches diameter holes, dual wing handles, concealed mount. Retractable spray and hose. Solid brass construction, chrome finish, 2.2 gpm VR aerator, 360° swing spout. Elkay Model LKD2433. Complies with: ADA.

4. Supply Fittings:

   a. Standard: ASME A112.18.1/CSA B125.1.
   b. Supplies: Chrome-plated brass compression stop with inlet connection matching water-supply piping type and size.

      1) Operation: Loose key.
      2) Risers: NPS 1/2, ASME A112.18.6, braided or corrugated stainless-steel flexible hose.

5. Waste Fittings:

   a. Standard: ASME A112.18.2/CSA B125.2.
   b. Trap(s): Size NPS 2.

   c. Continuous Waste:

      1) NPS 2.
      2) Material: Chrome-plated, thick brass tube.

6. Mounting: under counter with sealant.

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 sink installation.

B. Examine walls, floors, and counters for suitable conditions where sinks will be installed.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install sinks level and plumb according to roughing-in drawings.

B. Install supports, affixed to building substrate, for wall-hung sinks.

C. Install accessible wall-mounted sinks at handicapped/elderly mounting height according to ICC/ANSI A117.1.

D. Set floor-mounted sinks in leveling bed of cement grout.

E. Install water-supply piping with stop on each supply to each sink faucet.

1. Exception: Use ball, gate, or globe valves if supply stops are not specified with sink. Comply with valve requirements specified in Section 220523 "General-Duty Valves for Plumbing Piping."
2. Install stops in locations where they can be easily reached for operation.

F. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations. Use deep-pattern escutcheons if required to conceal protruding fittings. Comply with escutcheon requirements specified in Section 220518 "Escutcheons for Plumbing Piping."

G. Seal joints between sinks and counters, floors, and walls using sanitary-type, one-part, mildew-resistant silicone sealant. Match sealant color to fixture color. Comply with sealant requirements.

3.3 CONNECTIONS

A. Connect sinks with water supplies, stops, and risers, and with traps, soil, waste, and vent piping. Use size fittings required to match fixtures.

B. Comply with water piping requirements specified in Section 221116 "Domestic Water Piping."

C. Comply with soil and waste piping requirements specified in Section 221316 "Sanitary Waste and Vent Piping."

3.4 ADJUSTING

A. Operate and adjust sinks and controls. Replace damaged and malfunctioning sinks, fittings, and controls.

B. Adjust water pressure at faucets to produce proper flow.

3.5 CLEANING AND PROTECTION

A. After completing installation of sinks, inspect and repair damaged finishes.

B. Clean sinks, faucets, and other fittings with manufacturers' recommended cleaning methods and materials.

C. Provide protective covering for installed sinks and fittings.

D. Do not allow use of sinks for temporary facilities unless approved in writing by Owner.

END OF SECTION 224216.16

SECTION 224223 - COMMERCIAL SHOWERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Individual showers.
2. Shower faucets.
3. Grout.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.3 CLOSEOUT SUBMITTALS

A. Maintenance data.

PART 2 - PRODUCTS

2.1 INDIVIDUAL SHOWERS

A. NSF Standard: Comply with NSF 61, "Drinking Water System Components - Health Effects," for shower materials that will be in contact with potable water.

B. Individual Showers (P-7):

1. Manufacturers:
   a. Accessibility Professionals inc.; Model APF3637BF3P.
2. General: shower enclosure with faucet, and receptor and appurtenances.
3. Nominal Size and Shape: 40.125" x 39.5" x 77.375"; 36" x 36" inside dimension.
4. Durable and easy to clean gelcoat fiberglass. Full plywood backing in walls.
5. Bathing Surface: Slip resistant according to ASTM F 462.
6. Outlet: Caulkless drain with NPS 2 outlet. Use only an ASTM recommended silicone sealer. Installation is per manufacturer written instructions.
7. Shower Rod and Curtain: Required.
8. Shower Faucets:
   Manufacturers:
   a. American Standard America.
   b. Chicago Faucets.
   c. Kohler Co.
   d. Speakman Company.

e. Zurn Industries, LLC; AquaSpec Commercial Faucet Products.

Description: Single-handle, pressure-balance mixing valve with hot- and cold-water indicators; check stops; and shower head.

f. Standards: ASME A112.18.1/CSA B125.1.
g. Body Material: Solid brass.
h. Finish: Polished chrome plate.
i. Maximum Flow Rate: 1.5 gpm.
j. Antiscald Device: Integral with mixing valve.
k. Check Stops: Check-valve type, integral with or attached to body; on hot- and cold-water supply connections.
l. Vacuum breaker, brass.
m. Supply Connections: NPS 1/2.
n. Shower Head: Commercial type. Standard: ASME A112.18.1/CSA B125.1.

C. Individual Showers (P-7A):

1. Manufacturers:
   a. Accessibility Professionals inc.; Model APFQ3698BF625.

2. General: shower enclosure with faucet and handicapped accessible receptor and appurtenances.
3. Nominal Size and Shape: see architectural drawings for dimensions.
4. Bathing Surface: Slip resistant according to ASTM F 462.
5. Outlet: Caulkless drain with NPS 2 outlet. Use only an ASTM recommended silicone sealer. Installation is per manufacturer written instructions.
6. Shower Rod and Curtain: Required.
7. Accessibility Options: Grab bar and bench.
8. Shower Faucets:

   Manufacturers:

   a. Accessibility Professionals, Inc.
   b. American Standard America.
   c. Chicago Faucets.
   d. Kohler Co.
   e. Zurn Industries, LLC; AquaSpec Commercial Faucet Products.

   Description: Single-handle, pressure-balance mixing valve with hot- and cold-water indicators; check stops; and handheld shower with grab bar assembly.

   f. Standards: ASME A112.18.1/CSA B125.1 and ASSE 1016.
   g. Body Material: Solid brass.
   h. Finish: Polished chrome plate.
   i. Maximum Flow Rate: 1.5 gpm.
   j. Antiscald Device: Integral with mixing valve.
   k. Check Stops: Check-valve type, integral with or attached to body; on hot- and cold-water supply connections.
   l. Supply Connections: NPS 1/2.
   m. Vacuum breaker, brass.

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 shower installation.

B. Examine walls and floors for suitable conditions where showers will be installed.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Assemble shower components according to manufacturers' written instructions.

B. Install showers level and plumb according to roughing-in drawings.

C. Install water-supply piping with stop on each supply to each shower faucet.

1. Exception: Use ball, gate, or globe valves if supply stops are not specified with shower. Comply with valve requirements specified in Section 220523 "General-Duty Valves for Plumbing Piping."
2. Install stops in locations where they can be easily reached for operation.

D. Install shower flow-control fittings with specified maximum flow rates in shower arms.

E. Set shower receptors in leveling bed of cement grout.

F. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations. Use deep-pattern escutcheons if required to conceal protruding fittings. Comply with escutcheons requirements specified in Section 220518 "Escutcheons for Plumbing Piping."

G. Seal joints between showers and floors and walls using sanitary-type, one-part, mildew-resistant silicone sealant. Match sealant color to fixture color. Comply with sealant requirements specified in Section 079200 "Joint Sealants."

3.3 CONNECTIONS

A. Connect fixtures with water supplies, stops, and risers, and with traps, soil, waste, and vent piping. Use size fittings required to match fixtures.

B. Comply with water piping requirements specified in Section 221116 "Domestic Water Piping."

C. Comply with traps and soil and waste piping requirements specified in Section 221316 "Sanitary Waste and Vent Piping."

3.4 ADJUSTING

A. Operate and adjust showers and controls. Replace damaged and malfunctioning showers, fittings, and controls.

B. Adjust water pressure at faucets to produce proper flow.

3.5 CLEANING AND PROTECTION

A. After completing installation of showers and basins, inspect and repair damaged finishes.

B. Clean showers and basins, faucets, and other fittings with manufacturers' recommended cleaning methods and materials.

C. Provide protective covering for installed fixtures and fittings.

D. Do not allow use of showers and basins for temporary facilities unless approved in writing by Owner.

END OF SECTION 224223

SECTION 224723 - WATER COOLERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes water coolers and related components.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of remote water coolers.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

B. Shop Drawings: Include diagrams for power, signal, and control wiring.

1.3 CLOSEOUT SUBMITTALS

A. Maintenance Data: For remote water coolers to include in maintenance manuals.

1.4 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Filter Cartridges: Equal to 2.

PART 2 - PRODUCTS

2.1 REMOTE WATER COOLERS

A. Water Coolers (P-8): chiller equipment.

1. Manufacturers:
   a. Elkay Manufacturing Co.
   b. Halsey Taylor.
   c. Haws Corporation.

2. Standards:

a. Comply with NSF 61.
b. Comply with UL 1951.
c. Comply with ASHRAE 34, "Designation and Safety Classification of Refrigerants," for water coolers. Provide HFC 134a (tetrafluoroethane) refrigerant unless otherwise indicated.

3. 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.
4. Chassis: Galvanized or corrosion-resistant-coated steel.
5. Chiller: Hermetically sealed compressor, cooling coil, air-cooled condensing unit, corrosion-resistant tubing, and refrigerant.
6. Controls: Adjustable thermostat.
7. Capacities and Characteristics:

a. Cooled Water: 8 gph.
b. Ambient-Air Temperature: 90 deg F.
c. Inlet-Water Temperature: 80 deg F.
d. Cooled-Water Temperature: 50 deg F.
e. Electrical Characteristics:
1) Volts: 115.
2) Phase: Single.
3) Hertz: 60.
4) Full Load Amps: 2.8.

8. Ventilation Grille: Stainless steel.
9. Filter: One or more water filters complying with NSF 42 and NSF 53 for cyst and lead reduction to below EPA standards; with capacity sized for unit peak flow rate.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine roughing-in for water-supply and sanitary drainage piping systems to verify actual locations of piping connections before fixture installation.

B. Examine walls and floors for suitable conditions where remote water coolers will be installed.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install remote water coolers level and plumb according to roughing-in drawings.

B. Install water-supply piping with shutoff valve on supply to each remote water cooler to be connected to domestic-water distribution piping. Use ball, gate, or globe valve. Install valves in locations where they can be easily reached for operation. Valves are specified in Section 220523 "General-Duty Valves for Plumbing Piping."

C. Set remote water coolers on floor unless otherwise indicated.

D. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations. Use deep-pattern escutcheons where required to conceal protruding fittings. Comply with escutcheon requirements specified in Section 220518 "Escutcheons for Plumbing Piping."

3.3 CONNECTIONS

A. Connect fixtures with water supplies. Use size fittings required to match fixtures.

B. Comply with water piping requirements specified in Section 221116 "Domestic Water Piping."

C. Install ball, gate, or globe shutoff valve on water supply to each fixture. Install valve upstream from filter for water cooler. Comply with valve requirements specified in Section 220523 "General-Duty Valves for Plumbing Piping."

D. Install ball, gate, or globe isolation valves with valved bypass on water connections to water filters. Comply with valve requirements specified in Section 220523 "General-Duty Valves for Plumbing Piping."

3.4 ADJUSTING

A. Adjust water-cooler temperature settings.

3.5 CLEANING

A. After installing remote water cooler, inspect unit. Remove paint splatters and other spots, dirt, and debris. Repair damaged finish to match original finish.

END OF SECTION 224723

SECTION 230513 - COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes general requirements for single-phase and polyphase, general-purpose, horizontal, small and medium, squirrel-cage induction motors for use on ac power systems up to 600 V and installed at equipment manufacturer's factory or shipped separately by equipment manufacturer for field installation.

1.3 COORDINATION

A. Coordinate features of motors, installed units, and accessory devices to be compatible with the following:

1. Motor controllers.
2. Torque, speed, and horsepower requirements of the load.
3. Ratings and characteristics of supply circuit and required control sequence.
4. Ambient and environmental conditions of installation location.

PART 2 - PRODUCTS

2.1 GENERAL MOTOR REQUIREMENTS

A. Comply with requirements in this Section except when stricter requirements are specified in HVAC equipment schedules or Sections.

B. Comply with NEMA MG 1 unless otherwise indicated.

C. Comply with IEEE 841 for severe-duty motors.

2.2 MOTOR CHARACTERISTICS

A. Duty: Continuous duty at ambient temperature of 40 deg C and at altitude of 3300 feet above sea level.

B. Capacity and Torque Characteristics: Sufficient to start, accelerate, and operate connected loads at designated speeds, at installed altitude and environment, with indicated operating sequence, and without exceeding nameplate ratings or considering service factor.

2.3 POLYPHASE MOTORS

A. Description: NEMA MG 1, Design B, medium induction motor.

B. Efficiency: Energy efficient, as defined in NEMA MG 1.

C. Service Factor: 1.15.

D. Multispeed Motors: Variable torque.

1. For motors with 2:1 speed ratio, consequent pole, single winding.
2. For motors with other than 2:1 speed ratio, separate winding for each speed.

E. Multispeed Motors: Separate winding for each speed.

F. Rotor: Random-wound, squirrel cage.

G. Bearings: Regreasable, shielded, antifriction ball bearings suitable for radial and thrust loading.

H. Temperature Rise: Match insulation rating.

I. Code Letter Designation:

1. Motors 15 HP and Larger: NEMA starting Code F or Code G.
2. Motors smaller than 15 HP: Manufacturer's standard starting characteristic.

2.4 POLYPHASE MOTORS WITH ADDITIONAL REQUIREMENTS

A. Motors Used with Reduced-Voltage and Multispeed Controllers: Match wiring connection requirements for controller with required motor leads. Provide terminals in motor terminal box, suited to control method.

B. Motors Used with Variable Frequency Controllers: Ratings, characteristics, and features coordinated with and approved by controller manufacturer.

1. Windings: Copper magnet wire with moisture-resistant insulation varnish, designed and tested to resist transient spikes, high frequencies, and short time rise pulses produced by pulse-width modulated inverters.
2. Energy- and Premium-Efficient Motors: Class B temperature rise; Class F insulation.
3. Inverter-Duty Motors: Class F temperature rise; Class H insulation.
4. Thermal Protection: Comply with NEMA MG 1 requirements for thermally protected motors.

C. Severe-Duty Motors: Comply with IEEE 841, with 1.15 minimum service factor.

2.5 SINGLE-PHASE MOTORS

A. Motors larger than 1/20 hp shall be one of the following, to suit starting torque and requirements of specific motor application:

1. Permanent-split capacitor.
2. Split phase.
3. Capacitor start, inductor run.
4. Capacitor start, capacitor run.

B. Bearings: Prelubricated, antifriction ball bearings or sleeve bearings suitable for radial and thrust loading.

C. Motors 1/20 HP and Smaller: Shaded-pole type.

D. Thermal Protection: Internal protection to automatically open power supply circuit to motor when winding temperature exceeds a safe value calibrated to temperature rating of motor insulation. Thermal-protection device shall automatically reset when motor temperature returns to normal range.

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 230513

SECTION 230519 - METERS AND GAGES FOR HVAC PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Bimetallic-actuated thermometers.
2. Liquid-in-glass thermometers.
3. Thermowells.
4. Dial-type pressure gages.
5. Gage attachments.

1.2 SUBMITTALS

A. Product Data: For each type of product indicated.

PART 2 - PRODUCTS

2.1 BIMETALLIC-ACTUATED THERMOMETERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Ashcroft Inc.
2. Ernst Flow Industries.
3. Marsh Bellofram.
4. Miljoco Corporation.
5. Nanmac Corporation.
6. Noshok.
7. Palmer Wahl Instrumentation Group.
8. REOTEMP Instrument Corporation.
9. Tel-Tru Manufacturing Company.
10. Trerice, H. O. Co.
11. Watts Regulator Co.; a div. of Watts Water Technologies, Inc.
12. Weiss Instruments, Inc.
13. WIKA Instrument Corporation - USA.
14. Winters Instruments - U.S.

B. Standard: ASME B40.200.

C. Case: Liquid-filled and sealed type(s); stainless steel with 5-inch nominal diameter.

D. Dial: Nonreflective aluminum with permanently etched scale markings and scales in deg F.

E. Connector Type(s): Union joint, adjustable angle, with unified-inch screw threads.

F. Connector Size: 1/2 inch with ASME B1.1 screw threads.

G. Stem: 0.25 or 0.375 inch in diameter; stainless steel.

H. Window: Plain glass or plastic.

I. Ring: Stainless steel.

J. Element: Bimetal coil.

K. Pointer: Dark-colored metal.

L. Accuracy: Plus or minus 1 percent of scale range.

2.2 LIQUID-IN-GLASS THERMOMETERS

A. Metal-Case, Industrial-Style, Liquid-in-Glass Thermometers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Flo Fab Inc.
    b. Miljoco Corporation.
    c. Palmer Wahl Instrumentation Group.
    d. Tel-Tru Manufacturing Company.
    e. Trerice, H. O. Co.
    f. Weiss Instruments, Inc.
    g. Winters Instruments - U.S.

2. Standard: ASME B40.200.
3. Case: Cast aluminum; 9-inch nominal size unless otherwise indicated.
4. Case Form: Adjustable angle.
5. Tube: Glass with magnifying lens and blue or red organic liquid.
6. Tube Background: Nonreflective aluminum with permanently etched scale markings graduated in deg F.
7. Window: Glass or plastic.
8. Stem: Aluminum and of length to suit installation.

    a. Design for Air-Duct Installation: With ventilated shroud.
    b. Design for Thermowell Installation: Bare stem.

9. Connector: 1-1/4 inches, with ASME B1.1 screw threads.
10. Accuracy: Plus or minus 1 percent of scale range or one scale division, to a maximum of 1.5 percent of scale range.

B. Plastic-Case, Industrial-Style, Liquid-in-Glass Thermometers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Ernst Flow Industries.
    b. Marsh Bellofram.
    c. Miljoco Corporation.
    d. Palmer Wahl Instrumentation Group.
    e. REOTEMP Instrument Corporation.
    f. Watts Regulator Co.; a div. of Watts Water Technologies, Inc.
    g. Weiss Instruments, Inc.
    h. WIKA Instrument Corporation - USA.

2. Standard: ASME B40.200.
3. Case: Plastic 9-inch nominal size unless otherwise indicated.
4. Case Form: Adjustable angle.
5. Tube: Glass with magnifying lens and blue or red organic liquid.
6. Tube Background: Nonreflective aluminum with permanently etched scale markings graduated in deg F.
7. Window: Glass or plastic.
8. Stem: Aluminum, brass, or stainless steel and of length to suit installation.

    a. Design for Air-Duct Installation: With ventilated shroud.
    b. Design for Thermowell Installation: Bare stem.

9. Connector: 1-1/4 inches, with ASME B1.1 screw threads.
10. Accuracy: Plus or minus 1 percent of scale range or one scale division, to a maximum of 1.5 percent of scale range.

2.3 DUCT-THERMOMETER MOUNTING BRACKETS

A. Description: Flanged bracket with screw holes, for attachment to air duct and made to hold thermometer stem.

2.4 THERMOWELLS

A. Thermowells:

1. Standard: ASME B40.200.
2. Description: Pressure-tight, socket-type fitting made for insertion into piping tee fitting.
3. Material for Use with Copper Tubing: CNR or CUNI.
4. Material for Use with Steel Piping: CRES.
5. Type: Stepped shank unless straight or tapered shank is indicated.
6. External Threads: NPS 1/2, NPS 3/4, or NPS 1, ASME B1.20.1 pipe threads.
7. Internal Threads: 1/2, 3/4, and 1 inch, with ASME B1.1 screw threads.
8. Bore: Diameter required to match thermometer bulb or stem.
9. Insertion Length: Length required to match thermometer bulb or stem.
10. Lagging Extension: Include on thermowells for insulated piping and tubing.

11. Bushings: For converting size of thermowell's internal screw thread to size of thermometer connection.

B. Heat-Transfer Medium: Mixture of graphite and glycerin.

2.5 PRESSURE GAGES

A. Direct-Mounted, Metal-Case, Dial-Type Pressure Gages:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. AMETEK, Inc.; U.S. Gauge.
   b. Ashcroft Inc.
   c. Ernst Flow Industries.
   d. Flo Fab Inc.
   e. Marsh Bellofram.
   f. Miljoco Corporation.
   g. Noshok.
   h. Palmer Wahl Instrumentation Group.
   i. REOTEMP Instrument Corporation.
   j. Tel-Tru Manufacturing Company.
   k. Trerice, H. O. Co.
   l. Watts Regulator Co.; a div. of Watts Water Technologies, Inc.
   m. Weiss Instruments, Inc.
   n. WIKA Instrument Corporation - USA.
   o. Winters Instruments - U.S.

2. Standard: ASME B40.100.
3. Case: Liquid-filled type; cast aluminum or drawn steel; 6-inch nominal diameter.
4. Pressure-Element Assembly: Bourdon tube unless otherwise indicated.
5. Pressure Connection: Brass, with NPS 1/4 or NPS 1/2, ASME B1.20.1 pipe threads and bottom-outlet type unless back-outlet type is indicated.
6. Movement: Mechanical, with link to pressure element and connection to pointer.
7. Dial: Nonreflective aluminum with permanently etched scale markings graduated in psi and kPa.
8. Pointer: Dark-colored metal.
9. Window: Glass or plastic.
10. Ring: Brass
11. Accuracy: Grade B, plus or minus 2 percent of middle half of scale range.

B. Direct-Mounted, Plastic-Case, Dial-Type Pressure Gages:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. AMETEK, Inc.; U.S. Gauge.
   b. Ashcroft Inc.
   c. Flo Fab Inc.

d. Marsh Bellofram.
e. Miljoco Corporation.
f. Noshok.
g. Palmer Wahl Instrumentation Group.
h. REOTEMP Instrument Corporation.
i. Tel-Tru Manufacturing Company.
j. Trerice, H. O. Co.
k. Weiss Instruments, Inc.
l. WIKA Instrument Corporation - USA.
m. Winters Instruments - U.S.

2. Standard: ASME B40.100.
3. Case: Sealed type; plastic; 6-inch (152-mm) nominal diameter.
4. Pressure-Element Assembly: Bourdon tube unless otherwise indicated.
5. Pressure Connection: Brass, with NPS 1/4 or NPS 1/2, ASME B1.20.1 pipe threads and bottom-outlet type unless back-outlet type is indicated.
6. Movement: Mechanical, with link to pressure element and connection to pointer.
7. Dial: Nonreflective aluminum with permanently etched scale markings graduated in psi and kPa.
8. Pointer: Dark-colored metal.
9. Window: Glass or plastic.
10. Accuracy: Grade B, plus or minus 2 percent of middle half of scale range.

C. Remote-Mounted, Metal-Case, Dial-Type Pressure Gages:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. AMETEK, Inc.; U.S. Gauge.
b. Ashcroft Inc.
c. Ernst Flow Industries.
d. Flo Fab Inc.
e. Marsh Bellofram.
f. Miljoco Corporation.
g. Noshok.
h. Palmer Wahl Instrumentation Group.
i. REOTEMP Instrument Corporation.
j. Tel-Tru Manufacturing Company.
k. Trerice, H. O. Co.
l. Watts Regulator Co.; a div. of Watts Water Technologies, Inc.
m. Weiss Instruments, Inc.
n. WIKA Instrument Corporation - USA.
o. Winters Instruments - U.S.

2. Standard: ASME B40.100.
3. Case: Liquid-filled type; cast aluminum or drawn steel, 6-inch nominal diameter with back flange and holes for panel mounting.
4. Pressure-Element Assembly: Bourdon tube unless otherwise indicated.
5. Pressure Connection: Brass, with NPS 1/4 or NPS 1/2, ASME B1.20.1 pipe threads and bottom-outlet type unless back-outlet type is indicated.

6. Movement: Mechanical, with link to pressure element and connection to pointer.
7. Dial: Nonreflective aluminum with permanently etched scale markings graduated in psi and kPa.
8. Pointer: Dark-colored metal.
9. Window: Glass or plastic.
10. Ring: Metal.
11. Accuracy: Grade B, plus or minus 2 percent of middle half of scale range.

2.6 GAGE ATTACHMENTS

A. Snubbers: ASME B40.100, brass; with NPS 1/4 or NPS 1/2 ASME B1.20.1 pipe threads and piston-type surge-dampening device. Include extension for use on insulated piping.

B. Siphons: Loop-shaped section of brass pipe with NPS 1/4 or NPS 1/2 pipe threads.

C. Valves: Brass ball, with NPS 1/4 or NPS 1/2 ASME B1.20.1 pipe threads.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install thermowells with socket extending one-third of pipe diameter and in vertical position in piping tees.

B. Install thermowells of sizes required to match thermometer connectors. Include bushings if required to match sizes.

C. Install thermowells with extension on insulated piping.

D. Fill thermowells with heat-transfer medium.

E. Install direct-mounted thermometers in thermowells and adjust vertical and tilted positions.

F. Install remote-mounted thermometer bulbs in thermowells and install cases on panels; connect cases with tubing and support tubing to prevent kinks. Use minimum tubing length.

G. Install duct-thermometer mounting brackets in walls of ducts. Attach to duct with screws.

H. Install direct-mounted pressure gages in piping tees with pressure gage located on pipe at the most readable position.

I. Install remote-mounted pressure gages on panel.

J. Install valve and snubber in piping for each pressure gage for fluids (except steam).

K. Install flow indicators in piping systems in accessible positions for easy viewing.

L. Assemble and install connections, tubing, and accessories between flow-measuring elements and flowmeters according to manufacturer's written instructions.

M. Install flowmeter elements in accessible positions in piping systems.

N. Install differential-pressure-type flowmeter elements, with at least minimum straight lengths of pipe, upstream and downstream from element according to manufacturer's written instructions.

O. Install permanent indicators on walls or brackets in accessible and readable positions.

P. Install connection fittings in accessible locations for attachment to portable indicators.

Q. Mount thermal-energy meters on wall if accessible; if not, provide brackets to support meters.

R. Install thermometers in the following locations:

1. Inlet and outlet of each hydronic zone.
2. Inlet and outlet of each hydronic boiler.
3. Two inlets and two outlets of cooling tower.
4. Inlet and outlet of each hydronic coil in air-handling units.
5. Two inlets and two outlets of each hydronic heat exchanger.
6. Outside-, return-, supply-, and mixed-air ducts.

S. Install pressure gages in the following locations:

1. Discharge of each pressure-reducing valve.
2. Inlet and outlet of each condenser-water connection.
3. Suction and discharge of each pump.

3.2 CONNECTIONS

A. Install meters and gages adjacent to machines and equipment to allow service and maintenance of meters, gages, machines, and equipment.

B. Connect flowmeter-system elements to meters.

C. Connect flowmeter transmitters to meters.

D. Connect thermal-energy meter transmitters to meters.

3.3 ADJUSTING

A. After installation, calibrate meters according to manufacturer's written instructions.

B. Adjust faces of meters and gages to proper angle for best visibility.

3.4 THERMOMETER SCHEDULE

A. Thermometers at inlet and outlet of each hydronic zone shall be one of the following:

1. Sealed, bimetallic-actuated type.
2. Industrial-style, liquid-in-glass type.

B. Thermometers at inlet and outlet of each hydronic boiler shall be one of the following:

1. Sealed, bimetallic-actuated type.
2. Industrial-style, liquid-in-glass type.

C. Thermometers at inlets and outlets of each hydronic heat exchanger shall be one of the following:

1. Sealed, bimetallic-actuated type.
2. Industrial-style, liquid-in-glass type.

D. Thermometers at inlet and outlet of hydronic heat-recovery unit shall be one of the following:
1. Sealed, bimetallic-actuated type.
2. Industrial-style, liquid-in-glass type.

E. Thermometers at inlet and outlet of each pump or hydronic coil in air-handling units shall be one of the following:

1. Liquid-filled, bimetallic-actuated type.
2. Industrial-style, liquid-in-glass type.

F. Thermometers at outside-, return-, supply-, and mixed-air ducts shall be one of the following:

1. Sealed, bimetallic-actuated type.
2. Industrial-style, liquid-in-glass type.

G. Thermometer stems shall be of length to match thermowell insertion length.

3.5 THERMOMETER SCALE-RANGE SCHEDULE

A. Scale Range for Heating, Hot-Water Piping: 20 to 240 deg F.

B. Scale Range for Condenser-Water Piping: 0 to 150 deg F.

C. Scale Range for Air Ducts: 0 to 150 deg F.

3.6 PRESSURE-GAGE SCHEDULE

A. Pressure gages at inlet and outlet of each condenser-water connection shall be the following:
1. Liquid-filled, direct-mounted, metal case.

B. Pressure gages at suction and discharge of each pump shall be the following:

1. Liquid-filled, direct-mounted, metal case.

3.7 PRESSURE-GAGE SCALE-RANGE SCHEDULE

A. Scale Range for Heating, Hot-Water Piping: 0 to 100 psi.

B. Scale Range for Condenser-Water Piping: 0 to 100 psi.

END OF SECTION 230519

SECTION 230523 - GENERAL-DUTY VALVES FOR HVAC PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Bronze ball valves.
2. High-performance butterfly valves.
3. Iron swing check valves.
4. Iron gate valves.
5. Chainwheels.

B. Related Sections:

1. Division 23 HVAC piping Sections for specialty valves applicable to those Sections only.

1.2 SUBMITTALS

A. Product Data: For each type of valve indicated.

1.3 QUALITY ASSURANCE

A. Source Limitations for Valves: Obtain each type of valve from single source from single manufacturer.

B. ASME Compliance: ASME B16.10 and ASME B16.34 for ferrous valve dimensions and design criteria.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Prepare valves for shipping as follows:

1. Protect internal parts against rust and corrosion.
2. Protect threads, flange faces, grooves, and weld ends.
3. Set gate, and globe valves closed to prevent rattling.
4. Set ball valves open to minimize exposure of functional surfaces.
5. Set butterfly valves closed or slightly open.
6. 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 HVAC 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. Handwheel: For valves other than quarter-turn types.
2. Handlever: For quarter-turn valves NPS 6 and smaller.
3. Chainwheel: Device for attachment to valve handwheel, stem, or other actuator; of size and with chain for mounting height, as indicated in the "Valve Installation" article.

E. Valves in Insulated Piping: With 2-inch stem extensions and the following features:
1. 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.
2. Butterfly Valves: With extended neck.
3. Gate Valves: With rising stem.

F. Valve-End Connections:

1. Flanged: With flanges according to ASME B16.1 for iron valves.
2. Solder Joint: With sockets according to ASME B16.18.
3. Threaded: With threads according to ASME B1.20.1.

2.2 BRONZE BALL VALVES

A. Two-Piece, Full-Port, Bronze Ball Valves with Bronze 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. American Valve, Inc.
b. Conbraco Industries, Inc.; Apollo Valves.
c. Crane Co.; Crane Valve Group; Crane Valves.
d. Hammond Valve.
e. Legend Valve.
f. Milwaukee Valve Company.
g. NIBCO INC.

h. 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: Two piece.
e. Body Material: Bronze.
f. Ends: Threaded.
g. Seats: PTFE or TFE.
h. Stem: Bronze.
i. Ball: Chrome-plated brass.
j. Port: Full.

2.3 IRON, SINGLE-FLANGE BUTTERFLY VALVES

A. 200 CWP, Iron, Single-Flange Butterfly Valves with NBR Seat and Aluminum-Bronze Disc:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. ABZ Valve and Controls; a division of ABZ Manufacturing, Inc.
b. Bray Controls; a division of Bray International.
c. Conbraco Industries, Inc.; Apollo Valves.
d. Cooper Cameron Valves; a division of Cooper Cameron Corp.
e. Crane Co.; Crane Valve Group; Jenkins Valves.
f. Crane Co.; Crane Valve Group; Stockham Division.
g. DeZurik Water Controls.
h. Hammond Valve.
i. Kitz Corporation.
j. Milwaukee Valve Company.
k. NIBCO INC.
l. Norriseal; a Dover Corporation company.
m. Red-White Valve Corporation.
n. Spence Strainers International; a division of CIRCOR International.
o. Tyco Valves & Controls; a unit of Tyco Flow Control.
p. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

2. Description:

a. Standard: MSS SP-67, Type I.
b. CWP Rating: 200 psig.
c. Body Design: Lug type; suitable for bidirectional dead-end service at rated pressure without use of downstream flange.
d. Body Material: ASTM A 126, cast iron or ASTM A 536, ductile iron.
e. Seat: NBR.
f. Stem: One- or two-piece stainless steel.
g. Disc: Aluminum bronze.

2.4 IRON SWING CHECK VALVES

A. Class 125, Iron Swing Check Valves with Metal Seats:

1. Manufacturers: Subject to compliance with requirements, provide products by one of 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. Kitz Corporation.
f. Legend Valve.
g. Milwaukee Valve Company.
h. NIBCO INC.
i. Powell Valves.
j. Red-White Valve Corporation.
k. Sure Flow Equipment Inc.
l. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
m. Zy-Tech Global Industries, Inc.

2. Description:

a. Standard: MSS SP-71, Type I.
b. NPS 2-1/2 to NPS 12, CWP Rating: 200 psig.
c. Body Design: Clear or full waterway.
d. Body Material: ASTM A 126, gray iron with bolted bonnet.
e. Ends: Flanged.
f. Trim: Bronze.
g. Gasket: Asbestos free.

2.5 IRON GATE VALVES

A. Class 125, OS&Y, Iron Gate Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of 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. Flo Fab Inc.
e. Hammond Valve.
f. Kitz Corporation.
g. Legend Valve.
h. Milwaukee Valve Company.
i. NIBCO INC.
j. Powell Valves.
k. Red-White Valve Corporation.
l. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

m. Zy-Tech Global Industries, Inc.

2. Description:

a. Standard: MSS SP-70, Type I.
b. NPS 2-1/2 to NPS 12, CWP Rating: 200 psig.
c. Body Material: ASTM A 126, gray iron with bolted bonnet.
d. Ends: Flanged.
e. Trim: Bronze.
f. Disc: Solid wedge.
g. Packing and Gasket: Asbestos free.

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.

F. Do not proceed with installation until unsatisfactory conditions have been corrected.

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 swing check valves for proper direction of flow and in horizontal position with hinge pin level.

F. Install chainwheels on operators for gate valves NPS 4 and larger and more than 96 inches above floor. Extend Chains to 60 inches above finished floo.

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, butterfly, or gate valves.
2. Throttling Service: Ball or butterfly valves.
3. Pump-Discharge Check Valves:

a. NPS 2 and Smaller: Bronze swing check valves with bronze or nonmetallic disc.
b. NPS 2-1/2 and Larger: Iron swing check valves with lever and weight or with spring.

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, except wafer types, 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 HEATING-WATER VALVE SCHEDULE

A. Pipe NPS 2 and Smaller:
1. Ball Valves: Two piece, full port, bronze with bronze trim.

B. Pipe NPS 2-1/2 and Larger:
1. High-Performance Butterfly Valves: Class 150, single flange.
2. Iron Swing Check Valves: Class 125, metal seats.
3. Iron Gate Valves: Class 125, NRS.

3.6 CONDENSER-WATER VALVE SCHEDULE

A. Pipe NPS 2 and Smaller:

1. Bronze and Brass Valves: May be provided with solder-joint ends instead of threaded ends.

2. Ball Valves: Two piece, full port, brass or bronze with brass trim.
3. Bronze Swing Check Valves: Class 125, bronze disc.

B. Pipe NPS 2-1/2 and Larger:

1. Iron Valves, NPS 2-1/2 to NPS 4: May be provided with threaded ends instead of flanged ends.
2. High-Performance Butterfly Valves: Class 150, single flange.
3. Iron Swing Check Valves: Class 125, metal seats.

END OF SECTION 230523

SECTION 230529 - HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Metal pipe hangers and supports.
2. Trapeze pipe hangers.
3. Thermal-hanger shield inserts.
4. Equipment supports.

B. Related Sections:

1. Division 23 Section "Metal Ducts" for duct hangers and supports.
2. Division 23 Section "Vibration and Seismic Controls for HVAC Piping and Equipment" for vibration isolation devices.

1.3 DEFINITIONS

A. MSS: Manufacturers Standardization Society of The Valve and Fittings Industry Inc.

1.4 PERFORMANCE REQUIREMENTS

A. Structural Performance: Hangers and supports for HVAC piping and equipment shall withstand the effects of gravity loads and stresses within limits and under conditions indicated according to ASCE/SEI 7.

1. Design supports for pipes capable of supporting combined weight of supported systems, system contents, and test water.
2. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.
3. Design seismic-restraint hangers and supports for piping and equipment.

1.5 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: Show fabrication and installation details and include calculations for the following; include Product Data for components:
   1. Equipment supports.

C. Welding certificates for welding procedures and welder's qualification test.

1.6 QUALITY ASSURANCE

A. Structural Steel Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

PART 2 - PRODUCTS

2.1 METAL PIPE HANGERS AND SUPPORTS

A. Steel Pipe Hangers and Supports:

1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
2. Galvanized Metallic Coatings: Pregalvanized or hot dipped.
3. Nonmetallic Coatings: Plastic coating, jacket, or liner.
4. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
5. Hanger Rods: Rod, nuts, and washer made of galvanized steel

B. Copper Pipe Hangers:

1. Description: MSS SP-58, Types 1 through 58, copper-coated-steel, factory-fabricated components.
2. Hanger Rods: Rod, nuts, and washer made of galvanized steel

2.2 TRAPEZE PIPE HANGERS

A. Description: MSS SP-69, Type 59, shop- or field-fabricated pipe-support assembly made from structural carbon-steel shapes with MSS SP-58 carbon-steel hanger rods, nuts, saddles, and U-bolts.

2.3 THERMAL-HANGER SHIELD INSERTS

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. Carpenter & Paterson, Inc.
2. Clement Support Services.
3. ERICO International Corporation.
4. National Pipe Hanger Corporation.
5. PHS Industries, Inc.
6. Pipe Shields, Inc.; a subsidiary of Piping Technology & Products, Inc.

7. Piping Technology & Products, Inc.
8. Rilco Manufacturing Co., Inc.
9. Value Engineered Products, Inc.

B. Insulation-Insert Material for Cold Piping: ASTM C 552, Type II cellular glass with 100-psig minimum compressive strength and vapor barrier.

C. Insulation-Insert Material for Hot Piping: ASTM C 552, Type II cellular glass with 100-psig minimum compressive strength.

D. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.

E. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.

F. Insert Length: Extend 2 inches beyond sheet metal shield for piping operating below ambient air temperature.

2.4 EQUIPMENT SUPPORTS

A. Description: Welded, shop- or field-fabricated equipment support made from structural carbon-steel shapes.

2.5 MISCELLANEOUS MATERIALS

A. Structural Steel: ASTM A 36, carbon-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 INSTALLATION

A. Metal 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 the building structure.

B. Metal 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 for individual pipe hangers.

2. Field fabricate from ASTM A 36, carbon-steel shapes selected for loads being supported. Weld steel according to AWS D1.1.

C. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.

D. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.

E. Equipment Support Installation: Fabricate from welded-structural-steel shapes.

F. 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.

G. Install lateral bracing with pipe hangers and supports to prevent swaying.

H. 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.

I. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

J. Pipe Slopes: Install hangers and supports to provide pipe slopes as required and to not exceed maximum pipe deflections allowed by ASME B31.9 for building services piping.

K. Insulated Piping:

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 allowed by ASME B31.9 for building services piping.

2. 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 weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.

3. 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.

4. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

3.2 EQUIPMENT SUPPORTS

A. Fabricate structural-steel stands to suspend equipment from structure overhead..

B. Provide lateral bracing, to prevent swaying, for equipment supports.

3.3 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 so contours of welded surfaces match adjacent contours.
5. Weld shall be free from cracks, incomplete penetration or blow holes.

3.4 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.

3.5 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 a minimum dry film thickness of 2.0 mils (0.05 mm).

B. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

3.6 HANGER AND SUPPORT SCHEDULE

A. Specific hanger and support requirements are 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 carbon-steel pipe hangers and supports and attachments for general service applications.

F. Use stainless-steel pipe hangers and stainless-steel or corrosion-resistant attachments for hostile environment applications.

G. Use copper-plated pipe hangers and stainless-steel attachments for copper piping and tubing.

H. Use thermal-hanger shield inserts for insulated piping and tubing.

I. 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 2-1/2.
   2. Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension of pipes NPS 3/4 to NPS 2-1/2, requiring clamp flexibility and up to 4 inches of insulation.
   3. Steel Pipe Clamps (MSS Type 4): For suspension of cold and hot pipes NPS 1/2 to NPS 2 1/2 if little or no insulation is required.
   4. Pipe Hangers (MSS Type 5): For suspension of pipes NPS 1/2 to NPS 2 1/2, to allow off-center closure for hanger installation before pipe erection.
   5. Adjustable, Swivel Split- or Solid-Ring Hangers (MSS Type 6): For suspension of noninsulated, stationary pipes NPS 3/4 to NPS 8.
   6. Adjustable, Steel Band Hangers (MSS Type 7): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 2 1/2.
   7. Adjustable Band Hangers (MSS Type 9): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 2 1/2.
   8. Adjustable, Swivel-Ring Band Hangers (MSS Type 10): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 2 1/2.
   9. Split Pipe Ring with or without Turnbuckle Hangers (MSS Type 11): For suspension of noninsulated, stationary pipes NPS 3/8 to NPS 2 1/2.
   10. Extension Hinged or Two-Bolt Split Pipe Clamps (MSS Type 12): For suspension of noninsulated, stationary pipes NPS 3/8 to NPS 2 1/2.
   11. Clips (MSS Type 26): For support of insulated pipes not subject to expansion or contraction.
   12. Single-Pipe Rolls (MSS Type 41): For suspension of pipes NPS 1 to NPS 2-1/2, from two rods if longitudinal movement caused by expansion and contraction might occur.

13. Pipe Roll and Plate Units (MSS Type 45): For support of pipes NPS 2 to NPS 2-1/2 if small horizontal movement caused by expansion and contraction might occur and vertical adjustment is not necessary.

J. 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 2 ½.
2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers NPS 3/4 to NPS 2 ½ if longer ends are required for riser clamps.

K. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel Clevises (MSS Type 14): For 120 to 450 deg F piping installations.
2. Malleable-Iron Sockets (MSS Type 16): For attaching hanger rods to various types of building attachments.
3. Steel Weldless Eye Nuts (MSS Type 17): For 120 to 450 deg F piping installations.

L. 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. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
3. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
4. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
5. Top-Beam Clamps (MSS Type 25): For top of beams if hanger rod is required tangent to flange edge.
6. Side-Beam Clamps (MSS Type 27): For bottom of steel I-beams.
7. Steel-Beam Clamps with Eye Nuts (MSS Type 28): For attaching to bottom of steel I-beams for heavy loads.
8. Linked-Steel Clamps with Eye Nuts (MSS Type 29): For attaching to bottom of steel I-beams for heavy loads, with link extensions.
9. Malleable-Beam Clamps with Extension Pieces (MSS Type 30): For attaching to structural steel.
10. 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.

11. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
12. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.
13. Horizontal Travelers (MSS Type 58): For supporting piping systems subject to linear horizontal movement where headroom is limited.

M. 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.

N. 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 allow 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 allow 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 allow 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.

O. Comply with MSS SP-69 for trapeze pipe-hanger selections and applications that are not specified in piping system Sections.

P. Comply with MFMA-103 for metal framing system selections and applications that are not specified in piping system Sections.

END OF SECTION 230529

SECTION 230548 - VIBRATION AND SEISMIC CONTROLS FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Isolation pads.
2. Isolation mounts.
3. Restrained elastomeric isolation mounts.
4. Freestanding and restrained spring isolators.
5. Housed spring mounts.
6. Spring hangers.
7. Spring hangers with vertical-limit stops.
8. Resilient pipe guides.
9. Seismic snubbers.
10. Restraining braces and cables.

1.3 DEFINITIONS

A. IBC: International Building Code.

B. ICC-ES: ICC-Evaluation Service.

C. OSHPD: Office of Statewide Health Planning and Development for the State of California.

1.4 PERFORMANCE REQUIREMENTS

A. Seismic-Restraint Loading:

1. Site Class as Defined in the IBC: D.
2. Assigned Seismic Use Group or Building Category as Defined in the IBC: II.

a. Component Importance Factor: 1.0.
b. Component Response Modification Factor: 1.5.
c. Component Amplification Factor: 1.0.

3. Design Spectral Response Acceleration at Short Periods (0.2 Second): 25%.

4. Design Spectral Response Acceleration at 1-Second Period: 8.6%.

1.5 SUBMITTALS

A. Product Data: For the following:

1. Include rated load, rated deflection, and overload capacity for each vibration isolation device.
2. Illustrate and indicate style, material, strength, fastening provision, and finish for each type and size of seismic-restraint component used.

   a. Tabulate types and sizes of seismic restraints, complete with report numbers and rated strength in tension and shear as evaluated by an agency acceptable to authorities having jurisdiction.
   b. Annotate to indicate application of each product submitted and compliance with requirements.

3. Interlocking Snubbers: Include ratings for horizontal, vertical, and combined loads.

B. Delegated-Design Submittal: For vibration isolation and seismic-restraint details indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1. Design Calculations: Calculate static and dynamic loading due to equipment weight and operation, seismic forces required to select vibration isolators, seismic restraints, and for designing vibration isolation bases.
2. Vibration Isolation Base Details: Detail overall dimensions, including anchorages and attachments to structure and to supported equipment. Include auxiliary motor slides and rails, base weights, equipment static loads, power transmission, component misalignment, and cantilever loads.
3. Seismic Restraint Details:

   a. Design Analysis: To support selection and arrangement of seismic restraints. Include calculations of combined tensile and shear loads.
   b. Details: Indicate fabrication and arrangement. Detail attachments of restraints to the restrained items and to the structure. Show attachment locations, methods, and spacings. Identify components, list their strengths, and indicate directions and values of forces transmitted to the structure during seismic events. Indicate association with vibration isolation devices.

C. Coordination Drawings: Show coordination of seismic bracing for HVAC piping and equipment with other systems and equipment in the vicinity, including other supports and seismic restraints.

D. Welding certificates.

E. Qualification Data: For professional engineer and testing agency.

F. Field quality-control test reports.

1.6 QUALITY ASSURANCE

A. Comply with seismic-restraint requirements in the IBC unless requirements in this Section are more stringent.

B. Welding: Qualify procedures and personnel according to AWS D1.1, "Structural Welding Code - Steel."

C. Seismic-restraint devices shall have horizontal and vertical load testing and analysis and shall bear anchorage preapproval OPA number from OSHPD, preapproval by ICC-ES, or preapproval by another agency acceptable to authorities having jurisdiction, showing maximum seismic-restraint ratings. Ratings based on independent testing are preferred to ratings based on calculations. If preapproved ratings are not available, submittals based on independent testing are preferred. Calculations (including combining shear and tensile loads) to support seismic-restraint designs must be signed and sealed by a qualified professional engineer.

PART 2 - PRODUCTS

2.1 VIBRATION ISOLATORS

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. Mason Industries.
2. Vibration Eliminator Co., Inc.
3. Vibration Isolation.
4. Vibration Mountings & Controls, Inc.

B. Pads : Arranged in single or multiple layers of sufficient stiffness for uniform loading over pad area, molded with a nonslip pattern and galvanized-steel baseplates, and factory cut to sizes that match requirements of supported equipment.

1. Resilient Material: Oil- and water-resistant neoprene.

C. Mounts: Double-deflection type, with molded, oil-resistant rubber, hermetically sealed compressed fiberglass, or neoprene isolator elements with factory-drilled, encapsulated top plate for bolting to equipment and with baseplate for bolting to structure. Color-code or otherwise identify to indicate capacity range.

1. Materials: Cast-ductile-iron or welded steel housing containing two separate and opposing, oil-resistant rubber or neoprene elements that prevent central threaded element and attachment hardware from contacting the housing during normal operation.
2. Neoprene: Shock-absorbing materials compounded according to the standard for bridge-bearing neoprene as defined by AASHTO.

D. Restrained Mounts: All-directional mountings with seismic restraint.

1. Materials: Cast-ductile-iron or welded steel housing containing two separate and opposing, oil-resistant rubber or neoprene elements that prevent central threaded element and attachment hardware from contacting the housing during normal operation.
2. Neoprene: Shock-absorbing materials compounded according to the standard for bridge-bearing neoprene as defined by AASHTO.

E. Restrained Spring Isolators: Freestanding, steel, open-spring isolators with seismic or limit-stop restraint.

1. Housing: Steel with resilient vertical-limit stops to prevent spring extension due to weight being removed; factory-drilled baseplate bonded to 1/4-inch thick, neoprene or rubber isolator pad attached to baseplate underside; and adjustable equipment mounting and leveling bolt that acts as blocking during installation.
2. Restraint: Seismic or limit stop as required for equipment and authorities having jurisdiction.
3. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
4. Minimum Additional Travel: 50 percent of the required deflection at rated load.
5. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
6. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.

F. Housed Spring Mounts: Housed spring isolator with integral seismic snubbers.

1. Housing: Ductile-iron or steel housing to provide all-directional seismic restraint.
2. Base: Factory drilled for bolting to structure.
3. Snubbers: Vertically adjustable to allow a maximum of 1/4-inch travel up or down before contacting a resilient collar.

G. Elastomeric Hangers: Single or double-deflection type, fitted with molded, oil-resistant elastomeric isolator elements bonded to steel housings with threaded connections for hanger rods. Color-code or otherwise identify to indicate capacity range.

H. Spring Hangers: Combination coil-spring and elastomeric-insert hanger with spring and insert in compression.

1. Frame: Steel, fabricated for connection to threaded hanger rods and to allow for a maximum of 30 degrees of angular hanger-rod misalignment without binding or reducing isolation efficiency.
2. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
3. Minimum Additional Travel: 50 percent of the 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.
6. Elastomeric Element: Molded, oil-resistant rubber or neoprene. Steel-washer-reinforced cup to support spring and bushing projecting through bottom of frame.
7. Self-centering hanger rod cap to ensure concentricity between hanger rod and support spring coil.

I. Spring Hangers with Vertical-Limit Stop: Combination coil-spring and elastomeric-insert hanger with spring and insert in compression and with a vertical-limit stop.

1. Frame: Steel, fabricated for connection to threaded hanger rods and to allow for a maximum of 30 degrees of angular hanger-rod misalignment without binding or reducing isolation efficiency.
2. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
3. Minimum Additional Travel: 50 percent of the 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.
6. Elastomeric Element: Molded, oil-resistant rubber or neoprene.
7. Adjustable Vertical Stop: Steel washer with neoprene washer "up-stop" on lower threaded rod.
8. Self-centering hanger rod cap to ensure concentricity between hanger rod and support spring coil.

J. Pipe Riser Resilient Support: All-directional, acoustical pipe anchor consisting of 2 steel tubes separated by a minimum of 1/2-inch thick neoprene. Include steel and neoprene vertical-limit stops arranged to prevent vertical travel in both directions. Design support for a maximum load on the isolation material of 500 psig and for equal resistance in all directions.

K. Resilient Pipe Guides: Telescopic arrangement of 2 steel tubes or post and sleeve arrangement separated by a minimum of 1/2-inch thick neoprene. Where clearances are not readily visible, a factory-set guide height with a shear pin to allow vertical motion due to pipe expansion and contraction shall be fitted. Shear pin shall be removable and reinsertable to allow for selection of pipe movement. Guides shall be capable of motion to meet location requirements.

2.2 VIBRATION ISOLATION EQUIPMENT BASES

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. Mason Industries.
2. Amber/Booth Company, Inc.
3. California Dynamics Corporation.
4. Isolation Technology, Inc.
5. Kinetics Noise Control.
6. Vibration Eliminator Co., Inc.
7. Vibration Isolation.
8. Vibration Mountings & Controls, Inc.

2.3 SEISMIC-RESTRAINT DEVICES

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. Mason Industries.

2. Amber/Booth Company, Inc.
3. California Dynamics Corporation.
4. Cooper B-Line, Inc.; a division of Cooper Industries.
5. Hilti, Inc.
6. Kinetics Noise Control.
7. Loos & Co.; Cableware Division.

B. General Requirements for Restraint Components: Rated strengths, features, and applications shall be as defined in reports by an agency acceptable to authorities having jurisdiction.

1. Structural Safety Factor: Allowable strength in tension, shear, and pullout force of components shall be at least four times the maximum seismic forces to which they will be subjected.

C. Snubbers: Factory fabricated using welded structural-steel shapes and plates, anchor bolts, and replaceable resilient isolation washers and bushings.

1. Anchor bolts for attaching to concrete shall be seismic-rated, drill-in, and stud-wedge or female-wedge type.
2. Resilient Isolation Washers and Bushings: Oil- and water-resistant neoprene.
3. Maximum 1/4-inch air gap, and minimum 1/4-inch thick resilient cushion.

D. Restraint Cables: ASTM A 603 galvanized-steel cables with end connections made of steel assemblies with thimbles, brackets, swivel, and bolts designed for restraining cable service; and with a minimum of two clamping bolts for cable engagement.

E. Hanger Rod Stiffener: Steel tube or steel slotted-support-system sleeve with internally bolted connections to hanger rod.

F. Bushings for Floor-Mounted Equipment Anchor Bolts: Neoprene bushings designed for rigid equipment mountings, and matched to type and size of anchor bolts and studs.

G. Resilient Isolation Washers and Bushings: One-piece, molded, oil- and water-resistant neoprene, with a flat washer face.

H. Mechanical Anchor Bolts: Drilled-in and stud-wedge or female-wedge type in zinc-coated steel for interior applications and stainless steel for exterior applications. Select anchor bolts with strength required for anchor and as tested according to ASTM E 488. Minimum length of eight times diameter.

I. Adhesive Anchor Bolts: Drilled-in and capsule anchor system containing polyvinyl or urethane methacrylate-based resin and accelerator, or injected polymer or hybrid mortar adhesive. Provide anchor bolts and hardware with zinc-coated steel for interior applications and stainless steel for exterior applications. Select anchor bolts with strength required for anchor and as tested according to ASTM E 488.

2.4 FACTORY FINISHES

A. Finish: Manufacturer's standard prime-coat finish ready for field painting.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and equipment to receive vibration isolation and seismic-control devices for compliance with requirements for installation tolerances and other conditions affecting performance.

B. Examine roughing-in of reinforcement and cast-in-place anchors to verify actual locations before installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 APPLICATIONS

A. Multiple Pipe Supports: Secure pipes to trapeze member with clamps approved for application by an agency acceptable to authorities having jurisdiction.

B. Hanger Rod Stiffeners: Install hanger rod stiffeners where indicated or scheduled on Drawings to receive them and where required to prevent buckling of hanger rods due to seismic forces.

C. Strength of Support and Seismic-Restraint Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static and seismic loads within specified loading limits.

3.3 VIBRATION-CONTROL AND SEISMIC-RESTRAINT DEVICE INSTALLATION

A. Equipment Restraints:

1. Install seismic snubbers on HVAC equipment mounted on vibration isolators. Locate snubbers as close as possible to vibration isolators and bolt to equipment base and supporting structure.
2. Install resilient bolt isolation washers on equipment anchor bolts where clearance between anchor and adjacent surface exceeds 0.125 inch.
3. Install seismic-restraint devices using methods approved by an agency acceptable to authorities having jurisdiction providing required submittals for component.

B. Piping Restraints:

1. Comply with requirements in MSS SP-127.
2. Space lateral supports a maximum of 40 feet o.c., and longitudinal supports a maximum of 80 feet o.c.
3. Brace a change of direction longer than 12 feet.

C. Install cables so they do not bend across edges of adjacent equipment or building structure.

D. Install seismic-restraint devices using methods approved an agency acceptable to authorities having jurisdiction providing required submittals for component.

E. Install bushing assemblies for anchor bolts for floor-mounted equipment, arranged to provide resilient media between anchor bolt and mounting hole in concrete base.

F. Install bushing assemblies for mounting bolts for wall-mounted equipment, arranged to provide resilient media where equipment or equipment-mounting channels are attached to wall.

G. Attachment to Structure: If specific attachment is not indicated, anchor bracing to structure at flanges of beams, at upper truss chords of bar joists, or at concrete members.

H. Drilled-in Anchors:

1. Identify position of reinforcing steel and other embedded items prior to drilling holes for anchors. Do not damage existing reinforcing or embedded items during coring or drilling. Notify the structural engineer if reinforcing steel or other embedded items are encountered during drilling. Locate and avoid prestressed tendons, electrical and telecommunications conduit, and gas lines.
2. Do not drill holes in concrete or masonry until concrete, mortar, or grout has achieved full design strength.
3. Wedge Anchors: Protect threads from damage during anchor installation. Heavy-duty sleeve anchors shall be installed with sleeve fully engaged in the structural element to which anchor is to be fastened.
4. Adhesive Anchors: Clean holes to remove loose material and drilling dust prior to installation of adhesive. Place adhesive in holes proceeding from the bottom of the hole and progressing toward the surface in such a manner as to avoid introduction of air pockets in the adhesive.
5. Set anchors to manufacturer's recommended torque, using a torque wrench.
6. Install zinc-coated steel anchors for interior and stainless-steel anchors for exterior applications.

3.4 ACCOMMODATION OF DIFFERENTIAL SEISMIC MOTION

A. Install flexible connections in piping where they cross seismic joints, where adjacent sections or branches are supported by different structural elements, and where the connections terminate with connection to equipment that is anchored to a different structural element from the one supporting the connections as they approach equipment.

3.5 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Tests and Inspections:

1. Provide evidence of recent calibration of test equipment by a testing agency acceptable to authorities having jurisdiction.
2. Schedule test with Owner, through Architect, before connecting anchorage device to restrained component (unless postconnection testing has been approved), and with at least seven days' advance notice.
3. Obtain Architect's approval before transmitting test loads to structure. Provide temporary load-spreading members.

4. Test at least four of each type and size of installed anchors and fasteners selected by Architect.
5. Test to 90 percent of rated proof load of device.
6. Measure isolator restraint clearance.
7. Measure isolator deflection.
8. Verify snubber minimum clearances.
9. If a device fails test, modify all installations of same type and retest until satisfactory results are achieved.

C. Remove and replace malfunctioning units and retest as specified above.

D. Prepare test and inspection reports.

3.6 ADJUSTING

A. Adjust isolators after piping system is at operating weight.

B. Adjust limit stops on restrained spring isolators to mount equipment at normal operating height. After equipment installation is complete, adjust limit stops so they are out of contact during normal operation.

C. Adjust active height of spring isolators.

D. Adjust restraints to permit free movement of equipment within normal mode of operation.

END OF SECTION 230548

SECTION 230553 - IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Equipment labels.
2. Pipe labels.
3. Duct labels.
4. Valve tags.

1.2 SUBMITTAL

A. Product Data: For each type of product indicated.

PART 2 - PRODUCTS

2.1 EQUIPMENT LABELS

A. Metal Labels for Equipment:

1. Material and Thickness: Aluminum, 0.032-inch or anodized aluminum, 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 or self-tapping screws.
5. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

B. Label Content: Include equipment's Drawing designation or unique equipment number.

C. Equipment Label Schedule: For each item of equipment to be labeled, on 8-1/2-by-11-inch (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 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.

2.3 DUCT 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 or self-tapping screws.

H. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

I. Duct Label Contents: Include identification of duct service using same designations or abbreviations as used on Drawings, 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. 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 wire-link or beaded chain; or 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.

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, 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 50 feet along each run. Reduce intervals to 25 feet in areas of congested piping and equipment.

7. On piping above removable acoustical ceilings. Omit intermediately spaced labels.

C. Pipe Label Color Schedule:

1. Heating Water Piping:

a. Background Color: Green.
b. Letter Color: White.

2. Condenser-Water Piping:

a. Background Color: Blue.
b. Letter Color: Black.

3.4 DUCT LABEL INSTALLATION

A. Install self-adhesive duct labels with permanent adhesive on air ducts in the following color codes:
1. Yellow: For supply ducts.
2. Green: For exhaust-, outside-, relief-, return-, and mixed-air ducts.

B. Locate labels near points where ducts enter into concealed spaces and at maximum intervals of 50 feet in each space where ducts are exposed or concealed by removable ceiling system.

3.5 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 HVAC terminal devices 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. Condenser and Hot Water: 1-1/2 inches, round.

2. Valve-Tag Color:
a. Condenser and Hot Water: Natural.

3. Letter Color:
a. Condenser and Hot Water: Black.

END OF SECTION 230553

SECTION 230593 - TESTING, ADJUSTING AND BALANCING FOR HVAC

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. Balancing Air Systems:
      a. Constant-volume air systems.
   2. Balancing Hydronic Piping Systems:
      a. Variable-flow systems.

1.3 DEFINITIONS

A. AABC: Associated Air Balance Council.

B. NEBB: National Environmental Balancing Bureau.

C. TAB: Testing, adjusting, and balancing.

D. TABB: Testing, Adjusting, and Balancing Bureau.

E. TAB Specialist: An entity engaged to perform TAB Work.

1.4 SUBMITTALS

A. Qualification Data: Within 15 days of Contractor's Notice to Proceed, submit documentation that the TAB contractor and this Project's TAB team members meet the qualifications specified in "Quality Assurance" Article.

B. Contract Documents Examination Report: Within 15 days of Contractor's Notice to Proceed, submit the Contract Documents review report as specified in Part 3.

C. Strategies and Procedures Plan: Within 30 days of Contractor's Notice to Proceed, submit TAB strategies and step-by-step procedures as specified in "Preparation" Article.

D. Certified TAB reports.

E. Sample report forms.

F. Instrument calibration reports, to include the following:
   1. Instrument type and make.
   2. Serial number.
   3. Application.
   4. Dates of use.
   5. Dates of calibration.

1.5 QUALITY ASSURANCE

A. TAB Contractor Qualifications: Engage a TAB entity certified by AABC..
   1. TAB Field Supervisor: Employee of the TAB contractor and certified by AABC.
   2. TAB Technician: Employee of the TAB contractor and who is certified by AABC as a TAB technician.

B. Certify TAB field data reports and perform the following:
   1. Review field data reports to validate accuracy of data and to prepare certified TAB reports.
   2. Certify that the TAB team complied with the approved TAB plan and the procedures specified and referenced in this Specification.

C. TAB Report Forms: Use standard TAB contractor's forms approved by Construction Manager.

D. Instrumentation Type, Quantity, Accuracy, and Calibration: As described in ASHRAE 111, Section 5, "Instrumentation."

PART 2 - EXECUTION

2.1 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.

B. Examine systems for installed balancing devices, such as manual volume dampers. Verify that locations of these balancing devices are accessible.

C. Examine the approved submittals for HVAC systems and equipment.

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 curves.
   1. 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.
   2. Calculate system-effect factors to reduce performance ratings of HVAC equipment when installed under conditions different from the conditions used to rate equipment

performance. To calculate system effects for air systems, use tables and charts found in AMCA 201, "Fans and Systems," or in SMACNA's "HVAC Systems - Duct Design." Compare results with the design data and installed conditions.

F. Examine system and equipment installations and verify that field quality-control testing, cleaning, and adjusting specified in individual Sections have been performed.

G. Examine test reports specified in individual system and equipment Sections.

H. Examine HVAC equipment and filters and verify that bearings are greased, belts are aligned and tight, and equipment with functioning controls is ready for operation.

I. Examine terminal units, such as variable-air-volume boxes, to verify that they are accessible and their controls are connected and functioning.

J. Examine heat-transfer coils for correct piping connections and for clean and straight fins.

K. 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. Automatic modulating and shutoff valves, including three-way mixing and diverting valves, are properly connected.
5. Thermostats are located to avoid adverse effects of sunlight, drafts, and cold walls.
6. Sensors are located to sense only the intended conditions.
7. Sequence of operation for control modes is according to the Contract Documents.
8. Controller set points are set at indicated values.
9. Interlocked systems are operating.
10. Changeover from heating to cooling mode occurs according to indicated values.

L. Examine operating safety interlocks and controls on HVAC equipment.

M. 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.

2.2 PREPARATION

A. Prepare a TAB plan that includes strategies and step-by-step procedures.

B. Complete system-readiness checks and prepare 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 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.

2.3 GENERAL PROCEDURES FOR TESTING AND BALANCING

A. Perform testing and balancing procedures on each system according to the procedures contained in AABC's "National Standards for Total System Balance" and in this Section.

B. Cut insulation, ducts and equipment cabinets for installation of test probes to the minimum extent necessary for TAB procedures.
1. After testing and balancing, install test ports and duct access doors that comply with requirements in Division 23 Section "Air Duct Accessories."
2. Install and join new insulation that matches removed materials. Restore insulation, coverings, vapor barrier, and finish according to Division 23 Section "HVAC Insulation."

C. Mark equipment and balancing devices, including damper-control positions, fan-speed-control levers, and similar controls and devices, with paint or other suitable, permanent identification material to show final settings.

D. Take and report testing and balancing measurements in inch-pound (IP)] units.

2.4 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. Determine the best locations in main and branch ducts for accurate duct-airflow measurements.

D. Locate start-stop and disconnect switches, electrical interlocks, and motor starters.

E. Verify that motor starters are equipped with properly sized thermal protection.

F. Check dampers for proper position to achieve desired airflow path.

G. Check for airflow blockages.

H. Verify that air duct system is sealed as specified in Division 23 Section "Metal Ducts."

2.5 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 total airflow.
   a. Where sufficient space in ducts is unavailable for Pitot-tube traverse measurements, measure airflow at terminal outlets and inlets and calculate the total airflow.
2. Measure fan static pressures as follows to determine actual static pressure:
   a. Measure outlet static pressure as far downstream from the fan as practical 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 the flexible connection, and downstream from duct restrictions.
3. Measure static pressure across each component that makes up an air-handling unit, rooftop unit, and other air-handling and -treating equipment.
   a. Report the cleanliness status of filters and the time static pressures are measured.
4. Review Record Documents to determine variations in design static pressures versus actual static pressures. Calculate actual system-effect factors. Recommend adjustments to accommodate actual conditions.
5. Obtain approval from Construction Manager for adjustment of fan speed higher or lower than indicated speed. Comply with requirements in Division 23 Sections for air-handling units for adjustment of fans, belts, and pulley sizes to achieve indicated air-handling-unit performance.
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 mode to determine the maximum required brake horsepower.

B. Adjust volume dampers for main duct, sub-main ducts, and major branch ducts to indicated airflows within specified tolerances.
   1. Measure airflow of sub-main and branch ducts.
      a. Where sufficient space in submain and branch ducts is unavailable for Pitot-tube traverse measurements, measure airflow at terminal outlets and inlets and calculate the total airflow for that zone.
   2. Measure static pressure at a point downstream from the balancing damper, and adjust volume dampers until the proper static pressure is achieved.
   3. Remeasure each sub-main and branch duct after all have been adjusted. Continue to adjust sub-main and branch ducts to indicated airflows within specified tolerances.

C. Measure air 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 air outlets and inlets for each space to indicated airflows within specified tolerances of indicated values. Make adjustments using branch 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.

2.6 GENERAL PROCEDURES FOR HYDRONIC SYSTEMS

A. Prepare test reports with pertinent design data, and number in sequence starting at pump to end of system. Check the sum of branch-circuit flows against the approved pump flow rate. Correct variations that exceed plus or minus 5 percent.

B. Prepare schematic diagrams of systems' "as-built" piping layouts.

C. Prepare hydronic systems for testing and balancing according to the following, in addition to the general preparation procedures specified above:
   1. Open all manual valves for maximum flow.
   2. Check liquid level in expansion tank.
   3. Check makeup water-station pressure gage for adequate pressure for highest vent.
   4. Check flow-control valves for specified sequence of operation, and set at indicated flow.
   5. Set differential-pressure control valves at the specified differential pressure. Do not set at fully closed position when pump is positive-displacement type unless several terminal valves are kept open.
   6. Set system controls so automatic valves are wide open to heat exchangers.
   7. Check pump-motor load. If motor is overloaded, throttle main flow-balancing device so motor nameplate rating is not exceeded.
   8. Check air vents for a forceful liquid flow exiting from vents when manually operated

2.7 PROCEDURES FOR VARIABLE-FLOW HYDRONIC SYSTEMS

A. Balance systems with automatic two-way control valves by setting systems at maximum flow through heat-exchange terminals and proceed as specified above for hydronic systems.

2.8 PROCEDURES FOR HEAT EXCHANGERS

A. Measure water flow through all circuits.

B. Adjust water flow to within specified tolerances.

C. Measure inlet and outlet water temperatures.

D. Measure inlet steam pressure.

E. Check settings and operation of safety and relief valves. Record settings.

2.9 PROCEDURES FOR MOTORS

A. Motors, 1/2 HP and Larger: Test at final balanced conditions and record the following data:

   1. Manufacturer's name, model number, and serial number.
   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 of the controller to prove proper operation. Record observations including name of controller manufacturer, model number, serial number, and nameplate data.

2.10 PROCEDURES FOR COOLING TOWERS

A. Shut off makeup water for the duration of the test, and verify that makeup and blowdown systems are fully operational after tests and before leaving the equipment. Perform the following tests and record the results:

1. Measure condenser-water flow to each cell of the cooling tower.
2. Measure entering- and leaving-water temperatures.
3. Measure wet- and dry-bulb temperatures of entering air.
4. Measure wet- and dry-bulb temperatures of leaving air.
5. Measure condenser-water flow rate recirculating through the cooling tower.
6. Measure cooling-tower spray pump discharge pressure.
7. Adjust water level and feed rate of makeup water system.
8. Measure flow through bypass.

2.11 PROCEDURES FOR BOILERS

A. Hydronic Boilers: Measure and record entering- and leaving-water temperatures and water flow.

2.12 PROCEDURES FOR HEAT-TRANSFER COILS

A. Measure, adjust, and record the following data for each water coil:

1. Entering- and leaving-water temperature.
2. Water flow rate.
3. Water pressure drop.
4. Dry-bulb temperature of entering and leaving air.
5. Wet-bulb temperature of entering and leaving air for cooling coils.
6. Airflow.
7. Air pressure drop.

2.13 TOLERANCES

1. Supply, Return, and Exhaust Fans and Equipment with Fans: Plus or minus 10 percent.
2. Air Outlets and Inlets: Plus or minus 10 percent.
3. Heating-Water Flow Rate: Plus or minus 10 percent.

4. Cooling-Water Flow Rate: Plus or minus 10 percent.

2.14 REPORTING

A. Initial Construction-Phase Report: Based on examination of the Contract Documents as specified in "Examination" Article, prepare a report on the adequacy of design for systems' balancing devices. Recommend changes and additions to systems' balancing devices to facilitate proper performance measuring and balancing. Recommend changes and additions to HVAC systems and general construction to allow access for performance measuring and balancing devices.

2.15 FINAL REPORT

A. General: Prepare a certified written report; tabulate and divide the report into separate sections for tested systems and balanced systems.
   1. Include a certification sheet at the front of the report's binder, signed and sealed by the certified testing and balancing engineer.
   2. Include a list of instruments used for procedures, along with proof of calibration.

B. Final Report Contents: In addition to certified field-report data, include the following:
   1. Fan curves.
   2. Pump curves.
   3. Manufacturers' test data.
   4. Field test reports prepared by system and equipment installers.
   5. Other information relative to equipment performance; do not include Shop Drawings and product data.

C. General Report Data: In addition to form titles and entries, include the following data:
   1. Title page.
   2. Name and address of the TAB contractor.
   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 supervisor 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's name, type, size, and fittings.
   14. Notes to explain why certain final data in the body of reports vary from indicated values.
   15. Test conditions for fans and pump performance forms including the following:

a. Settings for outdoor-, return-, and exhaust-air dampers.
b. Conditions of filters.
c. Cooling coil, wet- and dry-bulb conditions.
d. Face and bypass damper settings at coils.
e. Fan drive settings including settings and percentage of maximum pitch diameter.
f. Inlet vane settings for variable-air-volume systems.
g. Settings for supply-air, static-pressure controller.
h. Other system operating conditions that affect performance.

D. Air-Handling-Unit Test Reports: For air-handling units with coils, include the following:
1. Unit Data:
a. Unit identification.
b. Location.
c. Make and type.
d. Model number and unit size.
e. Manufacturer's serial number.
f. Unit arrangement and class.
g. Discharge arrangement.
h. Sheave make, size in inches, and bore.
i. Center-to-center dimensions of sheave, and amount of adjustments in inches.
j. Number, make, and size of belts.
k. Number, type, and size of filters.

2. Motor Data:
a. Motor make, and frame type and size.
b. Horsepower and rpm.
c. Volts, phase, and hertz.
d. Full-load amperage and service factor.
e. Sheave make, size in inches, and bore.
f. Center-to-center dimensions of sheave, and amount of adjustments in inches.

3. Test Data (Indicated and Actual Values):
a. Total air flow rate in cfm.
b. Total system static pressure in inches wg.
c. Fan rpm.
d. Discharge static pressure in inches wg.
e. Filter static-pressure differential in inches wg.
f. Cooling-coil static-pressure differential in inches wg.
g. Heating-coil static-pressure differential in inches wg.
h. Outdoor airflow in cfm.
i. Return airflow in cfm.
j. Outdoor-air damper position.
k. Return-air damper position.

E. Apparatus-Coil Test Reports:
1. Coil Data:
a. System identification.
b. Location.
c. Coil type.
d. Number of rows.

e. Fin spacing in fins per inch o.c.
f. Make and model number.
g. Face area in sq. ft. .
h. Tube size in NPS (DN).
i. Tube and fin materials.
j. Circuiting arrangement.

2. Test Data (Indicated and Actual Values):
a. Air flow rate in cfm .
b. Average face velocity in fpm .
c. Air pressure drop in inches wg.
d. Outdoor-air, wet- and dry-bulb temperatures in deg F.
e. Return-air, wet- and dry-bulb temperatures in deg F .
f. Entering-air, wet- and dry-bulb temperatures in deg F .
g. Leaving-air, wet- and dry-bulb temperatures in deg F .
h. Water flow rate in gpm .
i. Water pressure differential in feet of head or psig .
j. Entering-water temperature in deg F .
k. Leaving-water temperature in deg F .
l. Refrigerant expansion valve and refrigerant types.
m. Refrigerant suction pressure in psig .
n. Refrigerant suction temperature in deg F .

F. Pump Test Reports: Calculate impeller size by plotting the shutoff head on pump curves and include the following:
1. Unit Data:
a. Unit identification.
b. Location.
c. Service.
d. Make and size.
e. Model and serial numbers.
f. Water flow rate in gpm .
g. Water pressure differential in feet of head or psig .
h. Required net positive suction head in feet of head or psig .
i. Pump rpm.
j. Impeller diameter in inches.
k. Motor make and frame size.
l. Motor horsepower and rpm.
m. Voltage at each connection.
n. Amperage for each phase.
o. Full-load amperage and service factor.
p. Seal type.

2. Test Data (Indicated and Actual Values):
a. Static head in feet of head or psig .
b. Pump shutoff pressure in feet of head or psig .
c. Actual impeller size in inches .
d. Full-open flow rate in gpm .
e. Full-open pressure in feet of head or psig .

f. Final discharge pressure in feet of head or psig .
g. Final suction pressure in feet of head or psig .
h. Final total pressure in feet of head or psig .
i. Final water flow rate in gpm .
j. Voltage at each connection.
k. Amperage for each phase.

G. Round and Rectangular Duct Traverse Reports: Include a diagram with a grid representing the duct cross-section and record the following:
1. Report Data:
a. System and air-handling-unit number.
b. Location and zone.
c. Traverse air temperature in deg F .
d. Duct static pressure in inches wg.
e. Duct size in inches .
f. Duct area in sq. ft. .
g. Indicated air flow rate in cfm .
h. Indicated velocity in fpm .
i. Actual air flow rate in cfm .
j. Actual average velocity in fpm .
k. Barometric pressure in psig.

H. Instrument Calibration Reports:
1. Report Data:
a. Instrument type and make.
b. Serial number.
c. Application.
d. Dates of use.
e. Dates of calibration.

2.16 INSPECTIONS

A. Initial Inspection:
1. After testing and balancing are complete, operate each system and randomly check measurements to verify that the system is operating according to the final test and balance readings documented in the final report.
2. Check the following for each system:
a. Measure airflow of at least 10 percent of air outlets.
b. Measure room temperature at each thermostat/temperature sensor. Compare the reading to the set point.
c. Verify that balancing devices are marked with final balance position.
d. Note deviations from the Contract Documents in the final report.

B. Final Inspection:
1. After initial inspection is complete and documentation by random checks verifies that testing and balancing are complete and accurately documented in the final report, request that a final inspection be made by Construction Manager.
2. The TAB contractor's test and balance engineer shall conduct the inspection in the presence of Construction Manager.

3. Construction Manager shall randomly select measurements, documented in the final report, to be rechecked. Rechecking shall be limited to either 10 percent of the total measurements recorded or the extent of measurements that can be accomplished in a normal 8-hour business day.
4. If rechecks yield measurements that differ from the measurements documented in the final report by more than the tolerances allowed, the measurements shall be noted as "FAILED."
5. If the number of "FAILED" measurements is greater than 10 percent of the total measurements checked during the final inspection, the testing and balancing shall be considered incomplete and shall be rejected.

C. TAB Work will be considered defective if it does not pass final inspections. If TAB Work fails, proceed as follows:
1. Recheck all measurements and make adjustments. Revise the final report and balancing device settings to include all changes; resubmit the final report and request a second final inspection.
2. If the second final inspection also fails, Owner may contract the services of another TAB contractor to complete TAB Work according to the Contract Documents and deduct the cost of the services from the original TAB contractor's final payment.

D. Prepare test and inspection reports.

END OF SECTION 230593

SECTION 230713 - DUCT INSULATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes insulating the following duct services:

1. Indoor, concealed supply and outdoor air.
2. Indoor, exposed supply and outdoor air.
3. Outdoor, exposed supply and return.

B. Related Sections:
1. Section 230719 "HVAC Piping Insulation."
2. Section 233113 "Metal Ducts" for duct liners.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include thermal conductivity, water-vapor permeance thickness, and jackets (both factory- and field-applied if any).

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. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products according to ASTM E 84, by a testing 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 agency.

1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed 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 sizes and locations of supports, hangers, and insulation shields specified in Section 230529 "Hangers and Supports for HVAC Piping and Equipment."

B. Coordinate clearance requirements with duct Installer for duct insulation application. Before preparing ductwork 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 "Duct Insulation Schedule, General," "Indoor Duct and Plenum Insulation Schedule," and "Aboveground, Outdoor Duct and Plenum Insulation 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. 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 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.; SoftTouch Duct Wrap.
b. Johns Manville; Microlite.
c. Knauf Insulation; Friendly Feel Duct Wrap.
d. Manson Insulation Inc.; Alley Wrap.
e. Owens Corning; SOFTR All-Service Duct Wrap.

E. 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. 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.
   g.

F. Mineral-Fiber, Pipe and Tank Insulation: Mineral or glass fibers bonded with a thermosetting resin. Semirigid board material with factory-applied FSK jacket complying with ASTM C 1393, Type II or Type IIIA Category 2, or with properties similar to ASTM C 612, Type IB. Nominal density is 2.5 lb/cu. ft. or more. Thermal conductivity (k-value) at 100 deg F is 0.29 Btu x in./h x sq. ft. x deg F or less. 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.; CrimpWrap.
   b. Johns Manville; MicroFlex.
   c. Knauf Insulation; Pipe and Tank Insulation.
   d. Manson Insulation Inc.; AK Flex.
   e. Owens Corning; Fiberglas Pipe and Tank Insulation.
   f. <Insert manufacturer's name; product name or designation>.

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. 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 Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-127.Eagle Bridges - Marathon Industries; 225.
   b. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-60/85-70.Mon-Eco Industries, Inc.; 22-25.

2. For indoor applications, adhesive shall have a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

C. ASJ Adhesive, and FSK Jacket 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 Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-82.
   b. Eagle Bridges - Marathon Industries; 225.
   c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-50.Mon-Eco Industries, Inc.; 22-25.

2. For indoor applications, adhesive shall have a VOC content of 50 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 Corning Corporation; 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; Polyco VP Adhesive.
   e.

2. For indoor applications, adhesive shall have 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-PRF-19565C, Type II.

1. For indoor applications, use mastics that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

B. Vapor-Barrier Mastic: Solvent based; suitable for 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 Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; Encacel.
   b. Eagle Bridges - Marathon Industries; 570.
   c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 60-95/60-96.

2. Water-Vapor Permeance: ASTM F 1249, 0.05 perm at 30-mil dry film thickness.
3. Service Temperature Range: Minus 50 to plus 220 deg F.

4. Solids Content: ASTM D 1644, 33 percent by volume and 46 percent by weight.
5. Color: White.

C. Breather Mastic: Water based; suitable for indoor and outdoor use on above ambient services.

1. Products: Subject to compliance with requirementsavailable products that may be incorporated into the Work include, but are not limited to, the following:

   a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-10.
   b. Eagle Bridges - Marathon Industries; 550.
   c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 46-50.
   d. Mon-Eco Industries, Inc.; 55-50.
   e. Vimasco Corporation; WC-1/WC-5.

2. Water-Vapor Permeance: ASTM F 1249, 1.8 perms at 0.0625-inch dry film thickness.
3. Service Temperature Range: Minus 20 to plus 180 deg F.
4. Solids Content: 60 percent by volume and 66 percent by weight.
5. Color: White.

2.4 LAGGING ADHESIVES

A. Description: Comply with MIL-A-3316C, Class I, Grade A and shall be compatible with insulation materials, jackets, and substrates.

1. For indoor applications, use lagging adhesives that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
2. 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 Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-50 AHV2.Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 30-36.
   b. Vimasco Corporation; 713 and 714.

3. Fire-resistant, water-based lagging adhesive and coating for use indoors to adhere fire-resistant lagging cloths over duct insulation.
4. Service Temperature Range: 0 to plus 180 deg F.
5. Color: White.

2.5 SEALANTS

A. ASJ Flashing Sealants, and Vinyl and PVC Jacket Flashing Sealants:

1. Products: Subject to compliance with requirementsavailable products that may be incorporated into the Work include, but are not limited to, the following:

a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 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, sealants shall have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.6 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.

2.7 FIELD-APPLIED JACKETS

A. Field-applied jackets shall comply with ASTM C 921, Type I, unless otherwise indicated.

B. PVC Jacket: High-impact-resistant, UV-resistant PVC complying with ASTM D 1784, Class 16354-C; thickness as scheduled; roll stock ready for shop or field cutting and forming. Thickness is indicated in field-applied jacket schedules.

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. Johns Manville; Zeston.
b. P.I.C. Plastics, Inc.; FG Series.
c. Proto Corporation; LoSmoke.
d. Speedline Corporation; SmokeSafe.

2. Adhesive: As recommended by jacket material manufacturer.
3. Color: White.

2.8 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. ABI, Ideal Tape Division; 428 AWF ASJ.
b. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0836.
c. Compac Corporation; 104 and 105.

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. ABI, Ideal Tape Division; 370 White PVC tape.
b. Compac Corporation; 130.
c. 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.

2.9 SECUREMENTS

A. Bands:

1. Products: Subject to compliance with requirementsavailable products that may be incorporated into the Work include, but are not limited to, the following:

a. ITW Insulation Systems; Gerrard Strapping and Seals.
b. RPR Products, Inc.; Insul-Mate Strapping, Seals, and Springs.

2. Aluminum: ASTM B 209, Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch thick, 1/2 inchwide with wing seal or closed seal.
3. Springs: Twin spring set constructed of stainless steel with ends flat and slotted to accept metal bands. Spring size determined by manufacturer for application.

B. Insulation Pins and Hangers:

1. Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.106-inch diameter shank, length to suit depth of insulation indicated.

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.; CWP-1.
2) GEMCO; CD.

3) Midwest Fasteners, Inc.; CD.
4) Nelson Stud Welding; TPA, TPC, and TPS.

2. Cupped-Head, Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.106-inch diameter shank, length to suit depth of insulation indicated with integral 1-1/2-inch galvanized carbon-steel washer.

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.; CHP-1.
2) GEMCO; Cupped Head Weld Pin.
3) Midwest Fasteners, Inc.; Cupped Head.
4) Nelson Stud Welding; CHP.

C. Staples: Outward-clinching insulation staples, nominal 3/4-inch- wide, stainless steel or Monel.

D. Wire: 0.062-inch soft-annealed, galvanized steel.

1. Manufacturers: Subject to compliance with requirementsavailable manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. C & F Wire.

2.10 CORNER ANGLES

A. PVC Corner Angles: 30 mils thick, minimum 1 by 1 inch, PVC according to ASTM D 1784, Class 16354-C. White or color-coded to match adjacent surface.

B. Aluminum Corner Angles: 0.040 inch thick, minimum 1 by 1 inch, aluminum according to ASTM B 209, Alloy 3003, 3005, 3105, or 5005; Temper H-14.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of insulation application.

1. Verify that systems to be insulated have been tested and are free of defects.
2. Verify that surfaces to be insulated are clean and dry.

B. 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.

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 ducts and fittings.

B. Install insulation materials, vapor barriers or retarders, jackets, and thicknesses required for each item of duct 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. 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.

J. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.

K. 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. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 2 incheso.c.

a. For below ambient services, apply vapor-barrier mastic over staples.

4. Cover joints and seams with tape, according to insulation material manufacturer's written instructions, to maintain vapor seal.
5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to duct flanges and fittings.

L. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.

M. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.

N. 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.

3.4 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. 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 roof flashing at least 2 inches below top of roof flashing.
4. Seal jacket to roof 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 Fire-Rated Wall and Partition Penetrations: Terminate insulation at fire damper sleeves for fire-rated wall and partition penetrations. Externally insulate damper sleeves to match adjacent insulation and overlap duct insulation at least 2 inches.

1. Comply with requirements in Section 078413 "Penetration Firestopping"irestopping and fire-resistive joint sealers.

D. Insulation Installation at Floor Penetrations:

1. Duct: 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. Seal penetrations through fire-rated assemblies. Comply with requirements in Section 078413 "Penetration Firestopping."

3.5 INSTALLATION OF MINERAL-FIBER INSULATION

A. 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 50 <Insert number> 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 one edge and one 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.

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.

B. 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 one edge and one 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 two 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.

3.6 FIELD-APPLIED JACKET INSTALLATION

A. Where glass-cloth jackets are indicated, install directly over bare insulation or insulation with factory-applied jackets.

1. Draw jacket smooth and tight to surface with 2-inch overlap at seams and joints.
2. Embed glass cloth between two 0.062-inch- thick coats of lagging adhesive.
3. Completely encapsulate insulation with coating, leaving no exposed insulation.

B. Where PVC jackets are indicated, install with 1-inch overlap at longitudinal seams and end joints; for horizontal applications, install with longitudinal seams along top and bottom of tanks and vessels. Seal with manufacturer's recommended adhesive.

1. Apply two continuous beads of adhesive to seams and joints, one bead under lap and the finish bead along seam and joint edge.

C. Where metal jackets are indicated, install with 2-inch overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with weatherproof sealant recommended by insulation manufacturer. Secure jacket with stainless-steel bands 12 inches o.c. and at end joints.

3.7 FINISHES

A. Insulation with ASJ, Glass-Cloth, or Other Paintable Jacket Material: Paint jacket with paint system identified below and as specified in Section 099113 "Exterior Painting" and Section 099123 "Interior Painting."

1. Flat Acrylic Finish: Two <Insert number> finish coats over a primer that is compatible with jacket material and finish coat paint. Add fungicidal agent to render fabric mildew proof.

a. Finish Coat Material: Interior, flat, latex-emulsion size.

B. Color: Final color as selected by Architect. Vary first and second coats to allow visual inspection of the completed Work.

C. Do not field paint aluminum or stainless-steel jackets.

3.8 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.

B. Perform tests and inspections.

C. 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 for each duct system defined in the "Duct Insulation Schedule, General" Article.

D. All insulation applications will be considered defective Work if sample inspection reveals noncompliance with requirements.

3.9 DUCT INSULATION SCHEDULE, GENERAL

A. Plenums and Ducts Requiring Insulation:

1. Indoor, concealed supply and outdoor air.
2. Indoor, exposed supply and outdoor air.
3. Indoor, exposed return located in unconditioned space.
4. Outdoor, exposed supply and return.

B. Items Not Insulated:

1. Fibrous-glass ducts.
2. Metal ducts with duct liner of sufficient thickness to comply with energy code and ASHRAE/IESNA 90.1.
3. Factory-insulated flexible ducts.
4. Factory-insulated plenums and casings.
5. Flexible connectors.
6. Vibration-control devices.
7. Factory-insulated access panels and doors.

3.10 INDOOR DUCT AND PLENUM INSULATION SCHEDULE

A. Concealed, round and flat-oval, supply-air duct insulation shall be one of the following:

1. Flexible Elastomeric: 1 inch thick.
2. Mineral-Fiber Blanket: 1-1/2 inches thick and 0.75-lb/cu. ft. nominal density.

B. Concealed, rectangular, supply-air duct insulation shall be one of the following:
1. Mineral-Fiber Blanket: 1-1/2 inches thick and 0.75-lb/cu. ft. nominal density.

C. Concealed, rectangular, return-air duct insulation shall be one of the following:

1. Flexible Elastomeric: 1 inch thick.
2. Mineral-Fiber Blanket: 1-1/2 inches thick and 0.75-lb/cu. ft. nominal density.

D. Exposed, rectangular, supply-air duct insulation shall be one of the following:
1. Mineral-Fiber Blanket: 1-1/2 inches thick and 0.75-lb/cu. ft. nominal density.

3.11 ABOVEGROUND, OUTDOOR DUCT INSULATION SCHEDULE

A. Insulation materials and thicknesses are identified below. If more than one material is listed for a duct system, selection from materials listed is Contractor's option.

B. Exposed, rectangular, supply-air duct insulation shall be the following:
1. Mineral-Fiber Board: 2 inches thick and 2-lb/cu. ft nominal density.

3.12 INDOOR, FIELD-APPLIED JACKET SCHEDULE

A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.

B. If more than one material is listed, selection from materials listed is Contractor's option.

C. Ducts and Plenums, Concealed:
   1. PVC 20 mils thick.

D. Ducts and Plenums, Exposed:
   1. PVC 20 mils thick.

3.13 OUTDOOR, FIELD-APPLIED JACKET SCHEDULE

A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.

B. If more than one material is listed, selection from materials listed is Contractor's option.

C. Ducts and Plenums, Exposed, up to 48 Inches in Diameter or with Flat Surfaces up to 72 Inches:

   1. Aluminum, Smooth: 0.016 inch thick.

END OF SECTION 230713

SECTION 230719 - HVAC PIPING INSULATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes insulating the following HVAC piping systems:

1. Condensate drain piping.
2. Condenser-water piping.
3. Heating hot-water piping.

B. Related Sections:

1. Section 230713 "Duct Insulation."

1.3 SUBMITTALS

A. Product Data: For each type of product indicated. Include thermal conductivity, thickness, and jackets (both factory and field applied, if any).

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 application of field-applied jackets.

C. Qualification Data: For qualified Installer.

D. Material Test Reports: From a qualified testing agency acceptable to authorities having jurisdiction indicating, interpreting, and certifying test results for compliance of insulation materials, sealers, attachments, cements, and jackets, with requirements indicated. Include dates of tests and test methods employed.

E. Field quality-control reports.

F. Material Test Reports: From a qualified testing agency acceptable to authorities having jurisdiction indicating, interpreting, and certifying test results for compliance of insulation

materials, sealers, attachments, cements, and jackets, with requirements indicated. Include dates of tests and test methods employed.

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-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 smoke-developed index of 50 or less.
2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed 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.

B. Store material in dry location on raised platform so as to avoid damage of any kind.

1.6 COORDINATION

A. Coordinate size and location of supports, hangers, and insulation shields specified in Division 23 Section "Hangers and Supports for HVAC Piping and Equipment."

B. Coordinate clearance requirements with piping Installer for piping insulation application.

1.7 SCHEDULING

A. Schedule insulation application after pressure testing systems. Insulation application may begin on segments that have satisfactory test results.

B. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

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. Mineral-Fiber, Preformed Pipe Insulation:

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

a. Fibrex Insulations Inc.; Coreplus 1200.
b. Johns Manville; Micro-Lok.
c. Knauf Insulation; 1000 Pipe Insulation.
d. Manson Insulation Inc.; Alley-K.
e. Owens Corning; Fiberglas Pipe Insulation.

2. Type I, 850 deg F Materials: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 547, Type I, Grade A.

D. Mineral-Fiber, Pipe and Tank Insulation: Mineral or glass fibers bonded with a thermosetting resin. Semirigid board material with factory-applied ASJ jacket complying with ASTM C 1393, Type II or Type IIIA Category 2, or with properties similar to ASTM C 612, Type IB. Nominal density is 2.5 lb/cu. ft. or more. Thermal conductivity (k-value) at 100 deg F is 0.29 Btu x in./h x sq. ft. x deg F or less. 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.; CrimpWrap.
b. Johns Manville; MicroFlex.
c. Knauf Insulation; Pipe and Tank Insulation.
d. Manson Insulation Inc.; AK Flex.
e. Owens Corning; Fiberglas Pipe and Tank Insulation.<

E. Mineral-Fiber, Pipe Insulation Wicking System: Preformed pipe insulation complying with ASTM C 547, Type I, Grade A, with absorbent cloth factory-applied to the entire inside surface of preformed pipe insulation and extended through the longitudinal joint to outside surface of insulation under insulation jacket. Factory apply a white, polymer, vapor-retarder jacket with self-sealing adhesive tape seam and evaporation holes running continuously along the longitudinal seam, exposing the absorbent cloth.

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. Knauf Insulation; Permawick Pipe Insulation.

b. Owens Corning; VaporWick Pipe Insulation.

2.2 INSULATING CEMENTS

A. Mineral-Fiber Insulating Cement: Comply with ASTM C 195.

1. Products: Subject to compliance with requirements:

a. Insulco, Division of MFS, Inc.; Triple I.
b. P. K. Insulation Mfg. Co., Inc.; Super-Stik.

B. Mineral-Fiber, Hydraulic-Setting Insulating and Finishing Cement: Comply with ASTM C 449/C 449M.

1. Products: Subject to compliance with requirements:

a. Insulco, Division of MFS, Inc.; SmoothKote.
b. P. K. Insulation Mfg. Co., Inc.; PK No. 127, and Quik-Cote.
c. Rock Wool Manufacturing Company; Delta One Shot.

2.3 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. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.

1. Products: Subject to compliance with requirements, provide one of 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.

C. ASJ Adhesive, and FSK and PVDC Jacket 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:

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.

D. PVC Jacket Adhesive: Compatible with PVC jacket.

1. Products: Subject to compliance with requirements:

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.

2.4 MASTICS

A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-C-19565C, Type II.

1. For indoor applications, use mastics that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

B. Vapor-Barrier Mastic: Water based; suitable for indoor 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. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 30-80/30-90.
b. Vimasco Corporation; 749.

2. Water-Vapor Permeance: ASTM E 96/E 96M, 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, 58 percent by volume and 70 percent by weight.
5. Color: White.

C. Vapor-Barrier Mastic: Solvent based; suitable for 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 Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; Encacel.
b. Eagle Bridges - Marathon Industries; 570.
c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 60-95/60-96.

2. Water-Vapor Permeance: ASTM F 1249, 0.05 perm at 30-mil dry film thickness.
3. Service Temperature Range: Minus 50 to plus 220 deg F.
4. Solids Content: ASTM D 1644, 33 percent by volume and 46 percent by weight.
5. Color: White.

2.5 LAGGING ADHESIVES

A. Description: Comply with MIL-A-3316C Class I, Grade A and shall be compatible with insulation materials, jackets, and substrates.

1. For indoor applications, use lagging adhesives that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
2. Products: Subject to compliance with requirements:

    a. Childers Products, Division of ITW; CP-52.
    b. Foster Products Corporation, H. B. Fuller Company; 81-42.
    c. Marathon Industries, Inc.; 130.
    d. Mon-Eco Industries, Inc.; 11-30.
    e. Vimasco Corporation; 136.

3. Fire-resistant, water-based lagging adhesive and coating for use indoors to adhere fire-resistant lagging cloths over duct, equipment, and pipe insulation.
4. Service Temperature Range: Minus 50 to plus 180 deg F.
5. Color: White.

2.6 SEALANTS

A. Joint Sealants:

1. Joint Sealants for Cellular-Glass, Phenolic, and Polyisocyanurate 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 Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-76.
    b. Eagle Bridges - Marathon Industries; 405.
    c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 30-45.
    d. Mon-Eco Industries, Inc.; 44-05.
    e. Pittsburgh Corning Corporation; Pittseal 444.

B. FSK and Metal Jacket Flashing Sealants:

1. Products: Subject to compliance with requirements:

    a. Foster Products Corporation, H. B. Fuller Company; 95-44.
    b. Marathon Industries, Inc.; 405.
    c. Mon-Eco Industries, Inc.; 44-05.
    d. 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 (Minus 40 to plus 121 deg C).
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:

    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 (Minus 40 to plus 121 deg C).
5. Color: White.

2.7 FIELD-APPLIED JACKETS

A. Field-applied jackets shall comply with ASTM C 921, Type I, unless otherwise indicated.

B. PVC Jacket: High-impact-resistant, UV-resistant PVC complying with ASTM D 1784, Class 16354-C; thickness as scheduled; roll stock ready for shop or field cutting and forming. Thickness is indicated in field-applied jacket schedules.

1. Products: Subject to compliance with requirements:

    a. Johns Manville; Zeston.
    b. P.I.C. Plastics, Inc.; FG Series.
    c. Proto PVC Corporation; LoSmoke.
    d. Speedline Corporation; SmokeSafe.

2. Adhesive: As recommended by jacket material manufacturer.
3. Color: White.
4. Factory-fabricated fitting covers to match jacket if available; otherwise, field fabricate.

    a. Shapes: 45- and 90-degree, short- and long-radius elbows, tees, valves, flanges, unions, reducers, end caps, soil-pipe hubs, traps, mechanical joints, and P-trap and supply covers for lavatories.

2.8 TAPES

A. 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:

    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.

2.9 SECUREMENTS

A. Bands:

1. Products: Subject to compliance with requirements:

   a. Childers Products; Bands.
   b. PABCO Metals Corporation; Bands.
   c. RPR Products, Inc.; Bands.

2. Aluminum: ASTM B 209, Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch, ½ inch wide.
3. Springs: Twin spring set constructed of stainless steel with ends flat and slotted to accept metal bands. Spring size determined by manufacturer for application.

B. Staples: Twin spring set constructed of stainless steel with ends flat and slotted to accept metal bands. Spring size determined by manufacturer for application.

C. Insulation Pins and Hangers:

1. Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.135-inch diameter shank, length to suit depth of insulation indicated.

   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.; CWP-1.
      2) GEMCO; CD.
      3) Midwest Fasteners, Inc.; CD.
      4) Nelson Stud Welding; TPA, TPC, and TPS.

2. Cupped-Head, Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.135-inch (3.5-mm-) diameter shank, length to suit depth of insulation indicated with integral 1-1/2-inch (38-mm) galvanized carbon-steel washer.

   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.; CHP-1.
      2) GEMCO; Cupped Head Weld Pin.
      3) Midwest Fasteners, Inc.; Cupped Head.
      4) Nelson Stud Welding; CHP.

D. Staples: Outward-clinching insulation staples, nominal 3/4-inch wide, stainless steel or Monel.

E. Wire: 0.062-inch soft-annealed, galvanized steel.

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. C & F Wire.
b. Childers Products.
c. PABCO Metals Corporation.

2.10 CORNER ANGLES

A. PVC Corner Angles: 30 mils thick, minimum 1 by 1 inch, PVC according to ASTM D 1784, Class 16354-C. White or color-coded to match adjacent surface.

B. Aluminum Corner Angles: 0.040 inch thick, minimum 1 by 1 inch, aluminum according to ASTM B 209, Alloy 3003, 3005, 3105 or 5005; Temper H-14

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. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless-steel surfaces, use demineralized water.

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 piping including fittings, valves, and specialties.

B. Install insulation materials, forms, 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 top and 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. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.

J. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.

K. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.

L. 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.

3.4 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.

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. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic for below ambient services and a breather mastic for above ambient services. Reinforce the mastic with fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.
8. Stencil or 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.

3.5 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. 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 roof flashing at least 2 inches (50 mm) below top of roof flashing.
4. Seal jacket to roof flashing with flashing sealant.

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.

3.7 FIELD-APPLIED JACKET INSTALLATION

A. Where PVC jackets are indicated, install with 1-inch overlap at longitudinal seams and end joints; for horizontal applications, install with longitudinal seams along top and bottom of tanks and vessels. Seal with manufacturer's recommended adhesive.

1. Apply two continuous beads of adhesive to seams and joints, one bead under lap and the finish bead along seam and joint edge.

3.8 PI FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.

B. Perform tests and inspections.

C. Tests and Inspections:

1. 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.

D. All insulation applications will be considered defective Work if sample inspection reveals noncompliance with requirements.

3.9 PING 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.

3.10 INDOOR PIPING INSULATION SCHEDULE

A. Condensate and Equipment Drain Water below 60 Deg F:

1. All Pipe Sizes: Insulation shall be the following:
   a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1/2 inch thick.

B. Condenser-Water Supply and Return:

1. All Pipe Sizes: Insulation shall be the following:
   a. Mineral-Fiber, Preformed Pipe, Type I: 1 inch thick.

A. Heating-Hot-Water Supply and Return, 200 Deg F and below:

1. NPS 12 and smaller: Insulation shall be the following:
   a. Mineral-Fiber, Preformed Pipe, Type I: 1 inch thick.

3.11 OUTDOOR, ABOVEGROUND PIPING INSULATION SCHEDULE

A. Condenser-Water Supply and Return:

1. All Pipe Sizes: Insulation shall be one of the following:
   a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 2 inches thick.

INDOOR, FIELD-APPLIED JACKET SCHEDULE

B. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.

C. Piping, Concealed:
1. PVC: 20 mils thick.

D. Piping, Exposed:
1. PVC: 20 mils thick.

3.12 OUTDOOR, FIELD-APPLIED JACKET SCHEDULE

A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.

B. Piping, Exposed:
1. PVC: 20 mils thick.

END OF SECTION 230719

SECTION 230900 - INSTRUMENTATION AND CONTROL FOR HVAC

PART 1 GENERAL

1.01 DESCRIPTION

A. The Contractor shall furnish all labor, materials, equipment, and service necessary for a complete and operating Building Management Control System (BMS), utilizing Direct Digital Controls as shown on the drawings and as described herein. Drawings are diagrammatic only. The Control System shall be capable of total integration of the HVAC systems with user access to all system data either locally over a secure Intranet within the plant or by remote access by a standard Web Browser over the Internet. This shall include HVAC control, all trending, reporting and maintenance management functions related to normal HVAC operations as indicated on the drawings, elsewhere in this specification or recommended by the equipment manufacturer. It is the intent of the specifications to construct a complete and working installation.

B. All work described in this section shall be installed, wired, circuit tested and calibrated by factory technicians qualified for this work. The Contractor shall be responsible for the proper operation and installation of all control systems herein specified. The Contractor shall be responsible for coordination of all interfaces with other equipment to achieve the required control operation.

C. All labor, material, equipment and software not specifically referred to herein or on the plans, which are required to meet the functional intent of this specification, shall be provided without additional cost to the PVSC.

D. The PVSC Facility presently has Invensys Building Systems in other buildings. The intent of this specification is to provide a new Invensys Building System at the Filter Press Building. The Contractor shall integrate the new and existing Invensys Building Systems together as part of the existing Facility Management Control PVSC Network. All components, software and operation shall be interoperable with the existing building automation system. The installed system shall be capable of interfacing directly with the existing Invensys systems, including the existing PVSC dynamic color graphics software, and programming software. All systems as described in the sequence of operation and as shown on the drawings will be shown via dynamic graphics with all pertinent system alarms for proper operation and maintenance. The use of separate PC workstations, gateways, metalinks, replacement of existing controllers and control devices and additional software graphic packages to accomplish this interface will not be accepted.

E. The Contractor shall visit PVSC Buildings in accordance with Section 00010 (Invitation to Bid) to verify the existing DDC controls equipment and ability to be compatible with new controls before bid. The Contractor shall provide Web based graphics for controlled equipment under this contract that matches the functionality and appearance of the graphics already in use on the existing systems. The Contractor shall configure graphic displays to meet PVSC's requirements.

F. All control devices that are installed in the Air Handling Units (AHUs) shall be wired and mounted in the factory of the air handling unit manufacturer. The Contractor shall ship the devices to the AHU factory for installation prior to the AHU being built.

1.02 SYSTEM DESCRIPTION

A. The entire Control System shall be comprised of a network of interoperable, stand-alone direct digital controllers (DDCs) communicating on a LonWorks open protocol communication network. All information from the controllers shall be available to local computers within the facility via local Intranet/Internet and to remote computers or from multiple facilities via the Internet. The Control System shall be able to communicate to third party systems such as HVAC, lighting, energy metering, power management, security, access control, fire-life safety systems and other building management related devices with open, interoperable communication capabilities.

1.03 SUBMITTALS

A. In accordance with the procedures and requirements set forth in Section 01300 of the General requirements, the Contractor shall obtain from the equipment manufacturer and submit the following:

1. Shop Drawings

a. Each submittal shall be complete in all respects, incorporating all information and data listed herein and all additional information required for evaluation of the proposed equipment's compliance with the Contract Documents.

b. Partial, incomplete or illegible submissions will be returned to the Contractor without review for re-submittal.

c. Shop drawing shall reflect careful coordination with work installed under these Specifications, and that of other Sections, especially with respect to interfacing between motor starters and controls. Refer to the elementary wiring diagrams shown on the Electrical Drawings. The logic diagrams submitted under this Section shall show not only the controls furnished by this Contractor, but the various elements of the motor start circuits furnished under other Sections.

d. In addition to the shop drawing submittal requirements indicated above, the Contractor shall provide computer disks (CD-RW) which shall contain the approved version of all shop drawings. Drawing files representation shall conform to the latest version of AutoCAD.

e. Shop Drawings shall include but not be limited to:

(1) Equipment specifications and data sheets identifying all specific model and number materials used and methods of fabrication.

(2) Complete assembly, diagrammatic layout drawings in 11" x 17" format showing unit and field mounted devices including their location, installation drawings with clearly marked dimensions.

(3) Control panel drawings with Bill of Materials showing component layouts, component and electrical laddle.

(4) Logic diagrams.

(5) Sequence of operations, indicating diagrams and power requirements function of each equipment.

(6) Point-to-Point interconnecting wiring diagrams in 11" x 17" format.

(7) Function definition tables for electronic and sequential controllers.

(8) Example equipment and control panel nameplate data sheet.

(9) Start-up and shutdown procedures.

(10) Sample of the as-built diagrammatic layout drawings in 11" x 17" format which shall define formats, labeling, etc.

(11) List of the final diagrammatic layout drawings and control panel drawings to be produced.

(12) Aggregate power requirements (in VA) of Control components for each system and control panel.

(13) Programming instruction manual for controllers.

(14) Control schematics conforming to Joint Indicating Council (JIC) standards. Complete control schematic and point-to-point internal and external wiring diagrams. Separate control schematics shall be provided for each panel.

(15) Conduit layout drawings in 11" x 17" format showing proposed routing of exposed and concealed conduits. Drawings shall show conduit size, quantity, locations and size of pull and junction boxes and all penetrations. All conduits shall have proper identification as to size and quantity of wire.

(16) Manufacturer's literature, illustrations, specifications, engineering data, and catalog cuts.

(17) Control Valve sizing and schedule which includes:

(a) Valve Size.

(b) CV Value.

(c) Design Flow Rate (gpm).

(d) Location and Unit Served.

(18) All devices submitted shall be cross-referenced and labeled with project designations.

(19) Preliminary and final database and alarm listings.

(20) Proposed Color Graphic displays with description.

(21) Network Configuration.

(22) Software listing with descriptions, model number, revision number and date.

(23) Program logic listings.

(24) System Block Diagram and architectural drawings in 11" x 17" format.

(25) Input/Output point list of all connected points including Adobe PDF and MS Excel files in addition to printer lists.

(26) All graphic displays to be provided are to be submitted full scale in color printer formatted and in PDF file format. For the Engineer and Owner's review format and modification.

(27) Lesson plan for required training.

(28) Submit a list of local projects (three minimum) of similar type and size the bidder has installed, utilizing the products proposed for this project, with Owner's representative's names and telephone numbers for the reference. This list should directly:

(a) Submitted project to include direct integration to third party microprocessor controllers of the type specified within the scope where an integration and interoperation of the Lonworks controls has been successfully achieved between two different manufacturers' controls systems.

(29) Qualifications Data: For firms and persons specified in Article 2.02.

(30) Written Confirmation shall be provided indicating that control systems provided under this Section will be fully compatible and interface properly with all equipment, control components and software and hardware currently residing in the plant.

(31) Written confirmation that a products used on this project are of current manufacturer's and are readily available through multiple distribution channels. New unproven products in "Field Testing" status are not acceptable.

B. Operation and Maintenance Manuals

1. The Contractor shall submit operation and maintenance manuals in accordance with the procedures and requirements set forth in Section 01330 of the General Requirements.

2. Two (2) copies of a preliminary O&M manual shall be included in the shop drawing submittal. Without inclusion of these manuals, the submittal will be considered incomplete and will be returned without review.

3. Operation and maintenance Manuals: Submit complete manuals including:

   a. Copies of all Shop Drawings, test reports, maintenance data and schedules, description of operation and spare parts information.

   b. Maintenance instructions and lists of recommended spare parts for each type of control device.

   c. Control panel and interconnection wiring diagrams in 11" x 17" format with identified and numbered system components and devices.

   d. Revise the existing facility architecture drawing to show the new addition.

   e. All drawings and description of interface with existing systems, including: interconnection drawings, screens, alarms. All O&M information shall be appended to the existing O&M manuals.

   f. Keyboard illustrations and step-by-step procedures indexed for each operator function.

   g. Inspection period, cleaning methods, cleaning materials, and calibration tolerances.

   h. Calibration records and list of set points.

   i. Programming instruction manuals for controllers.

   j. Software and Firmware Operational Documentation : Include the following:

      (1) Software lists with descriptions, model number, revision number and date.

      (2) Engineering and installation manuals.

      (3) Program Software Backup: On a magnetic media or compact disc, complete with data files.

      (4) Device address list.

      (5) Printout of software application and graphic screens.

(6) Licenses, guarantee, and warranty documents for all equipment and systems.

C. Record Drawings

1. Upon completion of the work, provide an electronic set of 'as-built' drawings, job documentation and application software on compact disk. Drawings shall be provided as AutoCAD compatible files. Submittal data such as sequence of operation and cut sheets shall be provided in an Adobe Acrobat format. Five (5) printed copies of the 'as-built' drawings shall be provided in addition to the documents on compact disk. Revise Shop Drawings to reflect actual installation and operating sequences.

D. Tools, Supplies and Spare Parts

1. Furnish all special tools necessary to disassemble service, repair and adjust the equipment.

2. The following spare parts shall be furnished:

a. One (1) of each type of control and timing relay used.

b. One (1) of each type differential pressure switch.

c. One (1) of each type damper operator.

d. One (1) of each type of freeze stat.

e. One (1) of each type smoke detector.

f. One (1) of each type of control device used.

g. One (1) of each valve with operator.

h. One (1) stop-start, switches.

i. Six (6) pilot lights.

j. Six (6) color caps for pilot light assemblies; assorted colors as directed.

k. One (1) of each type of thermostat with enclosures.

l. One (1) spare of each type of humidistat or sensor.

m. One (1) of each type of duct temperature sensor.

n. One (1) of each O.A. temperature sensor.

o. One (1) air flow switch.

p. Two (2) of each type Lon controllers as furnished.

q. One (1) of each type Ethernet switch converter, communication module, network device etc. of each type provided.

r. One (1) of each type auxiliary module and/or circuit board of each type provided.

s. One (1) of each type, size and range instrument provided.

t. One (1) each of all software used to program and monitor all equipment and instruments provided (including licensing).

3. Spare parts lists, included with the shop drawing submittal shall indicate specific sizes, quantities, and part numbers of the items to be furnished. Terms such as "1 lot of packing material" are not acceptable. Parts shall be completely identified with a numerical system to facilitate parts inventory control and stocking. Each part shall be properly identified by a separate number. Those parts which are identical for more than one size shall have the same parts number.

1.04 AGENCY AND CODE APPROVALS

A. All products of the Control System shall be provided with the following agency approvals. Verification that the approvals exist for all submitted products shall be provided with the submittal package. Systems or products not currently offering the following approvals are not acceptable.

1. UL-916; Energy Management Systems

2. ULC; UL - Canadian Standards Association

3. FCC, Part 15, Subpart J, Class A Computing Devices

1.05 SOFTWARE LICENSE AGREEMENT

A. The PVSC shall sign a copy of the manufacturer's standard software and firmware licensing agreement. The PVSC must be listed as the licensed user. The Contractor shall include the costs to transfer licenses to PVSC which includes a three (3) year agreement, upgrades and technical support. Such license shall grant use of all programs and application software to PVSC.

1.06 DELIVERY, STORAGE AND HANDLING

A. Provide factory-shipping cartons for each piece of equipment and control device. Maintain cartons through shipping, storage, and handling as required to prevent equipment damage. Store equipment and materials inside and protected from weather.

1.07 JOB CONDITIONS

A. Cooperation with Other Trades: Coordinate the Work of this section with that of other sections to insure that the Work will be carried out in an orderly fashion. It shall be this Contractor's responsibility to check the Contract Documents for possible conflicts between his work and that of other crafts in equipment location, pipe, duct and conduit runs, electrical outlets and fixtures, air diffusers, and structural and architectural features.

1.08 QUALITY ASSURANCE

A. The Manufacturer of the digital controllers shall provide documentation supporting compliance with ISO-9001 (Model for Quality Assurance in Design/Development, Production, Installation and Servicing). Product literature provided by the digital controller manufacturer shall contain the ISO-9001 Certification Mark from the applicable registrar.

B. The Contractor shall specialize in automatic temperature controls and have a minimum if 10 years documented experience with projects of this type and scope. The Contractor shall also have a minimum of 2 years experience in waste water plant systems and the special requirements of these environments.

1.09 SPECIFICATION NOMENCLATURE

A. Acronyms used in this specification are as follows:

NAC	Network Area Controller
IDC	Interoperable Digital Controller
BUI	Browser User Interface
PCW	Portable Computer Workstation
PMI	Power Measurement Interface
JDE	Java Desk Environment
DDC	Direct Digital Controls
LAN	Local Area Network
WAN	Wide Area Network
WBI	Web Browser Interface
OOT	Object Oriented Technology
PICS	Product Interoperability Compliance Statement
ATC	Automatic Temperature Controls
HVAC	Heating, Ventilation and Air Conditioning
AHU	Air Handling Unit
JIC	Joint Indicating Council
FUI	Full User Interface
XIF	External (Device) Interface File

PART 2 MATERIALS

2.01 GENERAL

A. The Control System shall be comprised of a network of interoperable, stand-alone digital controllers, a computer system, graphical user interface software, network devices, work place pro software, work place tech tool software and other devices as specified herein.

B. The installed system shall provide secure password access to all features, functions and data contained in the Control System.

2.02 ACCEPTABLE MANUFACTURERS

A. Control System

1. Tridium Front End based on Niagara framework utilizing a WEB Browser user interface and Lon Based Digital Controllers (TBS Controls, 201-327-9500) or equal. Substitute Manufacturer's will be required to provide a system demonstration along with the necessary software, etc. to provide a completely integrated system capable of communicating with the PVSC existing DDC Systems.

2.03 OPEN, INTEROPERABLE, INTERGRATED ARCHITECTURES

A. The programming computer software shall employ object-oriented technology (OOT) for representation of all data and control devices within the system. For each Lon Works device that does not have Lon Mark certification, the device supplier must provide an XIF file for the device. All components and controllers supplied under this contract shall be true "peer to peer" communicating devices. Components or controllers requiring "polling" by a host to pass data shall not be acceptable.

B. The supplied system must incorporate the ability to access all the data using Java enabled browsers without requiring proprietary operator interface and configuration programs. An Open Data Base Connectivity (ODBC) or Structured Query Language (SQL) compliant server database is required for all system database parameter storage. This data shall reside on PVSC's existing enterprise server for all database access. Systems requiring propriety database or property user interface programs shall not be acceptable.

C. A hierarchical topology is required to assure reasonable system response time and to manage the flow and sharing of data without unduly burdening the customer's internal Intranet network. Systems employing a "flat" single tiered architecture shall not be acceptable.

1. Maximum acceptable response time from any alarm occurrence (at the point of origin) to the point of annunciation shall not exceed 2 seconds for network connected user interfaces.

2. Maximum acceptable response time from any alarm occurrence (at the point of origin) to the point of annunciation shall not exceed 10 seconds for remote or dial-connected user interfaces.

2.04 NETWORKS

A. The Local Area Network (LAN) shall be either a 10 or 100 Megabits/sec Ethernet network supporting Java, XML, HTTP, and CORBA IIOP for maximum flexibility for integration of building data with enterprise information systems and providing support for multiple Network Area Controllers (NACs), Browser User Interfaces (BUI's)

B. Local area network minimum physical and media access requirements:

1. Ethernet; IEEE standard 802.3

2. Cable; 10 Base-T, UTP-8 wire, category 5

3. Minimum throughput; 10 Mbps, with ability to increase to 100 Mbps

2.05 NETWORK ACCESS

A. Remote Access.

1. For Local Area Network installations, provide access to the Owner's Ethernet Network. The owner shall provide a future connection to the LAN to enable this access.

2.06 NETWORK AREA CONTROLLER (NAC)

A. The Network Area Controller (NAC) shall provide the interface between the LAN or WAN and the field control devices, and provide global supervisory control functions over the control devices connected to the NAC. It shall be capable of executing application control programs to provide:

1. Calendar functions

2. Scheduling

3. Trending

4. Alarm monitoring and routing

5. Time synchronization

6. Integration of LonWorks controller data

7. Network Management functions for all LonWorks based devices.

8. Tunneling capabilities to perform remote programming of LON Controller (IDC).

B. The Network Area Controller must provide the following hardware features as a minimum:

1. One Ethernet Port -10 / 100 Mbps

2. One RS-232 port

3. One LonWorks Interface Port – 78KB FTT-10A

4. Battery Backup

5. Flash memory for long term data backup (If battery backup or flash memory is not supplied, the controller must contain a hard disk with at least 1 gigabyte storage capacity)

6. The NAC must be capable of operation over a temperature range of 0 to 55°C

7. The NAC must be capable of withstanding storage temperatures of between 0 and 70°C

8. The NAC must be capable of operation over a humidity range of 5 to 95% RH, non-condensing

9. ASD Driver capable communicating with existing network 8000 devices

10. BAC Net Driver

C. The NAC shall provide multiple user access to the system and support for ODBC or SQL. A database resident on the NAC shall be an ODBC-compliant database or must provide an ODBC data access mechanism to read and write data stored within it.

D. The NAC shall support standard Web browser access via the Intranet/Internet. It shall support a minimum of 16 simultaneous users.

E. Event Alarm Notification and actions

1. The NAC shall provide alarm recognition, storage; routing, management, and analysis to supplement distributed capabilities of equipment or application specific controllers.

2. The NAC shall be able to route any alarm condition to any defined user location whether connected to a local network or remote via dial-up, telephone connection, or wide-area network.

3. Alarm generation shall be selectable for annunciation type and acknowledgement requirements including but limited to:

   a. To alarm

   b. Return to normal

   c. To fault

4. Provide for the creation of an unlimited number of alarm classes for the purpose of routing types and or classes of alarms, i.e.: HVAC, Fire, smoke, high room temperature, etc.

5. Provide timed (schedule) routing of alarms by class, object, group, or node.

6. Provide alarm generation from binary object "runtime" and /or event counts for equipment maintenance. The user shall be able to reset runtime or event count values with appropriate password control.

F. Control equipment and network failures shall be treated as alarms and annunciated.

G. Alarms shall be annunciated in any of the following manners as defined by the user:

1. Screen message text
2. Email of the complete alarm message to multiple recipients. Provide the ability to route and email alarms based on:
   a. Day of week
   b. Time of day
   c. Recipient
3. Pagers via paging services that initiate a page on receipt of email message
4. Graphic with flashing alarm object(s)
5. Printed message, routed directly to a dedicated alarm printer

H. The following shall be recorded by the NAC for each alarm (at a minimum):

1. Time and date
2. Location (building, floor, zone, office number, etc.)
3. Equipment (air handler #, accessway, etc.)
4. Acknowledge time, date, and user who issued acknowledgement.
5. Number of occurrences since last acknowledgement.

I. Alarm actions may be initiated by user defined programmable objects created for that purpose.

J. Defined users shall be given proper access to acknowledge any alarm, or specific types or classes of alarms defined by the user.

K. A log of all alarms shall be maintained by the NAC and/or a server (if configured in the system) and shall be available for review by the user.

L. Provide a "query" feature to allow review of specific alarms by user-defined parameters.

M. A separate log for system alerts (controller failures, network failures, etc.) shall be provided and available for review by the user.

N. An Error Log to record invalid property changes or commands shall be provided and available for review by the user.

2.07 DATA COLLECTION AND STORAGE

A. The NAC shall have the ability to collect data for any property of any object and store this data for future use.

B. The data collection shall be performed by log objects, resident in the NAC that shall have, at a minimum, the following configurable properties:

1. Designating the log as interval or deviation.

2. For interval logs, the object shall be configured for time of day, day of week and the sample collection interval.

3. For deviation logs, the object shall be configured for the deviation of a variable to a fixed value. This value, when reached, will initiate logging of the object.

4. For all logs, provide the ability to set the maximum number of data stores for the log and to set whether the log will stop collecting when full, or rollover the data on a first-in, first-out basis.

5. Each log shall have the ability to have its data cleared on a time-based event or by a user-defined event or action.

C. All log data shall be stored in a relational database in the NAC and the data shall be accessed from a server (if the system is so configured) or a standard Web Browser.

D. All log data, when accessed from a server, shall be capable of being manipulated using standard SQL statements.

E. All log data shall be available to the user in the following data formats:

1. HTML

2. XML

3. Plain Text

4. Comma or tab separated values

F. Systems that do not provide log data in HTML and XML formats at a minimum shall not be acceptable.

G. The NAC shall have the ability to archive its log data either locally (to itself), or remotely to a server or other NAC on the network. Provide the ability to configure the following archiving properties, at a minimum:

1. Archive on time of day

2. Archive on user-defined number of data stores in the log (buffer size)

3. Archive when log has reached it's user-defined capacity of data stores

4. Provide ability to clear logs once archived

2.08 AUDIT LOG

A. Provide and maintain an Audit Log that tracks all activities performed on the NAC. Provide the ability to specify a buffer size for the log and the ability to archive log based on time or when the log has reached its user-defined buffer size. Provide the ability to archive the log locally (to the NAC), to another NAC on the network, or to a server. For each log entry, provide the following data:

1. Time and date

2. User ID

3. Change or activity: i.e., Change setpoint, add or delete objects, commands, etc.

2.09 DATABASE BACKUP AND STORAGE

A. The NAC shall have the ability to automatically backup its database. The database shall be backed up based on a user-defined time interval.

B. Copies of the current database and, at the most recently saved database shall be stored in the NAC. The age of the most recently saved database is dependent on the user-defined database save interval.

C. The NAC database shall be stored, at a minimum, in XML format to allow for user viewing and editing, if desired. Other formats are acceptable as well, as long as XML format is supported.

2.10 INTEROPERABLE DIGITAL CONTROLLER (IDC)

A. Controls shall be microprocessor based Interoperable LonMark or LonWorks Controllers (IDC). Where possible, all Interoperable Digital Controllers shall bear the applicable LonMark interoperability logo on each product delivered.

B. HVAC control shall be accomplished using LonMark based devices where the application has a LonMark profile defined. Where LonMark devices are not available for a particular application, devices based on LonWorks shall be acceptable. For each LonWorks device that does not have LonMark certification, the device supplier must provide an XIF file for the device. Publicly available specifications for the Applications Programming Interface (API) must be provided for each LonWorks / LonMark controller defining the programming or setup of each device. All programming, documentation and programming tools necessary to set up and configure the supplied devices per the specified sequences of operation shall be provided.

C. The LonWorks network trunk shall be run to the nearest Network Area Controller (NAC). A maximum of 126 devices may occupy any one LonWorks trunk and must be installed in buss architecture using the appropriate trunk termination device. All LonWorks and

LonMark devices must be supplied using FTT-10A LonWorks communications transceivers.

D. The Network Area Controller will provide all scheduling, alarming, trending, and network management for the LonMark / LonWorks based devices.

E. The IDCs shall communicate with the NAC at a baud rate of not less than 78.8K baud. The IDC shall provide LED indication of communication and controller performance to the technician, without cover removal.

F. All IDCs shall be fully application programmable and shall at all times maintain their LONMARK certification. Controllers offering application selection only (non-programmable), require a 10% spare point capacity to be provided for all applications. All control sequences within or programmed into the IDC shall be stored in non-volatile memory, which is not dependent upon the presence of a battery, to be retained.

G. The supplier of any programmable IDC shall provide one (1) copy of the manufacturer's programming tool, software with documentation, to the PVSC.

2.11 SOFTWARE

A. Development Software

1. The Contractor shall furnish, install, configure, program, customize and test software required herein or necessary to provide a system that is fully operational and meets the requirements of the Contract documents.

2. It shall be the responsibility of the Contractor to furnish the correct number of software packages complete with all documentation and licensing. Only fully licensed, original copies of software shall be provided. Once the installation is complete, the Contractor shall transfer registered ownership to the PVSC and turn over all software, disks, keys, documentation, license and warranty agreements. The PVSC shall receive all system upgrades and revisions offered by the software vendor including installation, reconfiguration, modifications, etc., at no additional cost, for a period of 2 years from date of final acceptance of the entire DDC system.

3. The Contractor shall furnish, install, configure, develop, customize, test and place in satisfactory operating condition, the JDE Program (Work Place Pro), Pro Block (Windows Base XPI) and Workplace Tech Tool software system. The system shall have an unlimited tag database capability. The system shall include all drivers, modules, etc, required for a complete installation. All necessary or manufacturer recommended add-on modules or programs shall be provided.

4. The Contractor shall, using the JDE Program (Work Place pro) software, build customized graphic displays, reports, trend graphics, alarm tables and historical records to allow the operator to display, control and print all information available from all HVAC system equipment prior to approval, all graphic displays shall be submitted for review. Graphic displays shall be highly detailed that matches title, functionality and appearance of the graphics already in use at the PVSC. The graphic displays shall show all available information for each piece of equipment as listed in

the sequence of operation and detailed on the Contract Drawings. Equipment status and control shall be shown graphically using color, flashing, animation, etc. and through text messages. A general plant and system overview graphic, along with floor plan navigation, shall be developed that will allow the operator to view and select individual items and displays for more detailed viewing and control. Each subsystem and piece of equipment shall have an individual graphic developed for it. Where space and clarity do not permit, a system may be broken up into multiple screens.

B. Browser User Interface Software

1. The system shall be capable of supporting an unlimited number of clients using a standard Web browser such as Internet Explorer or Netscape Navigator. Systems requiring additional software (to enable a standard Web browser) to be resident on the client machine, or manufacture-specific browsers shall not be acceptable.

2. The Web browser software shall run on any operating system and system configuration that is supported by the Web browser. Systems that require specific machine requirements in terms of processor speed, memory, etc., in order to allow the Web browser to function with the Control System, shall not be acceptable.

3. The Web browser shall provide the same view of the system, in terms of graphics, schedules, calendars, logs, etc., and provide the same interface methodology as is provided by the Full User Interface (FUI). Systems that require different views or that require different means of interacting with objects such as schedules, or logs, shall not be permitted.

4. The Web browser client shall support at a minimum, the following functions:

   a. User log-on identification and password shall be required. If an unauthorized user attempts access, a blank web page shall be displayed. Security using Java authentication and encryption techniques to prevent unauthorized access shall be implemented.

   b. Graphical screens developed for the FUI shall be the same screens used for the Web browser client. Any animated graphical objects supported by the FUI shall be supported by the Web browser interface.

   c. HTML programming shall not be required to display system graphics or data on a Web page. HTML editing of the Web page shall be allowed if the user desires a specific look or format.

   d. Storage of the graphical screens shall be in the Network Area Controller (NAC), without requiring any graphics to be stored on the client machine. Systems that require graphics storage on each client are not acceptable.

   e. Real-time values displayed on a Web page shall update automatically without requiring a manual "refresh" of the Web page.

f. Users shall have administrator-defined access privileges. Depending on the access privileges assigned, the user shall be able to perform the following:

(1) Modify common application objects, such as schedules, calendars, and set points in a graphical manner.

(a) Schedule times will be adjusted using a graphical slider, without requiring any keyboard entry from the operator.

(b) Holidays shall be set by using a graphical calendar, without requiring any keyboard entry from the operator.

(2) Commands to start and stop binary objects shall be done by right-clicking the selected object and selecting the appropriate command from the pop-up menu. No entry of text shall be required.

(a) View logs and charts

(b) View and acknowledge alarms

5. The system shall provide the capability to specify a user's (as determined by the log-on user identification) home page. Provide the ability to limit a specific user to just their defined home page. From the home page, links to other views, or pages in the system shall be possible, if allowed by the system administrator.

6. Graphic screens on the Web Browser client shall support hypertext links to other locations on the Internet or on Intranet sites, by specifying the Uniform Resource Locator (URL) for the desired link.

2.12 SYSTEM PROGRAMMING

A. The Graphical User Interface Software (GUI) shall provide the ability to perform system programming control and graphic display engineering as part of a complete software package. Access to the programming functions and features of the GUI shall be through password access as assigned by the system.

B. A library of control, application, and graphic objects shall be provided to enable the creation of all applications and user interface screens. Applications are to be created by selecting the desired control objects from the library, dragging or pasting them on the screen, and linking them together using a built in graphical connection tool. Completed applications may be stored in the library for future use. Graphical User Interface screens shall be created in the same fashion. Data for the user displays is obtained by graphically linking the user display objects to the application objects to provide "real-time" data updates. Any real-time data value or object property may be connected to display its current value on a user display. Systems requiring separate software tools or processes to create applications and user interface display shall not be acceptable.

C. Programming Methods

1. Provide the capability to copy objects from the supplied libraries, or from a user-defined library to the user's application. Objects shall be linked by a graphical linking scheme by dragging a link from one object to another. Object links will support one-to-one, many-to-one, or one-to-many relationships. Linked objects shall maintain their connections to other objects regardless of where they are positioned on the page and shall show link identification for links to objects on other pages for easy identification. Links will vary in color depending on the type of link; i.e., internal, external, hardware, etc.

2. Configuration of each object will be done through the object's property sheet using fill-in the blank fields, list boxes, and selection buttons. Use of custom programming, scripting language, or a manufacturer-specific procedural language for configuration will not be accepted.

3. The software shall provide the ability to view the logic in a monitor mode. When on-line, the monitor mode shall provide the ability to view the logic in real time for easy diagnosis of the logic execution. When off-line (debug), the monitor mode shall allow the user to set values to inputs and monitor the logic for diagnosing execution before it is applied to the system.

4. All programming shall be done in real-time. Systems requiring the uploading, editing, and downloading of database objects shall not be allowed.

5. The system shall support object duplication within a customer's database. An application, once configured, can be copied and pasted for easy re-use and duplication. All links, other than to the hardware, shall be maintained during duplication.

2.13 OBJECT LIBRARIES

A. A standard library of objects shall be included for development and setup of application logic, user interface displays, system services, and communication networks.

B. The objects in this library shall be capable of being copied and pasted into the user's database and shall be organized according to their function. In addition, the user shall have the capability to group objects created in their application and store the new instances of these objects in a user-defined library.

C. In addition to the standard libraries specified here, the supplier of the system shall maintain an on-line accessible (over the Internet) library, available to all registered users to provide new or updated objects and applications as they are developed.

D. All control objects shall conform to the control objects specified in the BACnet specification.

E. The library shall include applications or objects for the following functions in the BACnet Specifications:

1. Scheduling Object: The calendar must conform to the schedule object as defined in the BACnet specification, providing 7-day plus holiday & temporary scheduling

features and a minimum of 10 on/off events per day. Data entry to be by graphical sliders to speed creation and selection of on-off events.

2. Calendar Object. The calendar must conform to the calendar object as defined in the BACnet specification, providing 12-month calendar features to allow for holiday or special event data entry. Data entry to be by graphical "point-and-click" selection. This object must be "linkable" to any or all scheduling objects for effective event control.

3. Duty Cycling Object. Provide a universal duty cycle object to allow repetitive on/off time control of equipment as an energy conserving measure. Any number of these objects may be created to control equipment at varying intervals.

4. Temperature Override Object. Provide a temperature override object that is capable of overriding equipment turned off by other energy saving programs (scheduling, duty cycling etc.) to maintain occupant comfort or for equipment freeze protection.

5. Start-Stop Time Optimization Object. Provide a start-stop time optimization object to provide the capability of starting equipment just early enough to bring space conditions to desired conditions by the scheduled occupancy time. Also, allow equipment to be stopped before the scheduled un-occupancy time just far enough ahead to take advantage of the building's "flywheel" effect for energy savings. Provide automatic tuning of all start / stop time object properties based on the previous day's performance.

F. The library shall include control objects for the following functions. All control objects shall conform to the objects as specified in the BACnet specification.

1. Analog Output Object - Minimum requirement is to comply with the BACnet standard for data sharing.

2. Binary Input Object - Minimum requirement is to comply with the BACnet standard for data sharing. The user must be able to specify either input condition for alarming. This object must also include the capability to record equipment run-time by counting the amount of time the hardware input is in an "on" condition. The user must be able to specify either input condition as the "on" condition.

3. Binary Output Object - Minimum requirement is to comply with the BACnet standard for data sharing. Properties to enable minimum on and off times for equipment protection as well as interstart delay must be provided. The BACnet Command Prioritization priority scheme shall be incorporated to allow multiple control applications to execute commands on this object with the highest priority command being invoked. Provide sixteen levels of priority as a minimum. Systems not employing the BACnet method of contention resolution shall not be acceptable.

4. PID Control Loop Object - Minimum requirement is to comply with the BACnet standard for data sharing. Each individual property must be adjustable as well as to be disabled to allow proportional control only, or proportional with integral control, as well as proportional, integral and derivative control.

5. Comparison Object - Allow a minimum of two analog objects to be compared to select either the highest, lowest, or equality between the two linked inputs. Also, allow limits to be applied to the output value for alarm generation.

6. Math Object - Allow a minimum of four analog objects to be tested for the minimum or maximum, or the sum, difference, or average of linked objects. Also, allow limits to be applied to the output value for alarm generation.

7. Custom Programming Objects - Provide a blank object template for the creation of new custom objects to meet specific user application requirements. This object must provide a simple BASIC-like programming language that is used to define object behavior. Provide a library of functions including math and logic functions, string manipulation, and e-mail as a minimum. Also, provide a comprehensive on-line debug tool to allow complete testing of the new object. Allow new objects to be stored in the library for re-use.

8. Interlock Object - Provide an interlock object that provides a means of coordination of objects within a piece of equipment such as an Air Handler or other similar types of equipment. An example is to link the return fan to the supply fan such that when the supply fan is started, the return fan object is also started automatically without the user having to issue separate commands or to link each object to a schedule object. In addition, the control loops, damper objects, and alarm monitoring (such as return air, supply air, and mixed air temperature objects) will be inhibited from alarming during a user-defined period after startup to allow for stabilization. When the air handler is stopped, the interlocked return fan is also stopped, the outside air damper is closed, and other related objects within the air handler unit are inhibited from alarming thereby eliminating nuisance alarms during the off period.

9. Temperature Override Object - Provide an object whose purpose is to provide the capability of overriding a binary output to an "On" state in the event a user specified high or low limit value is exceeded. This object is to be linked to the desired binary output object as well as to an analog object for temperature monitoring, to cause the override to be enabled. This object will execute a Start command at the Temperature Override level of start/stop command priority unless changed by the user.

10. Composite Object - Provide a container object that allows a collection of objects representing an application to be encapsulated to protect the application from tampering, or to more easily represent large applications. This object must have the ability to allow the user to select the appropriate parameters of the "contained" application that are represented on the graphical shell of this container.

G. The object library shall include objects to support the integration of devices connected to the Network Area Controller (NAC). At a minimum, provide the following as part of the standard library included with the programming software:

1. LonMark/LonWorks devices. These devices shall include, but not be limited to, devices for control of HVAC. Provide LonMark manufacturer-specific objects to facilitate simple integration of these devices. All network variables defined in the LonMark profile shall be supported. Information (type and function) regarding

network variables not defined in the LonMark profile shall be provided by the device manufacturer.

2. For devices not conforming to the LonMark standard, provide a dynamic object that can be assigned to the device based on network variable information provided by the device manufacturer. Device manufacturer shall provide an XIF file and documentation for the device to facilitate device integration.

3. For BACnet devices, provide the following objects at a minimum:

   a. BACnet AI

   b. BACnet AO

   c. BACnet BI

   d. BACnet BO

      (1) BACnet Device

4. For each BACnet object, provide the ability to assign the object to a BACnet device and object's instance number.

5. For each ASD object, provide the ability to assign the object to a ASD Device & Objects instance number.

2.14 LONWORKS NETWORK MANAGEMENT

A. The software shall provide a complete set of integrated LonWorks network management tools for working with LonWorks networks. These tools shall manage a database for all LonWorks devices by type and revision, and shall provide a software mechanism for identifying each device on the network. These tools shall also be capable of defining network data connections between LonWorks devices, known as "binding". Systems requiring the use of third party LonWorks network management tools shall not be accepted.

B. Network management shall include the following services: device identification, device installation, device configuration, device diagnostics, device maintenance and network variable binding.

C. The Network configuration tool shall also provide diagnostics to identify devices on the network, to reset devices, and to view health and status counters within devices.

D. These tools shall provide the ability to "learn" an existing LonWorks network, regardless of what network management tool(s) were used to install the existing network, so that existing LonWorks devices and newly added devices are part of a single network management database.

E. The network management database shall be resident in the Network Area Controller (NAC), ensuring that anyone with proper authorization has access to the network

management database at all times. Systems employing network management databases that are not resident, at all times, and within the control system shall not be accepted.

2.15 HVAC PANEL CONSTRUCTION

A. General HVAC Panel Construction Requirements:

1. For the purpose of this Section, the term control panels shall include all enclosures housing any of the following: control equipment or devices, instruments, sensors, computer hardware, networking hardware, relays, controllers, patch bays, terminal strips, etc. All control panels shall be NEMA 4X Type 316 stainless steel Construction. Control panels shall be assembled, wired, and tested in the Contractor's own or other Engineer approved facilities. All components and all necessary accessories such as power supplies, conditioning, equipment, mounting hardware, input and output signal terminal blocks, plug strips, relays, lighting, circuit breakers and fuses, which may be required to complete the system shall be provided.

2. Control panels shall be formed or welded construction, reinforced with Unistrut, Powerstrut, or equal to facilitate mounting of internal components or equipment. Sufficient access plates and doors shall be provided to facilitate maintenance and testing of the supplier's equipment. Doors shall be removable. All floor standing units shall be provided with jackscrews for leveling. All doors shall be fitted with common-keyed locks. All interior wiring shall be color coded and tagged with machine printed plastic sleeves using wire and cable numbers matching those on the approved shop drawings.

3. Control panels shall be 14 USS gauge for units with dimension of 24 inches or less, 12USS gauge for units with any dimension greater than 24 inches and less than 36 inches. Panels with any dimension of 36 inches or more shall be 10 USS gauge.

4. Control panels shall be fabricated from steel plate and shall be free of surface flaws. The surface shall have a brushed finish and be free from defects and blemishes. The panel face shall be true and level and all panel edges including instrument cut-outs shall be ground smooth. Continuously weld all exterior seams and grind smooth.

5. Steel members shall be provided in the back of the panel where necessary for rigidity and support of wiring, accessories, etc. Stiffeners shall be welded to the back face of the panel where required and shall not interfere with instrument installations. Sufficient stiffeners and/or supports shall be provided so that the panel face does not distort due to the weight of the instruments.

6. All equipment and devices shall be identified with engraved nameplates both inside and out. The equipment shall be mounted such that service can occur without removal of other equipment. Face mounted equipment shall be flush or semiflush mounted with flat escutcheons. All equipment shall be accessible such that adjustments and services can be performed while the equipment is in service and operating.

7. The contract drawings show preferred face of panel layout. The Contractor shall be responsible for detailed design of all control panels.

8. All control panels shall have a single power supply entry point. Control devices shall be mounted in functional groups in accordance with good panel design practice so as to so as to present a neat and functional appearance and so as to be readily accessible for adjustment and service. The panel arrangement shall be approved by the Engineer. All alarm contacts shall be normally closed, open to alarm.

9. The panel door shall be hinged swing type. Door swing shall be horizontal and have a minimum of 165 degrees unobstructed swing. Continuous hinges (piano type) welded in place shall be used. Sub-plates and sub-panels shall be provided for mounting of all internal equipment and shall be USS gauge #10 minimum and painted gloss white epoxy. Provide oil resistant gasket completely around each door opening.

10. All equipment shall be neatly laid out, leveled and securely fastened in place. Clearances, in addition to those required by the manufacturer, shall be provided around all equipment to enhance cooling, ease maintenance and provide adequate wiring space.

11. Cut-outs shall be made, without distorting the face of the control panel, to the dimensions and tolerances specified on the instrument manufacturer's certified drawings.

12. Panel cut-outs shall be smooth, straight and level, leaving no evidence of sharp or rough edges; flame cutting shall not be used. Cut-out edges shall be ground smooth and free from burrs. Both the front and back surfaces of the panel face near the cut-outs shall be level to permit proper instrument installation.

13. Panels shall be furnished with red laminated plastic warning signs. The sign shall sign shall be inscribed "WARNING – THIS PANEL IS CONNECTED TO MULTIPLE SOURCES OF POWER". Letters shall be 1-inch high, white.

14. Control panels shall be completely factory assembled and wired, including cabinet, components, wiring, terminal strips to facilitate final connections and with nameplates. Contractor shall submit panel drawings, schematics and complete wiring diagrams to the Engineer for approval prior to fabrication. Panel drawings shall indicate conduit entry points all dimensions, internal and external layout, terminal strip layout, power requirements, etc.

15. All control logic/devices as well as all network components, shall be installed within the control panels, including all necessary interfacing devices for control of remote components. It shall be the responsibility of Contractor to fully coordinate each system requirements, including items furnished under Division 26, Electrical, to provide the proper sequence of operation and interconnection of all components as required.

16. Provide within the panel all auxiliaries including switches, controller, lights, timers, transmitters, as required for controls.

17. All indicators and control devices are to be flush mounted on door or face of cabinet and labeled with permanent nameplates.

18. Provide all electrical components and devices, support hardware, fasteners, interconnecting wiring required to make the control panels complete and operational.

19. Locate and install all devices and components so that connections can be easily made and that there is ample room for servicing each item.

20. Components for installation on panel exterior shall be located for easy operation.

21. Panels shall have full height front hinged access doors.

22. Adequately support and restrain all devices and components mounted on or within the panel to prevent any movement.

23. Provide sub-panels for installation of all relays and other internally mounted components.

24. All wiring to panel connections from field instruments, devices and other panels shall be terminated at master numbered terminal strips, unless otherwise specified.

25. Provide copper grounding studs for all panel equipment.

26. Provide additional modular panels as required.

27. Provide a folding door shelf for placement of portable computer during troubleshooting.

B. Identification: Identify control panels in accordance with the requirements of Section 15806 and as specified herein.

1. Provide laminated plastic nameplates for identification of panels and components mounted both inside and out.

2. Nameplates shall be of 3/32-inch thick laminated phenolic type with white matte finish surface and black letter engraving.

3. Panel identification nameplates to have ½ inch high letter engravings.

4. Panel mounted component identification (e.g., control devices, indicating lights, selector switches, etc.) nameplates to have 1/4 –inch high letter engravings.

5. Nameplates shall be attached to the panel face with two stainless steel self-tapping screws.

6. Nameplates engravings shall include the instrument or equipment tag number and descriptive title as shown and specified.

7. Tag all electrical components and devices mounted within control panels and enclosures with engraved nameplates.

8. Numerically code terminals on terminal strips.

9. Color code and numerically code wiring as required by applicable standards. Wires shall be identified at each end with permanent number codes. Computer printed sleeve type wire markers shall be used.

C. Electrical Systems:

1. All electrical controls located within the panel shall have electrical characteristics of 120 volts, 1 phase, 60 hertz. Provide transformers with fused output in the control panel as required. Power supply to each panel shall be 120 volt, single phase, 60 Hz for panel operating controls provide panel power disconnect.

2. Internal wiring shall be Type MTW standard copper wire with thermoplastic insulation rated for 600 V at 85 C for single conductors, color coded and labeled with wire identification.

3. Separate and shield low voltage signal wiring from power and control wiring by a minimum of 6-inches.

4. Group or bundle parallel runs of wire using covered troughs. Maximum bundle size to be 1-inch. Troughs shall have 60 percent spare capacity.

5. Install wire troughs along horizontal or vertical routes to present a neat appearance. Angled runs are not acceptable.

6. Adequately support and restrain all wiring runs to prevent sagging or other movement.

7. Terminate all field wiring using forked, insulated, crimp-on connectors (soldered type not acceptable) at 600 V rated barrier type terminal strips with screwed connections and permanently affixed numeric identifiers beside each connection. Identifiers to be self stick plastic tape strips with permanent type, machine printed numbers.

8. All wiring shall be installed such that if wires are removed from any one device, power will not be disrupted to any other advice.

9. For internal component to component wiring only, compression type terminal block are acceptable.

10. Provide spare terminals equal in number to 25 percent of the terminals used for each type of wiring.

11. Provide a separate terminal for grounding each shielded cable.

12. Use separate 5/16-inch diameter copper grounding studs for instrument signal cable shields and a-c power.

13. Where wires pass through panel walls, provide suitable bushings to prevent cutting or abrading of insulation.

14. When low voltage ac or dc power is required, provide and install the necessary power supplies and transformers with appropriate fusing in the panel.

15. Pushbuttons, selector switches and indicating lights are to be heavy duty, oil tight type as specified in Section 2.16 of this specification.

16. Provide complete wiring diagram showing "as built" circuitry. Diagram shall be enclosed in transparent plastic and placed in easily accessible pocket built into panel door.

17. Wires shall be color coded as follows:

Neutral	-	White
Ground	-	Green
Power	-	Red
Signal	-	Black (-) and White (+)
Control	-	Violet
Special	-	Blue

18. Relays

Relays shall be plug in type tubular or spade terminal and shall be provided with sockets. They shall be Potter-Brumfield type KU or KR, Square D type KP or KA or equal. All relays shall incorporate push-to-test feature and energized pilot lights. Where controlling motor or resistive loads relays shall be horsepower rated.

19. Time Delay Relays

Time delay relays shall be one of the timing range, contact arrangement, voltage and accurate required. In general, the following type should be used: Allen Bradley, Bulletin 849, type AX or BX; or equal.

D. Testing and Adjustments

1. Perform system testing and make any adjustments necessary. Each circuit and function shall be tested for proper connection, continuity and proper operation. Each I/O point shall be tested for availability throughout the system up to the Plant wide network level. All alarms shall be tested for display, logging and printing both locally and on the plant wide system.

2. Perform power supply, voltage adjustments to tolerances required by the appurtenant equipment.

E. Interface with Motor Starters and Plant Control System

1. Coordinate and show interface with motor starters and control schematic diagrams on the Drawings.

2.16 OTHER CONTROL SYSTEM HARDWARE

A. General

1. Provide all sensor power supplies and control devices required to provide the sequence of the operations described under Part 4 – Sequence of Operation, constructed and rated for the location in which they are installed.

    a. Each field device, (sensor, actuator, transmitter, thermostat, etc,) shall have attached or mounted immediately adjacent to a laminated plastic engraved nameplate indicating tag number, function and equipment served.

B. Electric Actuators – Two Position Dampers

1. Two (2) position direct coupled (over the shaft) electric actuators sized to provide a minimum of 50% spare available continuous torque above and beyond that actually required to operate the driver equipment. Provide multiple damper actuators, if required to meet the torque rotating as listed above. Actuators shall include the following:

    a. Coupling V-Bolt and V-Shaped, toothed cradle

    b. Overload protection: Electronic overload or digital rotation – Sensing circuitry

    c. Fail – safe operation: Mechanical spring return to close

    d. Reversible rotation by changing mounting orientation

    e. Power requirements: 24 VAC or as per manufacturer's recommendation

    f. End switches as required by the sequence of operation to delay starting of fan until dampers are open

    g. Accessories: angle or rotation limiter, position indicator, damper linkage kit, mounting bracket and adjustable auxiliary position switches

2. Actuators shall be manufactured by Belimo, or approved equal.

C. Control valves shall be 2-way or 3-way pattern as shown for tight shut off and shall operate satisfactorily against system pressure and differentials. Two-position valves shall be 'line size'. Proportional control valves shall be sized for a maximum pressure drop of 5.0 psi at rated flow and/or minimum torque based on manufacturer's calculations, required for flow control and rated valve close off. Valves with sizes up to and including 2 inches shall be "screwed" configuration and 2-1/2 inch and larger valves shall be "flanged" configuration. All control valves shall be electrically controlled and include spring return type actuators sized for tight shut off against system pressures and furnished with integral switches for indication of valve position (open closed).

D. Wall Mount Thermostats: Each room thermostat shall provide temperature indication to the digital controller, provide the capability for a software limited set point adjustment and

operation override capability. An integral LCD shall display current room temperature and set points as well as override status indication. In addition, the thermostat shall include a port for connection of the portable operator's terminal described elsewhere in this specification.

E. Freezestats shall be complete with SPDT snap acting switch, automatic reset, 1/8" OD X 20' long capillary mounting clips. The freezestat shall have a range between 30°F and 60°F. Freezestat shall respond to lowest temperature sensed by any one foot portion of capillary. Where required for adequate protection, multiple freezestats shall be supplied and installed. The freezestats shall be located downstream of each heating coil.

F. Sensors

1. Electronic Temperature Sensors: Vibration and corrosion resistant; for wall, immersion or duct mounting as required.

   a. Resistant Temperature Detector: Platinum, thermistor, or balco

      (1) Accuracy: Plus or minus 0.2 percent at calibration point; thermistors shall have a maximum 5 year drift of no more than .225°F maximum error of no more than .36°F.

      (2) Wire: Twisted, shielded-pair cable.

      (3) Insertion Elements in Ducts: Single point, minimum 6 inches long; use where not affected by temperature stratification or where ducts are smaller than 9.4 sq. ft.

      (4) Averaging Elements in Ducts: 60 inches long, flexible for use where prone to temperature stratification or where ducts are larger than 4 sq. ft. length as required.

      (5) Insertion Elements for Liquids: Brass socket with minimum insertion length of 2-1/2 inches.

      (6) Outside-Air Sensors: Watertight inlet fitting, shielded from direct sunlight.

   b. Humidity Sensors: Bulk polymer sensor element.

      (1) Accuracy: 5 percent full range with linear output.

      (2) Room Sensors: Range of 0 to 100 percent relative humidity.

      (3) Duct and outside-Air Sensors: With element guard and mounting plate, range of 0 to 100 percent relative humidity.

2. Equipment Operation Sensors as follows:

a. Status inputs for filters: Differential pressure switch with adjustable range of 0 to 5 inches wg.

b. Status inputs for Electric Motors (current Sensors): Provide a loop powered Analog current sensors for each 480v Motor. Current sensors shall have an output of 4ma to 20 ma and an adjustable span of 5 amp to 55 amp input at 600 Vac.

c. Status input for Air Flow: Static Pressure Transmitter: Nondirectional sensor with suitable range for expected input, and temperature compensated.

(1) Accuracy: 2 percent of full scale with repeatability of 0.5 percent.

(2) Output: 4 to 20 mA.

(3) Building Static-Pressure Range: -0.25 to 0.25 inch wg.

(4) Duct Static-Pressure Range: 0 to 5 inch wg.

d. Pressure Transmitter: Direct acting for liquid, or steam service; range suitable for system; proportional output 4 to 20 mA.

e. Flow Transducer/ Transmitter: Differential pressure transducers with a square root extractor, scaling multiplier and output filter in a single package to output volume (cfm).

(1) Accuracy: 1 percent full scale with repeatability of 0.1 percent.

(2) Output: 4 to 20 mA. Supply Power: 12 – 36 VDC.

(3) Process Input: Pneumatic ¼" barb.

f. Differential Pressure Transmitter: Differential pressure transducers with a scaling multiplier and output filter, and an independent front panel mounted magnehelic pressure gauge.

(1) Accuracy: 1 percent full scale with repeatability of 0.1 percent.

(2) Output: 4 to 20 mA. Supply Power: 18 – 28 VDC/AC

(3) Process Input: Pneumatic ¼" barb.

G. Smoke Detectors

1. Duct Mounted:

a. Ionization type for 120 or 24 Vac operation

b. Cross Sectional sampling tube

c. Housing listed in accordance with UL268A.

d. Contacts: Minimum two (2) form "C" contacts as required to meet sequence of operation for indication and shutdown.

e. Accessories.

(1) Remote test and capability from external dry contacts.

(2) Mounting kits.

2. Smoke detectors shall be located as shown on the HVAC control schematics.

3. All smoke detectors shall be accessible. Provide access doors at all units and where required. Smoke detectors shall be located and mounted as shown and in accordance with the manufacturers recommend installation procedures.

4. Smoke detector installation shall conform to NFPA 90A and 72 requirements.

5. All smoke detectors shall be hardwired by the Contractor to equipment starter for shutdown.

H. Selector Switches:

1. Rugged, oil tight,, snap fit N.O. and N.C contacts, self cleaning, durable nylon operator base, lever style complete with extra large nameplates and electrically rated for service intended.

I. Pilot Lights:

1. Pilot lights shall be replaceable led lights rugged, oil tight construction, complete with extra large nameplate for panel mounting rated for 24 VAC.

PART 3 EXECUTION

3.01 INSTALLATION

A. All work described in this section shall be installed, wired, circuit tested and calibrated by factory technicians qualified for this work. The Contractor shall be responsible for the proper operation and installation of all control systems herein specified. Contractor shall be responsible for coordination of all interfaces with other equipment to achieve the required control operation.

B. Install system and materials in accordance with manufacturer's instructions, and as detailed on the project drawing set.

C. Drawings of temperature control systems are diagrammatic only and any apparatus not shown, such as relays, accessories, etc., but required to make the system operative in accordance with the sequence of operation to the satisfaction of the Engineer and contract drawings shall be furnished and installed without additional cost.

D. Line and low voltage electrical connections to control equipment shown specified or shown on the control diagrams shall be furnished and installed by the Temperature Control contractor in accordance with these specifications.

E. All control devices mounted on the face of control panels shall be clearly identified as to function and system served with permanently engraved phenolic labels.

3.02 WIRING AND DEVICES

A. Items furnished under this Section:

1. Power and Control Wiring and Conduit: Furnish and install electrical conduit and wiring systems as required to provide all necessary connections for the system equipment. The conduit and wiring to be provided under this section shall include all wiring, conduit, junction boxes, supports, etc. to each ATC panel and any other HVAC equipment and panels, to associated air handling units, dampers, operators, sensors, temperature controllers, thermostats, HVAC smoke detectors, current switches, field mounted switches, etc. Conduit layouts for these wiring requirements are not shown on the drawings; the Contractor shall determine the requirements based upon the arrangement of the components being furnished. All electrical work shall be furnished and installed in accordance with the requirements of Division 26, drawings and specifications. All conduits shall be PVC coated rigid galvanized type. All penetrations shall be sealed in accordance with the contract documents.

2. Damper Operators – Furnished by the Equipment manufacturer and installed by the Contractor.

3. Smoke Detectors – Conduit and wiring to equipment starters. Include additional Contactors as required for Hardwiring to unit starters.

4. All ancillary items and services indicated or necessary for complete installation of the DDC based automatic temperature control system.

B. Items Furnished Under Other Sections:

1. 480 volt, 3 phase power wiring and conduit under Division 26, Electrical.

2. 120 volt, single phase power wiring and conduit under Division 26, Electrical except devices under control of ATC panels.

3. Starters under Division 26, Electrical (except where specified to be furnished by the equipment manufacturer).

4. Disconnects under Division 26, Electrical (except where specified to be furnished by the equipment manufacturer).

3.03 SERVICES OF MANUFACTURER'S REPRESENTATIVE

A. The Contractor shall provide the services of a qualified manufacturer's technical representative who shall adequately supervise the installation and testing of all equipment

furnished under this Contract. The services of the manufacturer's representative shall be provided for a period of not less than seven (7) days as follows:

1. At least one (1) day during installation of the equipment.

2. At least two (2) days during initial startup and testing of all systems, components and equipment.

3. At least two (2) days during final testing, tuning and commissioning of the control systems in the presence of the Engineer.

4. At least two (2) days while placing the system in fully automatic operation.

Any additional time required to achieve successful installation and operation shall be at the expense of the Contractor. The Manufacturer's representative shall sign in and out at the office of the Engineer on each day he is on the project.

3.04 WARRANTY

A. Equipment, materials and workmanship incorporated into the work shall be warranted for a period of one (1) year in accordance with Division 1 and as specified herein.

B. Within this period, upon notice by the PVSC, any defects in the Controls System due to faulty materials, methods of installation or workmanship shall be promptly (within 48 hours after receipt of notice) repaired or replaced by the Contractor at no expense to the PVSC.

3.05 WARRANTY ACCESS

A. The Contractor shall request from PVSC access to the Controls System during the warranty period. The PVSC shall allow the contractor to access the Controls System from a remote location for the purpose of diagnostics and troubleshooting, via the Internet, during the warranty period.

3.06 FIELD ACCEPTANCE TESTING

A. Upon completion of the installation, the Contractor shall load all system software and start-up the system. The Contractor shall perform all necessary calibration, testing and de-bugging and perform all required operational checks to insure that the system is functioning in full accordance with these specifications. All testing shall be witnessed and signed off by the Engineer, unless waived in writing.

B. The Contractor shall perform tests to verify proper performance of components, routines, and points. Repeat tests until proper performance results. This testing shall include a Point-by-Point validation log to validate 100% of the input and output points of the DDC system operation. DDC system shall be field tested both as individual controllers, able to operate their respective units as stand alone controllers and as an integrated system network of controllers and workstations. Each input I/O point (analog and digital) shall be tested for response from field devices, correct function, proper scaling, correct addressing and engineering units and appearance on the appropriate displays, alarms, reports and

graphs. Each output I/O point (analog and digital) shall be tested for proper response of the controlled device, correct power delivery, proper response to control logic, correct engineering units and addressing, proper scaling etc.

C. Each control strategy shall be tested both through simulation and again using real world conditions and actual equipment. Control systems shall be fine tuned for optimum efficiency and response prior to acceptance by the PVSC.

D. As one condition of system acceptance, the Contractor shall perform a system availability test on the entire completed HVAC control system. The system shall be required to operate properly, automatically and with only minor operator intervention for 14 consecutive 24 hour periods with no major failures. Conditions such as controller, workstation or software failures, equipment inoperable for more than 4 hours, repeated equipment shutdowns, multiple failures of one piece or type of equipment, inability of the system to maintain control or set point shall constitute failure and the entire test shall start over. Testing shall be repeated until satisfactory completion. Items suffering multiple failures and items deemed undependable by the PVSC shall be replaced by the Contractor at no additional expense to PVSC. The test shall be performed with all HVAC equipment operating in full automatic mode. In addition, all preliminary and final field testing of all HVAC equipment shall have been successfully completed prior to availability testing.

E. Upon completion of the performance tests described above, repeat these tests, point by point as described in the Point-by-Point validation log above in presence of PVSC's Representative, as required. Properly schedule these tests so testing is complete at a time directed by the PVSC's Representative. Do not delay tests.

F. System Acceptance: Satisfactory completion is when the Contractor has performed successfully all the required testing to show performance compliance with the requirements of the Contract Documents to the satisfaction of the Engineer. System acceptance shall be contingent upon completion and review of all corrected deficiencies.

G. Coordinate with HVAC System Balancer to assist with equipment operation during balancing.

3.07 TRAINING

A. General

1. A proposed training agenda will be submitted to the engineer in writing, and approved by the engineer before training takes place. All materials shall be supplied for the trainees selected by the PVSC.

B. On-Site Training (This phase of training shall be a minimum of 16 hours) Site personal and operators shall become familiar and proficient with:

1. Using As-Built documentation-Sequence of operation, control drawings, Input / Output summaries

2. Field sensor and actuator location and maintenance

3. Field controller location and maintenance
4. System architecture and functions as they pertain to the site
5. FUI and BUI hardware operation and maintenance
6. FUI and BUI software site specific capabilities
7. Monitoring and making changes to a preprogrammed Controls System
8. Understanding the PC and windows environment
9. Using the Browser tools to navigate BUI functions
10. Using graphic floor plans and equipment screens
11. Changing point values such as set points, schedules, and overrides
12. Retrieving trend reports and graphs
13. Acknowledging exceptions and alarms

3.08 TEMPORARY FACILITIES AND CONTROLS

A. The Contractor shall include the cost associated with the installation and maintenance of temporary facilities and control in accordance with Section 01500.

3.09 IDENTIFICATION

A. All equipment shall be identified in accordance with Section 01340 and as specified herein.

3.10 CERTIFICATIONS

A. The Contractor shall provide certifications in accordance with the requirements of Section 01700.

3.11 MAINTENANCE OF PLANT OPERATIONS

A. The Contractor shall include the cost associated with the Maintenance of Plant Operations in accordance with Section 01750.

END OF SECTION 230900

SECTION 232113 - HYDRONIC PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes pipe and fitting materials and joining methods for the following:

1. Hot-water heating piping.
2. Condenser-water piping.
3. Makeup-water piping.
4. Condensate-drain piping.
5. Blowdown-drain piping.
6. Air-vent piping.
7. Safety-valve-inlet and -outlet piping.

1.3 ACTION SUBMITTALS

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

B. Delegated-Design Submittal:

1. Design calculations and detailed fabrication and assembly of pipe anchors and alignment guides, hangers and supports for multiple pipes, expansion joints and loops, and attachments of the same to the building structure.
2. Locations of pipe anchors and alignment guides and expansion joints and loops.
3. Locations of and details for penetrations, including sleeves and sleeve seals for exterior walls, floors, basement, and foundation walls.
4. Locations of and details for penetration and firestopping for fire-rated wall and floor and ceiling assemblies.

C. Qualification Data: For Installer.

D. Welding certificates.

E. Field quality-control reports.

F. Water Analysis: Submit a copy of the water analysis to illustrate water quality available at Project site.

1.4 QUALITY ASSURANCE

A. Steel Support Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

B. Pipe Welding: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code: Section IX.

1. Comply with ASME B31.9, "Building Services Piping," for materials, products, and installation.
2. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Hydronic piping components and installation shall be capable of withstanding the following minimum working pressure and temperature unless otherwise indicated:

1. Hot-Water Heating Piping: 125 psig at 200 deg F.
2. Condenser-Water Piping: 125 psig at 150 deg F.
3. Condensate-Drain Piping: 150 deg F.
4. Blowdown-Drain Piping: 200 deg F.
5. Air-Vent Piping: 200 deg F.
6. Safety-Valve-Inlet and -Outlet Piping: Equal to the pressure of the piping system to which it is attached.

2.2 COPPER TUBE AND FITTINGS

A. Drawn-Temper Copper Tubing: ASTM B 88, Type L.

B. Wrought-Copper Unions: ASME B16.22.

2.3 STEEL PIPE AND FITTINGS

A. Steel Pipe: ASTM A 53, black steel with plain ends; welded and seamless, Grade B, and wall thickness as indicated in "Piping Applications" Article.

B. Cast-Iron Threaded Fittings: ASME B16.4; Classes 125 and 250 as indicated in "Piping Applications" Article.

C. Malleable-Iron Threaded Fittings: ASME B16.3, Classes 150 and 300 as indicated in "Piping Applications" Article.

D. Malleable-Iron Unions: ASME B16.39; Classes 150, 250, and 300 as indicated in "Piping Applications" Article.

E. Cast-Iron Pipe Flanges and Flanged Fittings: ASME B16.1, Classes 25, 125, and 250; raised ground face, and bolt holes spot faced as indicated in "Piping Applications" Article.

F. Wrought-Steel Fittings: ASTM A 234/A 234M, wall thickness to match adjoining pipe.

G. Wrought Cast- and Forged-Steel Flanges and Flanged Fittings: ASME B16.5, including bolts, nuts, and gaskets of the following material group, end connections, and facings:

1. Material Group: 1.1.
2. End Connections: Butt welding.
3. Facings: Raised face.

2.4 PLASTIC PIPE AND FITTINGS

A. PVC Plastic Pipe: ASTM D 1785, with wall thickness as indicated in "Piping Applications" Article.

1. PVC Plastic Pipe Fittings: Socket-type pipe fittings, ASTM D 2466 for Schedule 40 pipe; ASTM D 2467 for Schedule 80 pipe.

2.5 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 maximum thickness unless otherwise indicated.

a. Full-Face Type: For flat-face, Class 125, cast-iron and cast-bronze flanges.
b. Narrow-Face Type: For raised-face, Class 250, cast-iron and steel flanges.

B. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.

C. Brazing Filler Metals: AWS A5.8, BCuP Series, copper-phosphorus alloys for joining copper with copper; or BAg-1, silver alloy for joining copper with bronze or steel.

D. Welding Filler Metals: Comply with AWS D10.12M/D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

E. Solvent Cements for Joining Plastic Piping:

1. PVC Piping: ASTM D 2564. Include primer according to ASTM F 656.

a. PVC solvent cement shall have a VOC content of 510 g/L or less.
b. Adhesive primer shall have a VOC content of 550 g/L or less.

F. Gasket Material: Thickness, material, and type suitable for fluid to be handled and working temperatures and pressures.

2.6 DIELECTRIC FITTINGS

A. General Requirements: Assembly of copper alloy and ferrous materials with separating nonconductive insulating material. Include end connections compatible with pipes to be joined.

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. A.Y. McDonald Mfg. Co.
   b. Capitol Manufacturing Company.
   c. Central Plastics Company.
   d. Hart Industries International, Inc.
   e. Jomar International, Ltd.
   f. Matco-Norca.
   g. Watts Regulator Co.

2. Description:

   a. Standard: ASSE 1079.
   b. Pressure Rating: 125 psig minimum at 180 deg F>.
   c. End Connections: Solder-joint copper alloy and threaded ferrous.

C. Dielectric Flanges:

1. Manufacturers: 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. Matco-Norca.
   d. Watts Regulator Co.
   e. Zurn Industries, LLC; AquaSpec Commercial Faucet Products.

2. Description:

   a. Standard: ASSE 1079.
   b. Factory-fabricated, bolted, companion-flange assembly.
   c. Pressure Rating: 125 psig minimum at 180 deg F.
   d. End Connections: Solder-joint copper alloy and threaded ferrous; threaded solder-joint copper alloy and threaded ferrous.

D. Dielectric-Flange Insulating Kits:

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. Central Plastics Company.
d. Pipeline Seal and Insulator, Inc.

2. Description:

a. Nonconducting materials for field assembly of companion flanges.
b. Pressure Rating: 150 psig.
c. Gasket: Neoprene or phenolic.
d. Bolt Sleeves: Phenolic or polyethylene.
e. Washers: Phenolic with steel backing washers.

E. Dielectric Nipples:

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. Elster Perfection.
b. Grinnell Mechanical Products.
c. Matco-Norca.
d. Precision Plumbing Products, Inc.
e. Victaulic Company.

2. Description:

a. Standard: IAPMO PS 66.
b. Electroplated steel nipple, complying with ASTM F 1545.
c. Pressure Rating: 300 psig at 225 deg F.
d. End Connections: Male threaded or grooved.
e. Lining: Inert and noncorrosive, propylene.

PART 3 - EXECUTION

3.1 PIPING APPLICATIONS

A. Hot-water heating piping, aboveground, NPS 2 and smaller the following:

1. Type L, drawn-temper copper tubing, wrought-copper fittings, and brazed joints.

B. Hot-water heating piping, aboveground, NPS 2-1/2 and larger, shall be the following:

1. Type L, drawn-temper copper tubing, wrought-copper fittings, and brazed joints.

C. Condenser-water piping, aboveground, NPS 2 and smaller, shall be any of the following:

1. Type L, drawn-temper copper tubing, wrought-copper fittings, and brazed joints.

D. Condenser-water piping, aboveground, NPS 2-1/2 and larger, shall be any of the following:

1. Type L, drawn-temper copper tubing, wrought-copper fittings, and brazed joints.
2. Schedule 40 steel pipe, wrought-steel fittings and wrought-cast or forged-steel flanges and flange fittings, and welded and flanged joints.

E. Makeup-water piping installed aboveground shall be the following:

1. Type L, drawn-temper copper tubing, wrought-copper fittings, and brazed joints.

F. Condensate-Drain Piping: Type M, drawn-temper copper tubing, wrought-copper fittings, and soldered joints or Schedule 40 PVC plastic pipe and fittings and solvent-welded joints.

G. Blowdown-Drain Piping: Same materials and joining methods as for piping specified for the service in which blowdown drain is installed.

H. Air-Vent Piping:

1. Inlet: Same as service where installed with metal-to-plastic transition fittings for plastic piping systems according to piping manufacturer's written instructions.
2. Outlet: Type K, annealed-temper copper tubing with soldered or flared joints.

I. Safety-Valve-Inlet and -Outlet Piping for Hot-Water Piping: Same materials and joining methods as for piping specified for the service in which safety valve is installed with metal-to-plastic transition fittings for plastic piping systems according to piping manufacturer's written instructions.

3.2 PIPING INSTALLATIONS

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.

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 to permit valve servicing.

F. Install piping at indicated slopes.

G. Install piping free of sags and bends.

H. Install fittings for changes in direction and branch connections.

I. Install piping to allow application of insulation.

J. Select system components with pressure rating equal to or greater than system operating pressure.

K. Install groups of pipes parallel to each other, spaced to permit applying insulation and servicing of valves.

L. Install drains, consisting of a tee fitting, NPS 3/4 ball valve, and short NPS 3/4 threaded nipple with cap, at low points in piping system mains and elsewhere as required for system drainage.

M. Install piping at a uniform grade of 0.2 percent upward in direction of flow.

N. Reduce pipe sizes using eccentric reducer fitting installed with level side up.

O. Install branch connections to mains using [mechanically formed]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.

P. Install valves according to Section 230523 "General-Duty Valves for HVAC Piping."

Q. Install unions in piping, NPS 2 and smaller, adjacent to valves, at final connections of equipment, and elsewhere as indicated.

R. Install flanges in piping, NPS 2-1/2 and larger, at final connections of equipment and elsewhere as indicated.

S. Install shutoff valve immediately upstream of each dielectric fitting.

T. Comply with requirements in Section 230553 "Identification for HVAC Piping and Equipment" for identifying piping.

U. Install sleeves for piping penetrations of walls, ceilings, and floors.

V. Install sleeve seals for piping penetrations of concrete walls and slabs.

W. Install escutcheons for piping penetrations of walls, ceilings, and floors.

3.3 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 nipples.

C. Dielectric Fittings for NPS 2-1/2 to NPS 4: Use dielectric flanges.

D. Dielectric Fittings for NPS 5 and Larger: Use dielectric flange kits.

3.4 HANGERS AND SUPPORTS

A. Comply with requirements in Section 230529 "Hangers and Supports for HVAC Piping and Equipment" for hanger, support, and anchor devices. Comply with the following requirements for maximum spacing of supports.

B. Comply with requirements in Section 230548 "Vibration and Seismic Controls for HVAC" for seismic restraints.

C. Install the following pipe attachments:

1. Adjustable steel clevis hangers for individual horizontal piping less than 20 feet long.
2. Adjustable roller hangers and spring hangers for individual horizontal piping 20 feet or longer.
3. Pipe Roller: MSS SP-58, Type 44 for multiple horizontal piping 20 feet or longer, supported on a trapeze.
4. Spring hangers to support vertical runs.
5. Provide copper-clad hangers and supports for hangers and supports in direct contact with copper pipe.
6. On plastic pipe, install pads or cushions on bearing surfaces to prevent hanger from scratching pipe.

D. Install hangers for steel piping with the following maximum spacing and minimum rod sizes:

1. NPS 3/4: Maximum span, 7 feet.
2. NPS 1: Maximum span, 7 feet.
3. NPS 1-1/2: Maximum span, 9 feet.
4. NPS 2: Maximum span, 10 feet.
5. NPS 2-1/2: Maximum span, 11 feet.
6. NPS 3 and Larger: Maximum span, 12 feet.

E. Install hangers for drawn-temper copper piping with the following maximum spacing and minimum rod sizes:

1. NPS 3/4: Maximum span, 5 feet; minimum rod size, 1/4 inch.
2. NPS 1: Maximum span, 6 feet; minimum rod size, 1/4 inch.
3. NPS 1-1/4Maximum span, 7 feet; minimum rod size, 3/8 inch.
4. NPS 1-1/2: Maximum span, 8 feet; minimum rod size, 3/8 inch.
5. NPS 2: Maximum span, 8 feet; minimum rod size, 3/8 inch.
6. NPS 2-1/2: Maximum span, 9 feet; minimum rod size, 3/8 inch.
7. NPS 3 and Larger: Maximum span, 10 feet; minimum rod size, 3/8 inch.

F. Support vertical runs at roof, at each floor, and at 10-foot intervals between floors.

3.5 PIPE JOINT CONSTRUCTION

A. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

B. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

C. 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/A5.8M.

D. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:

1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

E. Welded Joints: Construct joints according to AWS D10.12M/D10.12, using qualified processes and welding operators according to "Quality Assurance" Article.

F. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.

3.6 TERMINAL EQUIPMENT CONNECTIONS

A. Sizes for supply and return piping connections shall be the same as or larger than equipment connections.

B. Install control valves in accessible locations close to connected equipment.

C. Install bypass piping with globe valve around control valve. If parallel control valves are installed, only one bypass is required.

D. Install ports for pressure gages and thermometers at coil inlet and outlet connections. Comply with requirements in Section 230519 "Meters and Gages for HVAC Piping."

3.7 CHEMICAL TREATMENT

A. Fill systems that have antifreeze or glycol solutions with the following concentrations:

1. Hot-Water Heating Piping: Minimum of 30 percent propylene glycol.
2. Condenser-Water Piping: Minimum of 30 percent propylene glycol.

3.8 FIELD QUALITY CONTROL

A. Prepare hydronic piping according to ASME B31.9 and as follows:

1. Leave joints, including welds, uninsulated and exposed for examination during test.
2. Provide temporary restraints for expansion joints that cannot sustain reactions due to test pressure. If temporary restraints are impractical, isolate expansion joints from testing.

3. Flush hydronic piping systems with clean water; then remove and clean or replace strainer screens.
4. Isolate equipment from piping. If a valve is used to isolate equipment, its closure shall be capable of sealing against test pressure without damage to valve. Install blinds in flanged joints to isolate equipment.
5. Install safety valve, set at a pressure no more than one-third higher than test pressure, to protect against damage by expanding liquid or other source of overpressure during test.

B. Perform the following tests on hydronic piping:

1. Use ambient temperature water as a testing medium unless there is risk of damage due to freezing. Another liquid that is safe for workers and compatible with piping may be used.
2. While filling system, use vents installed at high points of system to release air. Use drains installed at low points for complete draining of test liquid.
3. Isolate expansion tanks and determine that hydronic system is full of water.
4. Subject piping system to hydrostatic test pressure that is not less than 1.5 times the system's working pressure. Test pressure shall not exceed maximum pressure for any vessel, pump, valve, or other component in system under test. Verify that stress due to pressure at bottom of vertical runs does not exceed 90 percent of specified minimum yield strength or 1.7 times the "SE" value in Appendix A in ASME B31.9, "Building Services Piping."
5. After hydrostatic test pressure has been applied for at least 10 minutes, examine piping, joints, and connections for leakage. Eliminate leaks by tightening, repairing, or replacing components, and repeat hydrostatic test until there are no leaks.
6. Prepare written report of testing.

C. Perform the following before operating the system:

1. Open manual valves fully.
2. Inspect pumps for proper rotation.
3. Set makeup pressure-reducing valves for required system pressure.
4. Inspect air vents at high points of system and determine if all are installed and operating freely (automatic type), or bleed air completely (manual type).
5. Set temperature controls so all coils are calling for full flow.
6. Inspect and set operating temperatures of hydronic equipment, such as boilers, chillers, cooling towers, to specified values.
7. Verify lubrication of motors and bearings.

END OF SECTION 232113

SECTION 232116 - HYDRONIC PIPING SPECIALTIES

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 special-duty valves and specialties for the following:

1. Hot-water heating piping.
2. Condenser-water piping.

1.3 ACTION SUBMITTALS

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

1. Valves: Include flow and pressure drop curves based on manufacturer's testing for calibrated-orifice balancing valves and automatic flow-control valves.
2. Air-control devices.
3. Hydronic specialties.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For air-control devices, hydronic specialties, and special-duty valves to include in emergency, operation, and maintenance manuals.

1.5 MAINTENANCE MATERIAL SUBMITTALS

A. Differential Pressure Meter: For each type of balancing valve and automatic flow control valve, include flowmeter, probes, hoses, flow charts, and carrying case.

1.6 QUALITY ASSURANCE

A. Pipe Welding: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code: Section IX.

1. Safety valves and pressure vessels shall bear the appropriate ASME label. Fabricate and stamp air separators and expansion tanks to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Hydronic piping components and installation shall be capable of withstanding the following minimum working pressure and temperature unless otherwise indicated:

1. Hot-Water Heating Piping: 125 psig at 200 deg F .
2. Condenser-Water Piping: 125 psig at 150 deg F .
3. Makeup-Water Piping: 80 psig at 150 deg F .
4. Safety-Valve-Inlet and -Outlet Piping: Equal to the pressure of the piping system to which it is attached.

2.2 VALVES

A. Gate, Globe, Check, Ball, and Butterfly Valves: Comply with requirements specified in Section 230523 "General-Duty Valves for HVAC Piping."

B. Automatic Temperature-Control Valves, Actuators, and Sensors: Comply with requirements specified in Section 230900 "Instrumentation and Control for HVAC."

C. Bronze, Calibrated-Orifice, Balancing Valves:

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. Armstrong Pumps, Inc.
b. Bell & Gossett Domestic Pump.
c. Flow Design Inc.
d. Gerand Engineering Co.
e. Griswold Controls.
f. Nexus Valve, Inc.
g. Taco.

2. Body: Bronze, ball or plug type with calibrated orifice or venturi.
3. Ball: Brass or stainless steel.
4. Plug: Resin.
5. Seat: PTFE.
6. End Connections: Threaded or socket.
7. Pressure Gage Connections: Integral seals for portable differential pressure meter.
8. Handle Style: Lever, with memory stop to retain set position.
9. CWP Rating: Minimum 125 psig.
10. Maximum Operating Temperature: 250 deg .

D. Cast-Iron or Steel, Calibrated-Orifice, Balancing Valves:

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. Armstrong Pumps, Inc.
    b. Bell & Gossett Domestic Pump.
    c. Flow Design Inc.
    d. Gerand Engineering Co.
    e. Griswold Controls.
    f. Nexus Valve, Inc.
    g. Taco.

2. Body: Cast-iron or steel body, ball, plug, or globe pattern with calibrated orifice or venturi.
3. Ball: Brass or stainless steel.
4. Stem Seals: EPDM O-rings.
5. Disc: Glass and carbon-filled PTFE.
6. Seat: PTFE.
7. End Connections: Flanged or grooved.
8. Pressure Gage Connections: Integral seals for portable differential pressure meter.
9. Handle Style: Lever, with memory stop to retain set position.
10. CWP Rating: Minimum 125 psig.
11. Maximum Operating Temperature: 250 deg F.

E. Automatic Flow-Control Valves:

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. Flow Design Inc.
    b. Griswold Controls.
    c. Nexus Valve, Inc.

2. Body: Brass or ferrous metal.
3. Piston and Spring Assembly: Stainless steel, tamper proof, self-cleaning, and removable.
4. Combination Assemblies: Include bronze or brass-alloy ball valve.
5. Identification Tag: Marked with zone identification, valve number, and flow rate.
6. Size: Same as pipe in which installed.
7. Performance: Maintain constant flow, plus or minus 5 percent over system pressure fluctuations.
8. Minimum CWP Rating: 175 psig.
9. Maximum Operating Temperature: 200 deg F.

2.3 AIR-CONTROL DEVICES

A. Manual Air Vents:

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. AMTROL, Inc.
    b. Armstrong Pumps, Inc.
    c. Bell & Gossett Domestic Pump.
    d. Nexus Valve, Inc.
    e. Taco, Inc.

2. Body: Bronze.
3. Internal Parts: Nonferrous.
4. Operator: Screwdriver or thumbscrew.
5. Inlet Connection: NPS 1/2.
6. Discharge Connection: NPS 1/8.
7. CWP Rating: 150 psig.
8. Maximum Operating Temperature: 225 deg F.

B. Automatic Air Vents:

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. AMTROL, Inc.
    b. Armstrong Pumps, Inc.
    c. Bell & Gossett Domestic Pump.
    d. Nexus Valve, Inc.
    e. Taco, Inc.

2. Body: Bronze or cast iron.
3. Internal Parts: Nonferrous.
4. Operator: Noncorrosive metal float.
5. Inlet Connection: NPS 1/2.
6. Discharge Connection: NPS 1/4.
7. CWP Rating: 150 psig.
8. Maximum Operating Temperature: 240 deg F.

C. Expansion Tanks:

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. AMTROL, Inc.
    b. Armstrong Pumps, Inc.
    c. Bell & Gossett Domestic Pump.
    d. Taco, Inc.

2. Tank: Welded steel, rated for 125-psig working pressure and 375 deg F maximum operating temperature, with taps in bottom of tank for tank fitting and taps in end of tank for gage glass. Tanks shall be factory tested after taps are fabricated and shall be labeled according to ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.
3. Air-Control Tank Fitting: Cast-iron body, copper-plated tube, brass vent tube plug, and stainless-steel ball check, 100-gal. unit only; sized for compression-tank diameter. Provide tank fittings for 125-psig working pressure and 250 deg F maximum operating temperature.
4. Tank Drain Fitting: Brass body, nonferrous internal parts; 125-psig working pressure and 240 deg F maximum operating temperature; constructed to admit air to compression tank, drain water, and close off system.
5. Gage Glass: Full height with dual manual shutoff valves, 3/4-inch- diameter gage glass, and slotted-metal glass guard.

D. Bladder-Type Expansion Tanks:

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. AMTROL, Inc.
    b. Armstrong Pumps, Inc.
    c. Bell & Gossett Domestic Pump.
    d. Taco, Inc.

2. Tank: Welded steel, rated for 125-psig working pressure and 375 deg F maximum operating temperature. Factory test after taps are fabricated and supports installed and are labeled according to ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.
3. Bladder: Securely sealed into tank to separate air charge from system water to maintain required expansion capacity.
4. Air-Charge Fittings: Schrader valve, stainless steel with EPDM seats.

E. Tangential-Type Air Separators:

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. AMTROL, Inc.
    b. Armstrong Pumps, Inc.
    c. Bell & Gossett Domestic Pump.
    d. Taco, Inc.

2. Tank: Welded steel; ASME constructed and labeled for 125-psig minimum working pressure and 375 deg F maximum operating temperature.
3. Air Collector Tube: Perforated stainless steel, constructed to direct released air into expansion tank.
4. Tangential Inlet and Outlet Connections: Threaded for NPS 2 and smaller; flanged connections for NPS 2-1/2 and larger.

5. Blowdown Connection: Threaded.
6. Size: Match system flow capacity.

2.4 HYDRONIC PIPING SPECIALTIES

A. Y-Pattern Strainers:

1. Body: ASTM A 126, Class B, cast iron with bolted cover and bottom drain connection.
2. End Connections: Threaded ends for NPS 2 (DN 50) and smaller; flanged ends for NPS 2-1/2 (DN 65) and larger.
3. Strainer Screen: Stainless-steel, 20-mesh strainer, or perforated stainless-steel basket.
4. CWP Rating: 125 psig.

B. Basket Strainers:

1. Body: ASTM A 126, Class B, high-tensile cast iron with bolted cover and bottom drain connection.
2. End Connections: Threaded ends for NPS 2 and smaller; flanged ends for NPS 2-1/2 and larger.
3. Strainer Screen: 40-mesh startup strainer, and perforated stainless-steel basket with 50 percent free area.
4. CWP Rating: 125 psig.

C. Spherical, Rubber, Flexible Connectors:

1. Body: Fiber-reinforced rubber body.
2. End Connections: Steel flanges drilled to align with Classes 150 and 300 steel flanges.
3. Performance: Capable of misalignment.
4. CWP Rating: 150 psig.
5. Maximum Operating Temperature: 250 deg F.

PART 3 - EXECUTION

3.1 VALVE APPLICATIONS

A. Install shutoff-duty valves at each branch connection to supply mains and at supply connection to each piece of equipment.

B. Install calibrated-orifice, balancing valves at each branch connection to return main.

C. Install calibrated-orifice, balancing valves in the return pipe of each heating or cooling terminal.

D. Install check valves at each pump discharge and elsewhere as required to control flow direction.

E. Install safety valves at hot-water generators and elsewhere as required by ASME Boiler and Pressure Vessel Code. Install drip-pan elbow on safety-valve outlet and pipe without valves to the outdoors; pipe drain to nearest floor drain or as indicated on Drawings. Comply with

ASME Boiler and Pressure Vessel Code: Section VIII, Division 1, for installation requirements.

F. Install pressure-reducing valves at makeup-water connection to regulate system fill pressure.

3.2 HYDRONIC SPECIALTIES INSTALLATION

A. Install manual air vents at high points in piping, at heat-transfer coils, and elsewhere as required for system air venting.

B. Install automatic air vents at high points of system piping in mechanical equipment rooms only. Install manual vents at heat-transfer coils and elsewhere as required for air venting.

C. Install piping from boiler air outlet, air separator, to expansion tank with a 2 percent upward slope toward tank.

D. Install tangential air separator in pump suction. Install blowdown piping with gate or full-port ball valve; extend full size to nearest floor drain.

E. Install expansion tanks above the air separator. Install tank fitting in tank bottom and charge tank. Use manual vent for initial fill to establish proper water level in tank.

1. Install tank fittings that are shipped loose.
2. Support tank from floor or structure above with sufficient strength to carry weight of tank, piping connections, fittings, plus tank full of water. Do not overload building components and structural members.

F. Install expansion tanks on the floor. Vent and purge air from hydronic system, and ensure that tank is properly charged with air to suit system Project requirements.

END OF SECTION 232116

SECTION 232123 - HYDRONIC PUMPS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:
   1. Separately coupled, horizontal, in-line centrifugal pumps.
   2. Separately coupled, base-mounted, end-suction centrifugal pumps.

1.2 SUBMITTALS

A. Product Data: Include certified performance curves and rated capacities, operating characteristics, furnished specialties, final impeller dimensions, and accessories for each type of product indicated. Indicate pump's operating point on curves.

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. UL Compliance: Comply with UL 778 for motor-operated water pumps.

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 SEPARATELY COUPLED, HORIZONTAL, IN-LINE CENTRIFUGAL PUMPS

A. Manufacturers:

   1. Grundfos Pumps Corporation.
   2. PACO Pumps.
   3. Armstrong Pumps Inc.
   4. Aurora Pump; Division of Pentair Pump Group.
   5. Bell & Gossett; Div. of ITT Industries.

6. Flowserve Corporation; Div. of Ingersoll-Dresser Pumps.
7. MEPCO (Marshall Engineered Products Co.).
8. Taco, Inc.
9. Thrush Company Inc.

B. Description: Factory-assembled and -tested, centrifugal, overhung-impeller, separately coupled, in-line pump as defined in HI 1.1-1.2 and HI 1.3; designed for installation with pump and motor shafts mounted horizontally. Rate pump for 125-psig minimum working pressure and a continuous water temperature of 250 deg F.

C. Pump Construction:

1. Casing: Radially split, cast iron, with threaded gage tappings at inlet and outlet, and threaded companion-flange or union end connections.
2. Impeller: ASTM B 584, cast bronze; statically and dynamically balanced, and keyed to shaft. Trim impeller to match specified performance.
3. Pump Shaft: Steel, with copper-alloy shaft sleeve.
4. Mechanical Seal: Carbon rotating ring against a ceramic seat held by a stainless-steel spring, and Buna-N or EPT bellows and gasket. Include water slinger on shaft between motor and seal.
5. Pump Bearings: Permanently lubricated ball bearings.

D. Shaft Coupling: Interlocking frame with interconnecting springs capable of absorbing vibration.

E. Motor: Single speed, with permanently lubricated ball bearings, unless otherwise indicated; and resiliently mounted to pump casing. Comply with requirements in Division 23 Section "Common Motor Requirements for HVAC Equipment."

2.3 SEPARATELY COUPLED, BASE-MOUNTED, END-SUCTION CENTRIFUGAL PUMPS

A. Available Manufacturers:

1. PACO Pumps.
2. Armstrong Pumps Inc.
3. Aurora Pump; Division of Pentair Pump Group.
4. Bell & Gossett; Div. of ITT Industries.
5. Taco, Inc.
6. Thrush Company Inc.

B. Description: Factory-assembled and -tested, centrifugal, overhung-impeller, separately coupled, end-suction pump as defined in HI 1.1-1.2 and HI 1.3; designed for base mounting, with pump and motor shafts horizontal. Rate pump for 175-psig minimum working pressure and a continuous water temperature of 225 deg F.

C. Pump Construction:

1. Casing: Radially split, cast iron, with replaceable bronze wear rings, threaded gage tappings at inlet and outlet, drain plug at bottom and air vent at top of volute, and flanged connections.

2. Impeller: ASTM B 584, cast bronze; statically and dynamically balanced, keyed to shaft, and secured with a locking cap screw. Trim impeller to match specified performance.
3. Pump Shaft: Steel, with copper-alloy shaft sleeve.
4. Mechanical Seal: Carbon rotating ring against a ceramic seat held by a stainless-steel spring, and Buna-N bellows and gasket.
5. Pump Bearings: Grease-lubricated ball bearings contained in cast-iron housing with grease fittings.

D. Shaft Coupling: Molded rubber insert and interlocking spider capable of absorbing vibration. Couplings shall be drop-out type to allow disassembly and removal without removing pump shaft or motor.

E. Coupling Guard: Dual rated; ANSI B15.1, Section 8; OSHA 1910.219 approved; steel; removable; attached to mounting frame.

F. Mounting Frame: Welded-steel frame and cross members, factory fabricated from ASTM A 36/A 36M channels and angles. Fabricate to mount pump casing, coupling guard, and motor.

G. Motor: Single speed, with permanently lubricated ball bearings, unless otherwise indicated; secured to mounting frame, with adjustable alignment. Comply with requirements in Division 23 Section "Common Motor Requirements for HVAC Equipment."

2.4 PUMP SPECIALTY FITTINGS

A. Suction Diffuser: Angle pattern, 175-psig pressure rating, cast-iron body and end cap, pump-inlet fitting; with bronze startup and bronze or stainless-steel permanent strainers; bronze or stainless-steel straightening vanes; drain plug; and factory-fabricated support.

B. Triple-Duty Valve: Angle or straight pattern, 175-psig pressure rating, cast-iron body, pump-discharge fitting; with drain plug and bronze-fitted shutoff, balancing, and check valve features. Brass gage ports with integral check valve, and orifice for flow measurement.

PART 3 - EXECUTION

3.1 PUMP INSTALLATION

A. Comply with HI 1.4.

B. Install pumps with access for periodic maintenance including removal of motors, impellers, couplings, and accessories.

C. Independently support pumps and piping so weight of piping is not supported by pumps and weight of pumps is not supported by piping.

D. Install continuous-thread hanger rods and spring hangers with vertical-limit stop of sufficient size to support pump weight. Vibration isolation devices are specified in Division 23 Section "Vibration and Seismic Controls for HVAC Piping and Equipment." Fabricate brackets or

supports as required. Hanger and support materials are specified in Division 23 Section "Hangers and Supports for HVAC Piping and Equipment."

E. Suspend vertically mounted, in-line centrifugal pumps independent of piping. Install pumps with motor and pump shafts vertical. Use continuous-thread hanger rods and spring hangers with vertical-limit stop of sufficient size to support pump weight. Vibration isolation devices are specified in Division 23 Section "Vibration and Seismic Controls for HVAC Piping and Equipment." Hanger and support materials are specified in Division 23 Section "Hangers and Supports for HVAC Piping and Equipment."

F. Set base-mounted pumps on concrete foundation. Disconnect coupling before setting. Do not reconnect couplings until alignment procedure is complete.

1. Support pump baseplate on rectangular metal blocks and shims, or on metal wedges with small taper, at points near foundation bolts to provide a gap of 3/4 to 1-1/2 inches between pump base and foundation for grouting.
2. Adjust metal supports or wedges until pump and driver shafts are level. Check coupling faces and suction and discharge flanges of pump to verify that they are level and plumb.

3.2 ALIGNMENT

A. Align pump and motor shafts and piping connections after setting on foundation, grout has been set and foundation bolts have been tightened, and piping connections have been made.

B. Comply with pump and coupling manufacturers' written instructions.

C. Adjust pump and motor shafts for angular and offset alignment by methods specified in HI 1.1-1.5, "Centrifugal Pumps for Nomenclature, Definitions, Application and Operation."

D. After alignment is correct, tighten foundation bolts evenly but not too firmly. Completely fill baseplate with nonshrink, nonmetallic grout while metal blocks and shims or wedges are in place. After grout has cured, fully tighten foundation bolts.

3.3 CONNECTIONS

A. Piping installation requirements are specified in other Division 23 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to machine to allow service and maintenance.

C. Connect piping to pumps. Install valves that are same size as piping connected to pumps.

D. Install suction and discharge pipe sizes equal to or greater than diameter of pump nozzles.

E. Install triple-duty valve on discharge side of pumps.

F. Install Y-type strainer or suction diffuser and shutoff valve on suction side of pumps.

G. Install flexible connectors on suction and discharge sides of base-mounted pumps between pump casing and valves.

H. Install pressure gages on pump suction and discharge, at integral pressure-gage tapping, or install single gage with multiple input selector valve.

I. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."

J. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

END OF SECTION 232123

SECTION 232500 - HVAC WATER TREATMENT

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following HVAC water-treatment systems:
   1. Glycol- water heat transfer system.

1.2 PERFORMANCE REQUIREMENTS

A. Water quality for HVAC systems shall minimize corrosion, scale buildup, and biological growth for optimum efficiency of HVAC equipment without creating a hazard to operating personnel or the environment.

B. Base HVAC water treatment on quality of water available at Project site, HVAC system equipment material characteristics and functional performance characteristics, operating personnel capabilities, and requirements and guidelines of authorities having jurisdiction.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

1.4 QUALITY ASSURANCE

A. HVAC Water-Treatment Service Provider Qualifications: An experienced HVAC water-treatment service provider capable of analyzing water qualities, installing water-treatment equipment, and applying water treatment as specified in this Section.

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. John Wood Company.
   2. J.L.Wingert Company.

2.2 GLYCOL-WATER SYSTEM

A. Propylene glycol shall be inhibited with 1.75 percent dipotassium phosphate. Do not use automotive anti-freeze because the inhibitors used are not needed and can cause sludge precipitate that interferes with heat transfer.

B. Provide required amount of glycol to obtain the percent by volume for glycol-water systems as follows and to provide one-half tank reserve supply: 30 percent propylene -glycol for hot water systems. Max pressure: 100 PSI, Max temperature: 85 deg. F.

C. Glycol-Water Make-up System:

1. Tank: 30 gallon polyethylene tank with 1/3 hinged PE cover and visible level scale. Tank is fully supported and restrained by a carbon steel bottom mount stand that is painted with water based enamel.

2. Gear pump: 1/3 horsepower drip-proof motor. Pump suction plumbing includes PVC ball valve, flexible tubing and cast iron Y-strainer. Pump discharge piping shall be steel schedule 40, includes spring check valve, PVC piping and ¼" NPT back tap pressure gauge.

3. Pressure switch" ¼" NPT pressure switch.

4. Pressure relief valve: 0-150 PSI PVC pressure relief valve and gauge.

5. Suction valve: with Y-strainer.

6. Control panel: The NEMA 4X control panel with 8 feet 115V power cord. The control panel includes 2-position main power switch and light, 3-position (hand/off/auto) switch and light for gear pump, red low level light and 15 AMP fuse.

7. Low level switch: Polypropylene side entry low level switch with 10 AMP relay.

PART 3 - EXECUTION

3.1 CONNECTIONS

A. Piping installation requirements are specified in other Division 23 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to equipment to allow service and maintenance.

C. Make piping connections between HVAC water-treatment equipment and dissimilar-metal piping with dielectric fittings. Dielectric fittings are specified in Division 23 Section "Common Work Results for HVAC."

D. Install shutoff valves on HVAC water-treatment equipment inlet and outlet. Metal general-duty valves are specified in Division 23 Section "General-Duty Valves for HVAC Piping."

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.

C. Tests and Inspections:

1. Inspect field-assembled components and equipment installation, including piping and electrical connections.
2. Inspect piping and equipment to determine that systems and equipment have been cleaned, flushed, and filled with water, and are fully operational before introducing chemicals for water-treatment system.
3. Place HVAC water-treatment system into operation and calibrate controls during the preliminary phase of HVAC systems' startup procedures.
4. Do not enclose, cover, or put piping into operation until it is tested and satisfactory test results are achieved.
5. Test for leaks and defects. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.
6. Leave uncovered and unconcealed new, altered, extended, and replaced water piping until it has been tested and approved. Expose work that has been covered or concealed before it has been tested and approved.
7. 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 test pressure to stand for four hours. Leaks and loss in test pressure constitute defects.
8. Repair leaks and defects with new materials and retest piping until no leaks exist.

D. Remove and replace malfunctioning units and retest as specified above.

E. At four-week intervals following Substantial Completion, perform separate water analyses on hydronic systems to show that automatic chemical-feed systems are maintaining water quality within performance requirements specified in this Section. Submit written reports of water analysis advising Owner of changes necessary to adhere to Part 1 "Performance Requirements" Article.

END OF SECTION 232500

SECTION 233113 - METAL DUCTS

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. Single-wall rectangular ducts and fittings.
2. Single-wall round ducts and fittings.
3. Sheet metal materials.
4. Duct liner.
5. Sealants and gaskets.
6. Hangers and supports.
7. Seismic-restraint devices.

B. Related Sections:

1. Section 230593 "Testing, Adjusting, and Balancing for HVAC" for testing, adjusting, and balancing requirements for metal ducts.
2. Section 233300 "Air Duct Accessories" for dampers, sound-control devices, duct-mounted access doors and panels, turning vanes, and flexible ducts.

1.3 PERFORMANCE REQUIREMENTS

A. Delegated 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 ASCE/SEI 7. SMACNA's "Seismic Restraint Manual: Guidelines for Mechanical Systems."

1. Seismic Hazard Level A: Seismic force to weight ratio, 0.48.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of the following products:

1. Liners and adhesives.
2. Sealants and gaskets.
3. Leakage Test Report for Prerequisite EA 2: Documentation of work performed for compliance with ASHRAE/IESNA 90.1, Section 6.4.4.2.2 - "Duct Leakage Tests."
4. Duct-Cleaning Test Report for Prerequisite IEQ 1: Documentation of work performed for compliance with ASHRAE 62.1, Section 7.2.4 - "Ventilation System Start-up."

B. Shop Drawings:

1. Fabrication, assembly, and installation, including plans, elevations, sections, components, and attachments to other work.
2. Factory- and shop-fabricated ducts and fittings.
3. Duct layout indicating sizes, configuration, liner material, and static-pressure classes.
4. Elevation of top of ducts.
5. Dimensions of main duct runs from building grid lines.
6. Fittings.
7. Reinforcement and spacing.
8. Seam and joint construction.
9. Penetrations through fire-rated and other partitions.
10. Equipment installation based on equipment being used on Project.
11. Locations for duct accessories, including dampers, turning vanes, and access doors and panels.
12. Hangers and supports, including methods for duct and building attachment, seismic restraints, and vibration isolation.

C. Delegated-Design Submittal:

1. Sheet metal thicknesses.
2. Joint and seam construction and sealing.
3. Reinforcement details and spacing.
4. Materials, fabrication, assembly, and spacing of hangers and supports.

1.5 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: 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 smoke barriers and fire-rated construction.
6. Items penetrating finished ceiling including the following:

    a. Lighting fixtures.
    b. Air outlets and inlets.
    c. Speakers.
    d. Access panels.

B. Welding certificates.

C. Field quality-control reports.

1.6 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1, "Structural Welding Code - Steel," for hangers and supports, AWS D9.1, "Sheet Metal Welding Code," for duct joint and seam welding.]

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 2-1, "Rectangular Duct/Transverse 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 2-2, "Rectangular Duct/Longitudinal Seams," 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 4, "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 SINGLE-WALL ROUND DUCTS AND FITTINGS

A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 3, "Round, Oval, and Flexible Duct," based on indicated static-pressure class unless otherwise indicated.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Lindab Inc.

b. McGill AirFlow LLC.
c. SEMCO Incorporated.
d. Sheet Metal Connectors, Inc.
e. Spiral Manufacturing Co., Inc.

B. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-1, "Round Duct Transverse 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 3-2, "Round Duct Longitudinal Seams," 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. Tees and Laterals: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-5, "90 Degree Tees and Laterals," and Figure 3-6, "Conical Tees," 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."

2.3 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.

1. Galvanized Coating Designation: G60.
2. Finishes for Surfaces Exposed to View: Mill phosphatized.

C. Reinforcement Shapes and Plates: ASTM A36, steel plates, shapes, and bars; black and galvanized.

1. Where black- and galvanized-steel shapes and plates are used to reinforce aluminum ducts, isolate the different metals with butyl rubber, neoprene, or EPDM gasket materials.

D. Tie Rods: Galvanized steel, 1/4-inch minimum diameter for lengths 36 inches or less; 3/8-inch minimum diameter for lengths longer than 36 inches.

2.4 DUCT LINER

A. Natural-Fiber Duct Liner: 85 percent cotton, 10 percent borate, and 5 percent polybinding fibers, treated with a microbial growth inhibitor and complying with NFPA 90A or NFPA 90B.

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. Bonded Logic, Inc.
   b. Reflectix Inc.

2. Maximum Thermal Conductivity: 0.24 Btu x in./h x sq. ft. x deg F at75 deg F mean temperature when tested according to ASTM C 518.
3. Surface-Burning Characteristics: Maximum flame-spread index of 25 and maximum smoke-developed index of 50 when tested according to ASTM E 84; certified by an NRTL.
4. Liner Adhesive: As recommended by insulation manufacturer and complying with NFPA 90A or NFPA 90B.

B. Insulation Pins and Washers:

1. Cupped-Head, Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.106-inch diameter shank, length to suit depth of insulation indicated with integral 1-1/2-inch galvanized carbon-steel washer.
2. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch- thick galvanized steel; with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches in diameter.

C. Shop Application of Duct Liner: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 7-11, "Flexible Duct Liner Installation."

1. Adhere a single layer of indicated thickness of duct liner with at least 90 percent adhesive coverage at liner contact surface area. Attaining indicated thickness with multiple layers of duct liner is prohibited.
2. Apply adhesive to transverse edges of liner facing upstream that do not receive metal nosing.
3. Butt transverse joints without gaps, and coat joint with adhesive.
4. Fold and compress liner in corners of rectangular ducts or cut and fit to ensure butted-edge overlapping.
5. Do not apply liner in rectangular ducts with longitudinal joints, except at corners of ducts, unless duct size and dimensions of standard liner make longitudinal joints necessary.
6. Apply adhesive coating on longitudinal seams in ducts with air velocity of 2500 fpm.
7. Secure liner with mechanical fasteners 4 inches from corners and at intervals not exceeding 12 inches transversely; at 3 inches from transverse joints and at intervals not exceeding 18 inches longitudinally.
8. Secure transversely oriented liner edges facing the airstream with metal nosings that have either channel or "Z" profiles or are integrally formed from duct wall. Fabricate edge facings at the following locations:

   a. Fan discharges.
   b. Intervals of lined duct preceding unlined duct.

9. Secure insulation between perforated sheet metal inner duct of same thickness as specified for outer shell. Use mechanical fasteners that maintain inner duct at uniform distance from outer shell without compressing insulation.

    a. Sheet Metal Inner Duct Perforations: 3/32-inch diameter, with an overall open area of 23 percent.

10. Terminate inner ducts with buildouts attached to fire-damper sleeves, dampers, turning vane assemblies, or other devices. Fabricated buildouts (metal hat sections) or other buildout means are optional; when used, secure buildouts to duct walls with bolts, screws, rivets, or welds.

2.5 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.
3. Sealant: Modified styrene acrylic.
4. Water resistant.
5. Mold and mildew resistant.
6. Maximum Static-Pressure Class: 10-inch wg, positive and negative.
7. Service: Indoor and outdoor.
8. Service Temperature: Minus 40 to plus 200 deg F.
9. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum.
10. For indoor applications, sealant shall have 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, 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. 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.

E. Flange Gaskets: Butyl rubber, neoprene, or EPDM polymer with polyisobutylene plasticizer.

F. Round Duct Joint O-Ring Seals:

1. Seal shall provide maximum leakage class of 3 cfm/100 sq. ft. at 1-inch wg and shall be rated for 10-inch wg static-pressure class, positive or negative.
2. EPDM O-ring to seal in concave bead in coupling or fitting spigot.

2.6 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 5-1, "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct."

C. Steel Cables for Galvanized-Steel Ducts: Galvanized steel complying with ASTM A 603.

D. Steel Cable End Connections: Cadmium-plated steel assemblies with brackets, swivel, and bolts designed for duct hanger service; with an automatic-locking and clamping device.

E. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.

F. Trapeze and Riser Supports:

1. Supports for Galvanized-Steel Ducts: Galvanized-steel shapes and plates.

2.7 SEISMIC-RESTRAINT DEVICES

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. Cooper B-Line, Inc.; a division of Cooper Industries.
2. Ductmate Industries, Inc.
3. Hilti Corp.
4. Kinetics Noise Control.
5. Loos & Co.; Cableware Division.
6. Mason Industries.
7. TOLCO; a brand of NIBCO INC.

B. General Requirements for Restraint Components: Rated strengths, features, and applications shall be as defined in reports by an agency acceptable to authorities having jurisdiction.

1. Structural Safety Factor: Allowable strength in tension, shear, and pullout force of components shall be at least four times the maximum seismic forces to which they will be subjected.

C. Channel Support System: Shop- or field-fabricated support assembly made of slotted steel channels rated in tension, compression, and torsion forces and with accessories for attachment to braced component at one end and to building structure at the other end. Include matching components and corrosion-resistant coating.

D. Restraint Cables: ASTM A 603, galvanized-steel cables with end connections made of cadmium-plated steel assemblies with brackets, swivel, and bolts designed for restraining cable service; and with an automatic-locking and clamping device or double-cable clips.

E. Hanger Rod Stiffener: Reinforcing steel angle clamped to hanger rod.

F. Mechanical Anchor Bolts: Drilled-in and stud-wedge or female-wedge type. Select anchor bolts with strength required for anchor and as tested according to ASTM E 488.

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 round ducts in maximum practical lengths.

D. Install ducts with fewest possible joints.

E. Install factory- or shop-fabricated fittings for changes in direction, size, and shape and for branch connections.

F. Unless otherwise indicated, install ducts vertically and horizontally, and parallel and perpendicular to building lines.

G. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.

H. Install ducts with a clearance of 1 inch, plus allowance for insulation thickness.

I. Route ducts to avoid passing through transformer vaults and electrical equipment rooms and enclosures.

J. 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.

K. Where ducts pass through fire-rated interior partitions and exterior walls, install fire dampers. Comply with requirements in Section 233300 "Air Duct Accessories" for fire and smoke dampers.

L. Protect duct interiors from moisture, construction debris and dust, and other foreign materials. Comply with SMACNA's "IAQ Guidelines for Occupied Buildings Under Construction," Appendix G, "Duct Cleanliness for New Construction Guidelines."

3.2 INSTALLATION OF EXPOSED DUCTWORK

A. Protect ducts exposed in finished spaces from being dented, scratched, or damaged.

B. Trim duct sealants flush with metal. Create a smooth and uniform exposed bead. Do not use two-part tape sealing system.

C. Grind welds to provide smooth surface free of burrs, sharp edges, and weld splatter. When welding stainless steel with a No. 3 or 4 finish, grind the welds flush, polish the exposed welds, and treat the welds to remove discoloration caused by welding.

D. Maintain consistency, symmetry, and uniformity in the arrangement and fabrication of fittings, hangers and supports, duct accessories, and air outlets.

E. Repair or replace damaged sections and finished work that does not comply with these requirements.

3.3 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."

B. Seal ducts to the following seal classes according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible":

1. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
2. Outdoor, Supply-Air Ducts: Seal Class A.
3. Outdoor, Exhaust Ducts: Seal Class C.
4. Unconditioned Space, Supply-Air Ducts in Pressure Classes 2-Inch wg and Lower: Seal Class B.
5. Unconditioned Space, Exhaust Ducts: Seal Class C.
6. Unconditioned Space, Return-Air Ducts: Seal Class B.
7. Conditioned Space, Supply-Air Ducts in Pressure Classes 2-Inch wg and Lower: Seal Class C.
8. Conditioned Space, Exhaust Ducts: Seal Class B.

9. Conditioned Space, Return-Air Ducts: Seal Class C.

3.4 HANGER AND SUPPORT INSTALLATION

A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 5, "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 thick.
4. Do not use powder-actuated concrete fasteners for lightweight-aggregate concretes or for slabs less than 4 inches 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 5-1, "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct," for maximum hanger spacing; install hangers and supports within 24 inches of each elbow and within 48 inches of each branch intersection.

D. Hangers Exposed to View: Threaded rod and angle or channel supports.

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.

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.

3.5 SEISMIC-RESTRAINT-DEVICE INSTALLATION

A. Install ducts with hangers and braces designed to support the duct and to restrain against seismic forces required by applicable building codes. Comply with SMACNA's "Seismic Restraint Manual: Guidelines for Mechanical Systems."

1. Space lateral supports a maximum of 40 feet o.c., and longitudinal supports a maximum of 80 feet o.c.
2. Brace a change of direction longer than 12 feet.

B. Select seismic-restraint devices with capacities adequate to carry present and future static and seismic loads.

C. Install cables so they do not bend across edges of adjacent equipment or building structure.

D. Install cable restraints on ducts that are suspended with vibration isolators.

E. Install seismic-restraint devices using methods approved by an agency acceptable to authorities having jurisdiction.

F. Attachment to Structure: If specific attachment is not indicated, anchor bracing and restraints to structure, to flanges of beams, to upper truss chords of bar joists, or to concrete members.

G. Drilling for and Setting Anchors:

1. Identify position of reinforcing steel and other embedded items prior to drilling holes for anchors. Do not damage existing reinforcement or embedded items during drilling. Notify the Architect if reinforcing steel or other embedded items are encountered during drilling. Locate and avoid prestressed tendons, electrical and telecommunications conduit, and gas lines.
2. Do not drill holes in concrete or masonry until concrete, mortar, or grout has achieved full design strength.
3. Wedge Anchors: Protect threads from damage during anchor installation. Heavy-duty sleeve anchors shall be installed with sleeve fully engaged in the structural element to which anchor is to be fastened.
4. Set anchors to manufacturer's recommended torque, using a torque wrench.
5. Install zinc-coated steel anchors for interior applications and stainless-steel anchors for applications exposed to weather.

3.6 CONNECTIONS

A. Make connections to equipment with flexible connectors complying with Section 233300 "Air Duct Accessories."

B. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for branch, outlet and inlet, and terminal unit connections.

3.7 PAINTING

A. Paint interior of metal ducts that are visible through registers and grilles and that do not have duct liner. Apply one coat of flat, black, latex paint over a compatible galvanized-steel primer. Paint materials and application requirements are specified in Section 099113 "Exterior Painting" and Section 099123 "Interior Painting."

3.8 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. Test the following systems:

a. Supply Ducts with a Pressure Class of 2-Inch wg: Test representative duct sections, totaling no less than 50 percent of total installed duct area for each designated pressure class.
b. Return Ducts with a Pressure Class of 2-Inch wg: Test representative duct sections totaling no less than 50 percent of total installed duct area for each designated pressure class.
c. Exhaust Ducts with a Pressure Class of 2-Inch wg: Test representative duct sections, totaling no less than 50 percent of total installed duct area for each designated pressure class.

3. Disassemble, reassemble, and seal segments of systems to accommodate leakage testing and for compliance with test requirements.
4. Test for leaks before applying external insulation.
5. 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.
6. Give seven days' advance notice for testing.

C. Duct System Cleanliness Tests:

1. Visually inspect duct system to ensure that no visible contaminants are present.
2. Test sections of metal duct system, chosen randomly by Owner, for cleanliness according to "Vacuum Test" in NADCA ACR, "Assessment, Cleaning and Restoration of HVAC Systems."

a. Acceptable Cleanliness Level: Net weight of debris collected on the filter media shall not exceed 0.75 mg/100 sq. cm.

D. Duct system will be considered defective if it does not pass tests and inspections.

E. Prepare test and inspection reports.

3.9 DUCT CLEANING

A. Clean new and existing duct system(s) before testing, adjusting, and balancing.

B. Use service openings for entry and inspection.

1. Create new openings and install access panels appropriate for duct static-pressure class if required for cleaning access. Provide insulated panels for insulated or lined duct. Patch insulation and liner as recommended by duct liner manufacturer. Comply with Section 233300 "Air Duct Accessories" for access panels and doors.
2. Disconnect and reconnect flexible ducts as needed for cleaning and inspection.
3. Remove and reinstall ceiling to gain access during the cleaning process.

C. Particulate Collection and Odor Control:

1. When venting vacuuming system inside the building, use HEPA filtration with 99.97 percent collection efficiency for 0.3-micron-size (or larger) particles.

2. When venting vacuuming system to outdoors, use filter to collect debris removed from HVAC system, and locate exhaust downwind and away from air intakes and other points of entry into building.

D. Clean the following components by removing surface contaminants and deposits:

1. Air outlets and inlets (registers, grilles, and diffusers).
2. Supply, return, and exhaust fans including fan housings, plenums (except ceiling supply and return plenums), scrolls, blades or vanes, shafts, baffles, dampers, and drive assemblies.
3. Air-handling unit internal surfaces and components including mixing box, coil section, air wash systems, spray eliminators, condensate drain pans, humidifiers and dehumidifiers, filters and filter sections, and condensate collectors and drains.
4. Coils and related components.
5. Return-air ducts, dampers, actuators, and turning vanes except in ceiling plenums and mechanical equipment rooms.
6. Supply-air ducts, dampers, actuators, and turning vanes.
7. Dedicated exhaust and ventilation components and makeup air systems.

E. Mechanical Cleaning Methodology:

1. Clean metal duct systems using mechanical cleaning methods that extract contaminants from within duct systems and remove contaminants from building.
2. Use vacuum-collection devices that are operated continuously during cleaning. Connect vacuum device to downstream end of duct sections so areas being cleaned are under negative pressure.
3. Use mechanical agitation to dislodge debris adhered to interior duct surfaces without damaging integrity of metal ducts, duct liner, or duct accessories.
4. Clean fibrous-glass duct liner with HEPA vacuuming equipment; do not permit duct liner to get wet. Replace fibrous-glass duct liner that is damaged, deteriorated, or delaminated or that has friable material, mold, or fungus growth.
5. Clean coils and coil drain pans according to NADCA 1992. Keep drain pan operational. Rinse coils with clean water to remove latent residues and cleaning materials; comb and straighten fins.
6. Provide drainage and cleanup for wash-down procedures.
7. Antimicrobial Agents and Coatings: Apply EPA-registered antimicrobial agents if fungus is present. Apply antimicrobial agents according to manufacturer's written instructions after removal of surface deposits and debris.

3.10 START UP

A. Air Balance: Comply with requirements in Section 230593 "Testing, Adjusting, and Balancing for HVAC."

3.11 DUCT SCHEDULE

A. Fabricate ducts with galvanized sheet steel.

B. Supply Ducts:

1. Ducts Connected to Heat Pumps and Terminal Units :

   a. Pressure Class: Positive 1-inch wg.
   b. Minimum SMACNA Seal Class: C.
   c. SMACNA Leakage Class for Rectangular: 12.
   d. SMACNA Leakage Class for Round and Flat Oval: 12.

2. Ducts Connected to Constant-Volume Air-Handling Units :

   a. Pressure Class: Positive 2-inch wg .
   b. Minimum SMACNA Seal Class: B.
   c. SMACNA Leakage Class for Rectangular: 6>.

C. Return Ducts:

1. Ducts Connected to Heat Pumps and Terminal Units :

   a. Pressure Class: Positive or negative 1-inch wg.
   b. Minimum SMACNA Seal Class: C.
   c. SMACNA Leakage Class for Rectangular: 12.

2. Ducts Connected to Air-Handling Units :

   a. Pressure Class: Positive or negative 2-inch wg.
   b. Minimum SMACNA Seal Class: C.
   c. SMACNA Leakage Class for Rectangular: 6.

D. Exhaust Ducts:

1. Ducts Connected to Fans Exhausting (ASHRAE 62.1, Class 1 and 2) Air:

   a. Pressure Class: Negative 1-inch wg.
   b. Minimum SMACNA Seal Class: B if negative pressure, and A if positive pressure.
   c. SMACNA Leakage Class for Rectangular: 12.
   d. SMACNA Leakage Class for Round and Flat Oval: 6.

2. Ducts Connected to Air-Handling Units :

   a. Pressure Class: Positive or negative 2-inch wg.
   b. Minimum SMACNA Seal Class: B if negative pressure, and A if positive pressure.
   c. SMACNA Leakage Class for Rectangular: 6.

E. Liner:

1. Supply Air Ducts: Natural fiber, 1 inch thick.
2. Return Air Ducts: Natural fiber, 1 inch thick.
3. Exhaust Air Ducts: Natural fiber, 1 inch thick.

F. Elbow Configuration:

1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-2, "Rectangular Elbows."

   a. Velocity 1000 fpm or Lower:

      1) Radius Type RE 1 with minimum 0.5 radius-to-diameter ratio.
      2) Mitered Type RE 4 without vanes.

   b. Velocity 1000 to 1500 fpm:

      1) Radius Type RE 1 with minimum 1.0 radius-to-diameter ratio.
      2) Radius Type RE 3 with minimum 0.5 radius-to-diameter ratio and two vanes.
      3) Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-3, "Vanes and Vane Runners," and Figure 4-4, "Vane Support in Elbows."

   c. Velocity 1500 fpm or Higher:

      1) Radius Type RE 1 with minimum 1.5 radius-to-diameter ratio.
      2) Radius Type RE 3 with minimum 1.0 radius-to-diameter ratio and two vanes.
      3) Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-3, "Vanes and Vane Runners," and Figure 4-4, "Vane Support in Elbows."

2. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-2, "Rectangular Elbows."

   a. Radius Type RE 1 with minimum 1.5 radius-to-diameter ratio.
   b. Radius Type RE 3 with minimum 1.0 radius-to-diameter ratio and two vanes.
   c. Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-3, "Vanes and Vane Runners," and Figure 4-4, "Vane Support in Elbows."

3. Round Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-4, "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) Velocity 1000 fpm or Lower: 0.5 radius-to-diameter ratio and three segments for 90-degree elbow.
      2) Velocity 1000 to 1500 fpm: 1.0 radius-to-diameter ratio and four segments for 90-degree elbow.
      3) Velocity 1500 fpm or Higher: 1.5 radius-to-diameter ratio and five segments for 90-degree elbow.
      4) Radius-to Diameter Ratio: 1.5.

G. Branch Configuration:

1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-6, "Branch Connection."

   a. Rectangular Main to Rectangular Branch: 45-degree entry.
   b. Rectangular Main to Round Branch: Spin in.

2. Round and Flat Oval: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-5, "90 Degree Tees and Laterals," and Figure 3-6, "Conical Tees." Saddle taps are permitted in existing duct.

   a. Velocity 1000 fpm or Lower: 90-degree tap.
   b. Velocity 1000 to 1500 fpm: Conical tap.
   c. Velocity 1500 fpm or Higher: 45-degree lateral.

END OF SECTION 233113

SECTION 233300 - AIR DUCT ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Backdraft dampers.
2. Manual volume dampers.
3. Control dampers.
4. Fire dampers.
5. Flange connectors.
6. Turning vanes.
7. Duct-mounted access doors.
8. Flexible connectors.
9. Duct accessory hardware.

1.2 SUBMITTALS

A. Product Data: Catalog sheets and installation instructions for each manufactured product.

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."

B. Comply with AMCA 500-D testing for damper rating.

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.

1. Galvanized Coating Designation: G90.

C. Tie Rods: Galvanized steel, 1/4-inch minimum diameter for lengths 36 inches or less; 3/8-inch minimum diameter for lengths longer than 36 inches.

2.2 BACKDRAFT DAMPERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of 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.

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, with welded corners and mounting flange.

F. Blades: Multiple single-piece blades, maximum 6-inch width, 0.025-inch- thick, roll-formed aluminum with sealed edges.

G. Blade Action: Parallel.

H. Blade Seals: Extruded vinyl, mechanically locked.

I. Blade Axles:

1. Material: Aluminum.
2. Diameter: 0.20 inch.

J. Tie Bars and Brackets: Aluminum.

K. Return Spring: Adjustable tension.

L. Bearings: 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: Front mounted in sleeve.

a. Sleeve Thickness: 20-gage minimum.
b. Sleeve Length: 6 inches minimum.

4. Screen Mounting: Rear mounted.
5. Screen Material: Galvanized steel.
6. Screen Type: Bird.
7. 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. Rossi Hardware,
    f. METALAIRE, Inc.
    g. Nailor Industries Inc.
    h. Ruskin Company.
    i. 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-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-steel, 0.064 inch thick.

6. Blade Axles: Galvanized steel.
7. Bearings:

    a. Molded synthetic
    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 CONTROL DAMPERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. American Warming and Ventilating; a division of Mestek, Inc.
2. Arrow United Industries; a division of Mestek, Inc.
3. Cesco Products; a division of Mestek, Inc.
4. Duro Dyne Inc.
5. Flexmaster U.S.A., Inc.
6. Greenheck Fan Corporation.
7. Lloyd Industries, Inc.
8. M&I Air Systems Engineering; Division of M&I Heat Transfer Products Ltd.
9. McGill AirFlow LLC.
10. METALAIRE, Inc.
11. Metal Form Manufacturing, Inc.
12. Nailor Industries Inc.
13. NCA Manufacturing, Inc.
14. Ruskin Company.
15. Vent Products Company, Inc.
16. Young Regulator Company.

B. Frames:

1. Hat or U or Angle shaped.
2. Galvanized-steel channels, 0.064 inch thick.
3. Mitered and welded corners.

C. Blades:

1. Multiple blade with maximum blade width of 8 inches.
2. Opposed-blade design.
3. Galvanized steel.
4. 0.064 inch thick single skin.
5. Blade Edging: Closed-cell neoprene edging.
6. Blade Edging: Inflatable seal blade edging, or replaceable rubber seals.

D. Blade Axles: 1/2-inch- diameter; nonferrous metal; blade-linkage hardware of zinc-plated steel and brass; ends sealed against blade bearings.

1. Operating Temperature Range: From minus 40 to plus 200 deg F.

E. Bearings:

1. Molded synthetic.
2. 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.
3. Thrust bearings at each end of every blade.

2.5 FIRE DAMPERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Air Balance Inc.; a division of Mestek, Inc.
2. Arrow United Industries; a division of Mestek, Inc.
3. Cesco Products; a division of Mestek, Inc.
4. Greenheck Fan Corporation.
5. McGill AirFlow LLC.
6. METALAIRE, Inc.
7. Nailor Industries Inc.
8. NCA Manufacturing, Inc.
9. PHL, Inc.
10. Pottorff; a division of PCI Industries, Inc.
11. Prefco; Perfect Air Control, Inc.
12. Ruskin Company.
13. Vent Products Company, Inc.
14. Ward Industries, Inc.; a division of Hart & Cooley, Inc.

B. Type: Dynamic; rated and labeled according to UL 555 by an NRTL.

C. Closing rating in ducts up to 4-inch wg static pressure class and minimum 4000-fpm velocity.

D. Fire Rating: 1-1/2 hours.

E. Frame: Curtain type with blades outside airstream; fabricated with roll-formed, 0.034-inch-thick galvanized steel; with mitered and interlocking corners.

F. Mounting Sleeve: Factory- or field-installed, galvanized sheet steel.

1. Minimum Thickness: 0.138 inch thick, as indicated, and of length to suit application.
2. Exception: Omit sleeve where damper-frame width permits direct attachment of perimeter mounting angles on each side of wall or floor; thickness of damper frame must comply with sleeve requirements.

G. Mounting Orientation: Vertical.

H. Blades: Roll-formed, interlocking, 0.034-inch-thick, galvanized sheet steel. In place of interlocking blades, use full-length, 0.034-inch-thick, galvanized-steel blade connectors.

I. Heat-Responsive Device: Replaceable, 212 deg F rated, fusible links.

2.6 FLANGE CONNECTORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of 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.

2.7 TURNING VANES

A. Manufacturers: Subject to compliance with requirements, provide products by one of 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.

1. Acoustic Turning Vanes: Fabricate airfoil-shaped aluminum extrusions with perforated faces and fibrous-glass fill.

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: Double wall.

2.8 DUCT-MOUNTED ACCESS DOORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of 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" and Figures 2-10, "Duct Access Doors and Panels,"

1. Door:

   a. Double wall, rectangular.
   b. Galvanized sheet metal with insulation fill and thickness as indicated for duct pressure class.
   c. Vision panel.
   d. Hinges and Latches: 1-by-1-inch butt or piano hinge and cam latches.
   e. 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.

2.9 FLEXIBLE CONNECTORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of 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.

F. Thrust Limits: Combination coil spring and elastomeric insert with spring and insert in compression, and with a load stop. Include rod and angle-iron brackets for attaching to fan discharge and duct.

1. Frame: Steel, fabricated for connection to threaded rods and to allow for a maximum of 30 degrees of angular rod misalignment without binding or reducing isolation efficiency.
2. Outdoor Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
3. Minimum Additional Travel: 50 percent of the 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.
6. Elastomeric Element: Molded, oil-resistant rubber or neoprene.
7. Coil Spring: Factory set and field adjustable for a maximum of 1/4-inch (6-mm) movement at start and stop.

2.10 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 backdraft dampers at inlet of exhaust fans or exhaust ducts as close as possible to exhaust fan unless otherwise indicated.

B. Install volume dampers at points on supply, return, and exhaust systems where branches extend from larger ducts. Where dampers are installed in ducts having duct liner, install dampers with hat channels of same depth as liner, and terminate liner with nosing at hat channel.

1. Install steel volume dampers in steel ducts.

C. Set dampers to fully open position before testing, adjusting, and balancing.

D. Install test holes at fan inlets and outlets and elsewhere as indicated.

E. Install fire dampers according to UL listing.

F. 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. Adjacent to and close enough to fire dampers, to reset or reinstall fusible links. Access doors for access to fire dampers having fusible links shall be pressure relief access doors; and shall be outward operation for access doors installed upstream from dampers and inward operation for access doors installed downstream from dampers.
   3. Control devices requiring inspection.

G. Install access doors with swing against duct static pressure.

H. 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.

I. Label access doors according to Division 23 Section "Identification for HVAC Piping and Equipment" to indicate the purpose of access door.

J. Install flexible connectors to connect ducts to equipment.

A. Connect diffusers to ducts directly or with maximum 60-inch lengths of flexible duct clamped or strapped in place.

B. Install duct test holes where required for testing and balancing purposes.

C. 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 movement during start and stop of fans.

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. Operate fire dampers to verify full range of movement and verify that proper heat-response device is installed.
   4. Inspect turning vanes for proper and secure installation.

END OF SECTION 233300

SECTION 233423 - HVAC POWER VENTILATORS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Centrifugal roof ventilators.

1.2 SUBMITTALS

A. Product Data: For each type of product indicated.

1.3 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. AMCA Compliance: Fans shall have AMCA-Certified performance ratings and shall bear the AMCA-Certified Ratings Seal.

PART 2 - PRODUCTS

2.1 CENTRIFUGAL ROOF VENTILATORS

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. Greenheck Fan Corporation.
   2. Loren Cook Company.
   3. JencoFan.

B. Housing: Removable, spun-aluminum, dome top and outlet baffle; square, one-piece, aluminum base with venturi inlet cone.
   1. Hinged Subbase: Galvanized-steel hinged arrangement permitting service and maintenance.

C. Fan Wheels: Aluminum hub and wheel with backward-inclined blades.

D. Accessories:
   1. Disconnect Switch: Nonfusible type, with thermal-overload protection mounted inside fan housing, factory wired through an internal aluminum conduit.
   2. Bird Screens: Removable, 1/2-inch (13-mm-) mesh, aluminum or brass wire.
   3. Dampers: Counterbalanced, parallel-blade, backdraft dampers mounted in curb base; factory set to close when fan stops.

E. Roof Curbs: Galvanized steel; mitered and welded corners; 1-1/2-inch- thick, rigid, fiberglass insulation adhered to inside walls; and 1-1/2-inch wood nailer. Size as required to suit roof opening and fan base.

1. Configuration: Self-flashing without a cant strip, with mounting flange .
2. Overall Height: 8 inches.

2.2 MOTORS

A. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors 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: Comply with requirements for electrical devices and connections specified in Division 26 Sections.

B. Enclosure Type: Totally enclosed, fan cooled.

2.3 SOURCE QUALITY CONTROL

A. Certify sound-power level ratings according to 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. Certify fan performance ratings, including flow rate, pressure, power, air density, speed of rotation, and efficiency by factory tests according to AMCA 210, "Laboratory Methods of Testing Fans for Aerodynamic Performance Rating." Label fans with the AMCA-Certified Ratings Seal.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install units with clearances for service and maintenance.

B. Secure roof-mounted fans to roof curbs with cadmium-plated hardware. See Division 07 Section "Roof Accessories" for installation of roof curbs.

C. Label units according to requirements specified in Division 23 Section "Identification for HVAC Piping and Equipment." Nameplate shall indicate design CFM, static pressure and maximum fan RPM.

3.2 CONNECTIONS

A. Duct installation and connection requirements are specified in other Division 23 Sections. Drawings indicate general arrangement of ducts and duct accessories. Make final duct connections with flexible connectors.

B. Install ducts adjacent to power ventilators to allow service and maintenance.

C. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."

D. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

3.3 FIELD QUALITY CONTROL

A. Perform 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. Tests and Inspections:

1. Verify that shipping, blocking, and bracing are removed.
2. Verify that unit is secure on mountings and supporting devices and that connections to ducts and electrical components are complete. Verify that proper thermal-overload protection is installed in motors, starters, and disconnect switches.
3. Verify that cleaning and adjusting are complete.
4. Disconnect fan drive from motor, verify proper motor rotation direction, and verify fan wheel free rotation and smooth bearing operation. Reconnect fan drive system, align and adjust belts, and install belt guards.
5. Adjust belt tension.
6. Verify lubrication for bearings and other moving parts.
7. Remove and replace malfunctioning units and retest as specified above.

C. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

D. Prepare test and inspection reports.

3.4 ADJUSTING

A. Adjust belt tension.

B. Comply with requirements in Division 23 Section "Testing, Adjusting, and Balancing for HVAC" for testing, adjusting, and balancing procedures.

C. Replace fan and motor pulleys as required to achieve design airflow.

D. Lubricate bearings.

END OF SECTION 233423

SECTION 233713 - DIFFUSERS, REGISTERS, AND GRILLES

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. Rectangular and square ceiling diffusers.
2. Linear slot diffusers.
3. Fixed face registers.

B. Related Sections:
1. Section 233300 "Air Duct Accessories" for fire and smoke dampers and volume-control dampers not integral to diffusers, registers, and grilles.

1.3 ACTION 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.

1.4 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from Installers of the items involved:

1. Ceiling suspension assembly members.
2. Method of attaching hangers to building structure.
3. Size and location of initial access modules for acoustical tile.
4. Ceiling-mounted items including lighting fixtures, diffusers, grilles, speakers, sprinklers, access panels, and special moldings.

B. Source quality-control reports.

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:
   a. Titus.
   b. Price Industries.
   c. Anemostat Products; a Mestek company.
   d. Hart & Cooley Inc.
   e. Krueger.
   f. Nailor Industries Inc.
   g. Tuttle & Bailey.
2. Material: Steel.
3. Finish: Baked enamel.
4. Face Size: 24 by 24 inches, 20 by 20 inches, 12 by 12 inches.
5. Face Style: Plaque.
6. Mounting: T-Bar Lay-in and 9/16" Flat Tee Application, Surface Mount.
7. Pattern: Fixed.
8. Dampers: Radial opposed blade.
9. Accessories:
   a. Equalizing grid.

2.2 CEILING LINEAR SLOT OUTLETS

A. Linear Slot 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:
   a. Titus.
   b. Price Industries.
   c. Anemostat Products; a Mestek company.
   d. Hart & Cooley Inc.
   e. Krueger.
   f. Nailor Industries Inc.
   g. Tuttle & Bailey.
2. Material - Shell: Aluminum.
3. Material - Pattern Controller and Tees: Extruded Aluminum.
4. Finish - Face and Shell: Baked enamel, black.
5. Finish - Pattern Controller: Baked enamel, black.
6. Finish - Tees: Color selected by Architect.

2.3 REGISTERS

A. Fixed Face Register:

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. Titus.
   b. Anemostat Products; a Mestek company.
   c. Hart & Cooley Inc.
   d. Krueger.
   e. Nailor Industries Inc.
   f. Price Industries.
   g. Tuttle & Bailey.

2. Material: Steel.
3. Finish: Baked enamel, color selected by Architect.
4. Face Arrangement: 1/2-by-1/2-by-1/2-inch.
5. Core Construction: Integral.
6. Frame: 1-1/4 inches wide.
7. Mounting: Lay-in.
8. Damper Type: Adjustable opposed blade.

2.4 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 EXAMINATION

A. Examine areas where diffusers, registers, and grilles are to be installed for compliance with requirements for installation tolerances and other conditions affecting performance of equipment.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 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, registers, and grilles with airtight connections to ducts and to allow service and maintenance of dampers, air extractors, and fire dampers.

3.3 ADJUSTING

A. After installation, adjust diffusers, registers, and grilles to air patterns indicated, or as directed, before starting air balancing.

END OF SECTION 233713

SECTION 235700 - HEAT EXCHANGERS FOR HVAC

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 plate heat exchangers.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include rated capacities, operating characteristics, and furnished specialties and accessories.

B. Shop Drawings: Signed and sealed by a qualified professional engineer. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.

C. Delegated-Design Submittal: Details and design calculations for seismic restraints for heat exchangers.

1.4 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Equipment room, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Space for service and maintenance.
2. Structural members to which heat exchangers will be attached.

B. Seismic Qualification Certificates: For heat exchanger, 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 Heat Exchanger: Identify center of gravity and locate and describe mounting and anchorage provisions.

C. Source quality-control reports.

D. Field quality-control reports.

E. Sample Warranty: For manufacturer's warranty.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For heat exchangers to include in emergency, operation, and maintenance manuals.

1.6 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of domestic-water heat exchangers that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Structural failures including heat exchanger, storage tank, and supports.
b. Faulty operation of controls.
c. Deterioration of metals, metal finishes, and other materials beyond normal use.

2. Warranty Periods: From date of Substantial Completion.

a. Plate Heat Exchangers:
1) Plate-and-Frame Type: One year.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design seismic restraints for heat exchangers.

B. Seismic Performance: Heat exchangers 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 when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."
2. Component Importance Factor is 1.0.

2.2 GASKETED-PLATE HEAT EXCHANGERS

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. Polaris Plate Heat Exchangers.
2. GEA Plate Heat Exchangers System.
3. Alfa Laval Inc.

4. API Heat Transfer Inc.
5. APV; a brand of SPX Corporation.
6. Armstrong Pumps, Inc.
7. Delta T Heat Exchangers.
8. ITT Corporation; Bell & Gossett.
9. Mueller, Paul, Company.
10. TACO Incorporated.

B. Configuration: Freestanding assembly consisting of frame support, top and bottom carrying and guide bars, fixed and movable end plates, tie rods, individually removable plates, and one-piece gaskets.

C. Construction: Fabricate and label heat exchangers to comply with ASME Boiler and Pressure Vessel Code, Section VIII, "Pressure Vessels," Division 1.

D. Frame: The heat exchanger frame shall be constructed using either SA516-70 or A36 material. Entire frame shall be bolted together to allow unit to be field assembled, welded frames are not permitted. The unit cover plates shall be of sufficient thickness for the design pressure and shall have no welded reinforcements or stiffeners

1. Capacity to accommodate 20 percent additional plates.
2. Frame shall be primed using a zink-rich gray universal primer and finish painted blue using acrylic modified alkyd enamel.

E. Top and Bottom Carrying and Guide Bars: Plate carrying and guiding bar shall be carbon steel/Aluminum up to 8 inch connection and for above 8 inch connection, the surfaces of the carrying and guide bars that come into contact with the plates shall be 304 stainless steel.

1. Fabricate attachment of heat-exchanger carrying and guide bars with reinforcement strong enough to resist heat-exchanger movement during seismic event when heat-exchanger carrying and guide bars are anchored to building structure.

F. End-Plate Material: Painted carbon steel.

G. Tie Rods and Nuts: Steel or stainless steel.

H. Plate Material: 0.024 inch thick before stamping. Plates shall be individually field replaceable AISI 304 or AISI 316 stainless steel herringbone pattern channel corrugated plates. Plates to be provided with an alignment design, featuring an interlocking mechanism pressed into each plate, which interlocks with its adjacent plate providing a precise plate-to-plate alignment to assure proper sealing of the plate pack.

I. Gasket Materials: Gaskets shall be of glue free design and suitable for system fluids, either NBR or EPDM. The gaskets shall be designed in a pattern on each plate to distribute flow to alternating plate flow channels to create 100 percent counter flow between the mediums. Diagonal flow shall not be permitted. Relief grooves vented to the exterior of the unit shall be provided in gaskets at internal seals to indicate seal failure and cross contamination. Glued gasket design shall not be allowed

J. Piping Connections: Factory fabricated of materials compatible with heat-exchanger shell. Attach tappings to shell before testing and labeling.

1. NPS 2 and Smaller: Threaded ends according to ASME B1.20.1.
2. NPS 2-1/2 and Larger: Flanged ends according to ASME B16.5 for steel and stainless-steel flanges and according to ASME B16.24 for copper and copper-alloy flanges.

2.3 ACCESSORIES

A. Hangers and Supports:

1. Custom, steel supports for mounting on floor.

   a. Plate and frame type heat exchanger shall be furnished complete with gasketed plates supported in a frame with vertical and horizontal supports. Provide piping connections for each fluid stream on the same fixed end, permitting the heat exchanger to be opened for inspection, cleaning, replacement or addition of plates without removing the plates.

2. Field-fabricated steel supports to ensure both horizontal and vertical support of heat exchanger. Comply with requirements in Section 230529 "Hangers and Supports for HVAC Piping and Equipment."

B. Shroud: Steel sheet.

2.4 SOURCE QUALITY CONTROL

A. Factory Tests: Test and inspect heat exchangers according to ASME Boiler and Pressure Vessel Code, Section VIII, "Pressure Vessels," Division 1. Affix ASME label.

B. Hydrostatically test heat exchangers to minimum of one and one-half times pressure rating before shipment.

C. Heat exchangers will be considered defective if they do not pass tests and inspections.

D. Prepare test and inspection reports.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas for compliance with requirements for installation tolerances and for structural rigidity, strength, anchors, and other conditions affecting performance of heat exchangers.

B. Examine roughing-in for heat-exchanger piping to verify actual locations of piping connections before equipment installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 GASKETED-PLATE HEAT-EXCHANGER INSTALLATION

A. Install gasketed-plate heat exchanger on custom-designed wall supports anchored to structure as indicated on Drawings.

B. Install metal shroud over installed gasketed-plate heat exchanger according to manufacturer's written instructions.

3.3 CONNECTIONS

A. Comply with requirements for piping specified in other Section 232113 "Hydronic Piping" and Section 232116 Hydronic Piping Specialties." Drawings indicate general arrangement of piping, fittings, and specialties.

B. Maintain manufacturer's recommended clearances for plate replacement, service, and maintenance.

C. Install piping adjacent to heat exchangers to allow space for service and maintenance of heat exchangers. Arrange piping for easy removal of heat exchangers.

D. Install shutoff valves at heat-exchanger inlet and outlet connections.

E. Install relief valves on heat-exchanger heated-fluid connection and install pipe relief valves, full size of valve connection, to floor drain.

F. Install thermometer on heat-exchanger inlet and outlet piping, and install thermometer on heating-fluid inlet and outlet piping. Comply with requirements for thermometers specified in Section 230519 "Meters and Gages for HVAC Piping."

G. Install pressure gages on heat-exchanger and heating-fluid piping. Comply with requirements for pressure gages specified in Section 230519 "Meters and Gages for HVAC Piping."

3.4 FIELD QUALITY CONTROL

A. Perform the following tests and inspections with the assistance of a factory-authorized service representative:

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.

B. Heat exchanger will be considered defective if it does not pass tests and inspections.

C. Prepare test and inspection reports.

3.5 CLEANING

A. After completing system installation, including outlet fitting and devices, inspect exposed finish. Remove burrs, dirt, and construction debris and repair damaged finishes.

3.6 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain heat exchangers.

END OF SECTION 235700

SECTION 236500 - COOLING TOWERS

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. Closed-circuit, induced-draft combined-flow cooling towers.

1.3 DEFINITIONS

A. BMS: Building management system.

B. FRP: Fiber-reinforced polyester.

1.4 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Cooling towers shall withstand the effects of earthquake motions determined according to SEI/ASCE 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."

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include rated capacities, pressure drop, fan performance data, rating curves with selected points indicated, furnished specialties, and accessories.

   1. Maximum flow rate.
   2. Minimum flow rate.
   3. Drift loss as percent of design flow rate.
   4. Sound power levels in eight octave bands for operation with fans off, fans at minimum, and design speed.
   5. Performance curves for the following:

      a. Varying entering-water temperatures from design to minimum.
      b. Varying ambient wet-bulb temperatures from design to minimum.
      c. Varying water flow rates from design to minimum.
      d. Varying fan operation (off, minimum, and design speed).

6. Fan airflow, brake horsepower, and drive losses.
7. Pump flow rate, head, brake horsepower, and efficiency.
8. Motor amperage, efficiency, and power factor at 100, 75, 50, and 25 percent of nameplate horsepower.
9. Electrical power requirements for each cooling tower component requiring power.

B. Shop Drawings: Complete set of manufacturer's prints of cooling tower assemblies, control panels, sections and elevations, and unit isolation. Include the following:

1. Assembled unit dimensions.
2. Weight and load distribution.
3. Required clearances for maintenance and operation.
4. Sizes and locations of piping and wiring connections.
5. Wiring Diagrams: For power, signal, and control wiring.

C. Delegated-Design Submittal: For cooling tower support structure indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1. Detail fabrication and assembly of support structure.
2. Vibration Isolation Base Details: Detail fabrication including anchorages and attachments to structure and to supported equipment. Include adjustable motor bases, rails, and frames for equipment mounting.

1.6 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Floor 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. Structural supports.
2. Piping roughing-in requirements.
3. Wiring roughing-in requirements, including spaces reserved for electrical equipment.
4. Access requirements, including working clearances for mechanical controls and electrical equipment, and tube pull and service clearances.

B. Certificates: For certification required in "Quality Assurance" Article.

C. Seismic Qualification Certificates: For cooling towers, accessories, and components, from manufacturers.

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.

D. Source quality-control reports.

E. Field quality-control reports.

F. Startup service reports.

G. Warranty: Sample of special warranty.

1.7 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For each cooling tower to include in emergency, operation, and maintenance manuals.

1.8 QUALITY ASSURANCE

A. Testing Agency Qualifications: Certified by CTI.

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. CTI Certification: Cooling tower thermal performance according to CTI STD 201, "Certification Standard for Commercial Water-Cooling Towers Thermal Performance."

1.9 COORDINATION

A. Coordinate sizes and locations of equipment supports, with actual equipment provided.

1.10 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace the following components of cooling towers that fail in materials or workmanship within specified warranty period:

1. Fan assembly including fan, drive, and motor, sheaves and associated supports
2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 CLOSED-CIRCUIT, INDUCED-DRAFT, COMBINED-FLOW COOLING TOWERS

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. Baltimore Aircoil Company; Model FXV.
2. Delta Cooling Tower, Tower Tech
3. Marley Cooling Technologies; Model MH.

B. Fabricate cooling tower mounting base with reinforcement strong enough to resist cooling tower movement during a seismic event when cooling tower is anchored to field support structure.

C. Cooling tower designed to resist wind load of 30 lbf/sq. ft.

D. Casing and Frame:

Casing and Frame Material: Galvanized steel, ASTM A 653, G235 coating, hot-dip galvanized steel prepared in a four-step (clean, pre-treat, rinse, dry) process with an electrostatically sprayed, thermosetting, hybrid polymer fuse-bonded to the substrate during a thermally activated curing stage and monitored by a 23-step quality assurance program or Type 304 Stainless steel.

1. Fasteners: Stainless steel.
2. Joints and Seams: Sealed watertight.
3. Welded Connections: Continuous and watertight.

E. Collection Basin: Configure tower for installation with a field-constructed collection basin.

F. Collection Basin:

1. Material: The cold water basin shall be protected with the TriArmor® Corrosion Protection System. The system shall consist of G-235 galvanized steel encapsulated with a thermosetting hybrid polymer further protected by a polyurethane liner factory applied to all submerged surfaces. The polyurethane barrier shall seal all factory seams in the cold water basin to ensure a corrosion resistant and water tight construction, and shall be warranted against leaks and corrosion for five (5) years.
2. Strainer: The strainer and anti-vortexing device shall be constructed from type 304 minimum stainless steel to prevent corrosion.
3. Overflow and drain connections.
4. Makeup water connection.

G. Electric/Electronic, Collection Basin Water-Level Controller with Solenoid Valve:

1. Enclosure: NEMA 250, Type 4.
2. Sensor: Solid-state controls with multiple electrode probes and relays factory wired to a terminal strip to provide control of water makeup valve, low- and high-level alarms, and output for shutoff of pump on low level.
3. Electrode Probes: Stainless steel.
4. Water Stilling Chamber: PVC pipe.
5. Solenoid Valve: Slow closing with stainless-steel body, controlled and powered through level controller in response to water-level set point.
6. Electrical Connection Requirements: 120 V, single phase, 60 Hz.

H. Electric Basin Heater:

1. Stainless-Steel Electric Immersion Heaters: Installed in a threaded coupling on the side of the collection basin.
2. Heater Control Panel: Mounted on the side of each cooling tower cell.
3. Enclosure: NEMA 250, Type 4.
4. Magnetic contactors controlled by a temperature sensor/controller to maintain collection basin water-temperature set point. Water-level probe shall monitor cooling tower water level and de-energize the heater when the water reaches low-level set point.
5. Control-circuit transformer with primary and secondary side fuses.
6. Terminal blocks with numbered and color-coded wiring to match wiring diagram.

7. Single-point, field-power connection to a nonfused disconnect switch and heater branch circuiting complying with NFPA 70.
8. Factory Wiring Method: Metal raceway for factory-installed wiring outside of enclosures, except make connections to each electric basin heater with liquidtight conduit.

I. Pressurized Water Distribution Piping: Main header and lateral branch piping designed for even distribution over heat-exchanger coil or fill throughout the flow range without the need for balancing valves and for connecting individual, removable, nonclogging spray nozzles.

1. Pipe Material: PVC.
2. Spray Nozzle Material: Plastic.
3. Piping Supports: Corrosion-resistant hangers and supports to resist movement during operation and shipment.

J. Recirculating Piping: PVC.

K. Spray Pump: Close-coupled, end-suction, single-stage, bronze-fitted centrifugal pump; with suction strainer and flow balancing valve, and mechanical seal suitable for outdoor service.

1. General Requirements for Spray Pump Motor: Comply with NEMA designation and temperature-rating requirements specified in Section 230513 "Common Motor Requirements for HVAC Equipment" and not indicated below.
2. Motor Enclosure: Totally enclosed fan cooled (TEFC)
3. Energy Efficiency: Comply with ASHRAE/IESNA 90.1.
4. Service Factor: 1.0.

L. Fill:

1. Materials: PVC, with maximum flame-spread index of 5 according to ASTM E 84.
2. Fabrication: Fill-type sheets fabricated, formed, and bonded together after forming into removable assemblies that are factory installed by manufacturer.
3. Fill Material Operating Temperature: Suitable for entering-water temperatures up through 120 deg F.

M. Heat-Exchanger Coils:

1. Tube and Tube Sheet Materials: Stainless-steel tube and sheet.
2. Heat-Exchanger Arrangement: Serpentine tubes; and sloped for complete drainage of fluid by gravity.
3. ASME Compliance: Designed, manufactured, and tested according to ASME Boiler and Pressure Vessel Code: Section VIII, Division 1 and bearing ASME "U" stamp; and sloped for complete drainage of fluid by gravity.

N. Drift Eliminator:

1. Material: PVC; with maximum flame-spread index of **5** according to ASTM E 84.
2. UV Treatment: Inhibitors to protect against damage caused by UV radiation.
3. Configuration: Multipass, designed and tested to reduce water carryover to achieve performance indicated.
4. Fill Drift Eliminators: Separate and removable from fill.

5. Heat-Exchanger Coil Drift Eliminators: Located on discharge side and removable.

O. Air-Intake Louvers:

1. Material: FRP.
2. UV Treatment: Inhibitors to protect against damage caused by UV radiation.
3. Louver Blades: Arranged to uniformly direct air into cooling tower, to minimize air resistance, and to prevent water from splashing out of tower during all modes of operation including operation with fans off.

P. Axial Fan: Balanced at the factory after assembly.

1. Blade Material: Aluminum.
2. Hub Material: Aluminum.
3. Blade Pitch: Field adjustable.
4. Protective Enclosure: Removable, galvanized-steel, wire-mesh screens complying with OSHA regulations.
5. Fan Shaft Bearings: Self-aligning ball or roller bearings with moisture-proof seals and premium, moisture-resistant grease suitable for temperatures between minus 20 and plus 300 deg F. Bearings designed for an L-10 life of 80,000 hours.
6. Bearings Grease Fittings: Extended lubrication lines to an easily accessible location.

Q. Belt Drive:

1. Service Factor: based on motor nameplate horsepower.
2. Sheaves: Fan and motor shafts shall have taper-lock sheaves fabricated from corrosion-resistant materials.
3. Belt: One-piece, multigrooved, solid-back belt.
4. Belt Material: Oil resistant, nonstatic conducting, and constructed of neoprene polyester cord.
5. Belt-Drive Guard: Comply with OSHA regulations.
6. Two-Motor, Single-Fan Drive:

    a. Two single-speed motors per fan, one sized for full speed and load and the other sized for 67 percent of full-load speed.
    b. Each motor with belt drive and configured for operation when other motor fails.
    c. Controls and wiring same as two-speed, two-winding motor.

R. Fan Motor:

1. General Requirements for Fan Motors: Comply with NEMA designation and temperature-rating requirements specified in Section 230513 "Common Motor Requirements for HVAC Equipment" and not indicated below.
2. Motor Enclosure: Totally enclosed air over (TEAO).
3. Energy Efficiency: NEMA Premium Efficient.
4. Service Factor: 1.15.
5. Insulation: Class F.
6. Variable-Speed Motors: Inverter-duty rated per NEMA MG-1, Section IV, "Performance Standard Applying to All Machines," Part 31, "Definite-Purpose, Inverter-Fed, Polyphase Motors."

7. Motor Location: Mounted outside of cooling tower casing and cooling tower discharge airstream.
8. Severe-duty rating with the following features:

    a. Rotor and stator protected with corrosion-inhibiting epoxy resin.
    b. Double-shielded, vacuum-degassed bearings lubricated with premium, moisture-resistant grease suitable for temperatures between minus 20 and plus 300 deg F
    c. Internal heater automatically energized when motor is de-energized.

9. Motor Base: Adjustable, or other suitable provision for adjusting belt tension.

S. Vibration Switch: For each fan drive.

1. Enclosure: NEMA 250, Type 4.
2. Vibration Detection: Sensor with a field-adjustable, acceleration-sensitivity set point in a range of 0 to 1 g and frequency range of 0 to 3000 cycles per minute. Cooling tower manufacturer shall recommend switch set point for proper operation and protection.
3. Provide switch with manual-reset button hardwired connection to fan motor electrical circuit.
4. Switch shall, on sensing excessive vibration, signal an alarm through the BMS and shut down the fan.

T. Controls: Comply with requirements in Section 230900 "Instrumentation and Control for HVAC."

U. Control Package: Factory installed and wired, and functionally tested at factory before shipment.

1. NEMA 250, Type 4 enclosure with removable internally mount backplate.
2. Control-circuit transformer with primary and secondary side fuses.
3. Terminal blocks with numbered and color-coded wiring to match wiring diagram. Spare wiring terminal block for connection to external controls or equipment.
4. Electric basin heaters with temperature control and low-water-level safety switch for each cell, complying with requirements in "Electric Basin Heater" Paragraph.
5. Vibration switch for each fan, complying with requirements in "Vibration Switch" Paragraph.
6. Single-point, field-power connection to a nonfused disconnect switch.

    a. Branch power circuit to each motor and electric basin heater and to controls with a disconnect switch or circuit breaker.
    b. NEMA-rated motor controller, hand-off-auto switch, and overcurrent protection for each motor. Provide variable frequency controller with manual bypass and line reactors for each variable-speed motor indicated.

7. Factory-installed wiring outside of enclosures shall be in metal raceway, except make connections to each motor and electric basin heater with liquidtight conduit.
8. Visual indication of status and alarm with momentary test push button for each motor.
9. Audible alarm and silence switch.
10. Visual indication of elapsed run time, graduated in hours for each motor.
11. Cooling tower shall have hardware to enable BMS to remotely monitor and display the following:

a. Operational status of each motor.
b. Position of dampers.
c. Cooling tower leaving-fluid temperature.
d. Fan vibration alarm.
e. Collection basin high- and low-water-level alarms.

V. Personnel Access Components:

1. Doors: Large enough for personnel to access cooling tower internal components from both cooling tower end walls. Doors shall be operable from both sides of the door.
2. External Ladders with Safety Cages: Aluminum, galvanized- or stainless-steel, fixed ladders with ladder extensions to access external platforms and top of cooling tower from adjacent grade without the need for portable ladders. Comply with 29 CFR 1910.27.
3. External Platforms with Handrails: Aluminum, FRP, or galvanized-steel bar grating at cooling tower access doors when cooling towers are elevated and not accessible from grade.

2.2 SOURCE QUALITY CONTROL

A. Verification of Performance: Test and certify cooling tower performance according to CTI STD 201, "Certification Standard for Commercial Water-Cooling Towers Thermal Performance."

B. Factory pressure test heat exchangers after fabrication and prove to be free of leaks.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Before cooling tower installation, examine roughing-in for tower support, anchor-bolt sizes and locations, piping, and electrical connections to verify actual locations, sizes, and other conditions affecting tower performance, maintenance, and operation.

1. Cooling tower locations indicated on Drawings are approximate. Determine exact locations before roughing-in for piping and electrical connections.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install cooling towers on support structure indicated.

B. Equipment Mounting:
1. Comply with requirements for vibration isolation and seismic control devices specified in Section 230548 "Vibration and Seismic Controls for HVAC."

C. Install anchor bolts to elevations required for proper attachment to supported equipment.

D. Maintain manufacturer's recommended clearances for service and maintenance.

E. Loose Components: Install electrical components, devices, and accessories that are not factory mounted.

3.3 CONNECTIONS

A. Piping installation requirements are specified in other Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to cooling towers to allow service and maintenance.

C. Install flexible pipe connectors at pipe connections of cooling towers mounted on vibration isolators.

D. Provide drain piping with valve at cooling tower drain connections and at low points in piping.

E. Connect cooling tower overflows and drains, and piping drains to sanitary sewage system.

F. Domestic Water Piping: Comply with applicable requirements in Section 221116 "Domestic Water Piping." Connect to water-level control with shutoff valve and union, flange, or mechanical coupling at each connection.

G. Supply and Return Piping: Comply with applicable requirements in Section 232113 "Hydronic Piping" and Section 232116 Hydronic Piping Specialties." Connect to entering cooling tower connections with shutoff valve, balancing valve, thermometer, plugged tee with pressure gage, flow meter, and drain connection with valve. Connect to leaving cooling tower connection with shutoff valve. Make connections to cooling tower with a flange.

3.4 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.

B. Tests and Inspections: Comply with CTI ATC 105, "Acceptance Test Code for Water Cooling Towers."

C. Cooling towers will be considered defective if they do not pass tests and inspections.

D. Prepare test and inspection reports.

3.5 STARTUP SERVICE

A. Engage a factory-authorized service representative to perform startup service.

B. Inspect field-assembled components, equipment installation, and piping and electrical connections for proper assemblies, installations, and connections.

C. Obtain performance data from manufacturer.

1. Complete installation and startup checks according to manufacturer's written instructions and perform the following:

    a. Clean entire unit including basins.
    b. Verify that accessories are properly installed.
    c. Verify clearances for airflow and for cooling tower servicing.
    d. Check for vibration isolation and structural support.
    e. Lubricate bearings.
    f. Verify fan rotation for correct direction and for vibration or binding and correct problems.
    g. Adjust belts to proper alignment and tension.
    h. Operate variable-speed fans through entire operating range and check for harmonic vibration imbalance. Set motor controller to skip speeds resulting in abnormal vibration.
    i. Check vibration switch setting. Verify operation.
    j. Verify water level in tower basin. Fill to proper startup level. Check makeup water-level control and valve.
    k. Verify operation of basin heater and control.
    l. Verify that cooling tower air discharge is not recirculating air into tower or HVAC air intakes. Recommend corrective action.
    m. Replace defective and malfunctioning units.

D. Start cooling tower and associated water pumps. Follow manufacturer's written starting procedures.

E. Prepare a written startup report that records the results of tests and inspections.

3.6 ADJUSTING

A. Set and balance water flow to each tower inlet.

B. Adjust water-level control for proper operating level.

3.7 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain cooling towers.

END OF SECTION 236500

SECTION 237433 - DEDICATED OUTDOOR-AIR UNITS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes factory-packaged and engineered units capable of supplying 100 percent outdoor air with energy recovery and providing cooling and heating with the following features in each unit:

1. Stainless steel brazed Plate Heat Exchanger for Glycol-to-Refrigerant Heat Exchanger (One per Compressor)
2. Two High Efficiency Scroll Compressors
3. Water-to Air Refrigeration Heat Pump System Utilizing R-410A
4. Refrigeration Coil with Bronze-Glow Protective Coating
5. Supply Fan Shall Be Backward Incline Plenum Fans
6. Internally Isolated Fan Connections to Unit Casing Eliminating the Need for External Flexible Duct Connections
7. Air-to-Air Energy Recovery Module With Epoxy-Coated Aluminum Plates. Additional lacquer applied to reduce cross-contamination to 0.01%.
8. Stainless Steel Internal Ductwork Construction
9. Low Leakage Isolation Air Dampers At Each Air Inlet/Outlet
10. Air Temperature Sensor at Every Change in Process Parameters
11. Double Wall Stainless Steel Outdoor Type Insulated Enclosure With Hinges, Gaskets, and Quarter-Turn Latches
12. 2" Thick Air Filters With MERV 7 Efficiency
13. Factory installed DDC Controller with Bacnet Communications
14. NEMA 4X Stainless Steel Electrical Control Panels
15. Factory-Assisted Start-up Services

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product. Include rated capacities, operating characteristics, and furnished specialties and accessories.

B. Shop Drawings:

1. Include plans, elevations, sections, and attachment 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. Prepare the following by or under the supervision of a qualified professional engineer:

   a. Mounting Details: For securing and flashing roof curb to roof structure. Indicate coordinating requirements with roof membrane system.
   b. Include diagrams for power, signal, and control wiring.

1.4 INFORMATIONAL SUBMITTALS

A. Startup service reports.

B. Sample Warranty: For special warranty.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For units to include in emergency, operation, and maintenance manuals.

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. Fan Belts: Two sets for each belt-driven fan.
2. Filters: Two sets for each unit.

1.7 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of units that fail in materials or workmanship within specified warranty period. Labor and shipping charges are the responsibility of the installing contractor. All warranties begin at start-up or 6-months from shipping, whichever is sooner.

1. Warranty Period for Compressors: Five years.
2. Warranty Period for Heat Exchangers: Five years.
3. All other parts: One year.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements provide products by one of the following manufacturers:

1. Task Applied Products Inc.
2. Valent Air Management Systems.
3. Rapid Engineering.

2.2 PERFORMANCE REQUIREMENTS

A. General Fabrication Requirements: Comply with requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment," and Section 7 - "Construction and System Start-up."

B. Cabinet Thermal Performance:

1. Maximum Overall U-Value: Comply with requirements in ASHRAE/IESNA 90.1.
2. Maximum Overall U-Value: 0.10 Btu/h x sq. ft. x deg F.
3. Include effects of metal-to-metal contact and thermal bridges in the calculations.

C. Cabinet Surface Condensation:

1. Cabinet shall have additional insulation and vapor seals if required to prevent condensation on the interior and exterior of the cabinet.
2. Portions of cabinet located downstream from the refrigeration coil shall have a thermal break at each thermal bridge between the exterior and interior casing to prevent condensation from occurring on the interior and exterior surfaces. The thermal break shall not compromise the structural integrity of the cabinet.

D. Maximum Cabinet Leakage: 0.5 percent of the total supply-air flow at a pressure rating equal to the fan shut-off pressure.

E. Cabinet Deflection Performance:

1. Walls and roof deflection shall be within 1/200 of the span at the design working pressure equal to the fan shut-off pressure. Deflection limits shall be measured at any point on the surface.
2. Floor deflections shall be within 1/240 of the span considering the worst-case condition caused by the following:

   a. Service personnel.
   b. Internal components.
   c. Design working pressure defined for the walls and roof.

F. Electrical components, devices, and accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.3 CABINET

A. Construction: double wall.

B. Exterior Casing Material: stainless steel.

C. Interior Casing Material: stainless steel.

D. Lifting and Handling Provisions: Factory-installed shipping skids and lifting lugs.

E. Base Rails: Stainless-steel rails for mounting on roof curb or pad as indicated.

F. Access for Inspection, Cleaning, and Maintenance: Comply with requirements in ASHRAE 62.1.

1. Service Doors: Hinged access doors with gaskets. Material and construction of doors shall match material and construction of cabinet in which doors are installed.

G. Roof: Standing seam or membrane; sloped to drain water.

H. Floor: Reinforced, metal surface; reinforced to limit deflection when walked on by service personnel. Insulation shall be below metal walking surface.

I. Cabinet Insulation:

1. Type: Fibrous-glass duct lining complying with ASTM C 1071, Type II.
2. Thickness: 1 inch.
3. Insulation Adhesive: Comply with ASTM C 916, Type I.
4. Mechanical Fasteners: Suitable for adhesive, mechanical, or welding attachment to casing without damaging liner and without causing air leakage when applied as recommended by manufacturer.

J. Condensate Drain Pans:

1. Shape: Rectangular, with 1 percent slope in at least two planes to direct water toward drain connection.
2. Size: Large enough to collect condensate from cooling coils including coil piping connections, coil headers, and return bends.

   a. Length: Extend drain pan downstream from leaving face to comply with ASHRAE 62.1.
   b. Depth: A minimum of 2 inches.

3. Configuration: Single wall.
4. Material: Stainless-steel sheet.
5. Drain Connection:

   a. Located on both ends of pan, at lowest point of pan.
   b. Terminated with threaded nipple.
   c. Minimum Connection Size: NPS 1.

6. Units with stacked coils shall have an intermediate drain pan to collect condensate from top coil.

K. Surfaces in Contact with Airstream: Stainless Steel.

2.4 SUPPLY FAN

A. Plenum Fan Type: Single width, non-overloading, with backward-inclined or airfoil blades.

1. Fan Wheel Material: Aluminum; attached directly to motor shaft.
2. Fan Wheel Drive and Arrangement: Direct drive, AMCA Arrangement 4.

3. Fan panel and frame Material: Powder-coated aluminum for spark-resistant construction.
4. Fan Enclosure: Easily removable enclosure around rotating parts.
5. Fan Balance: Precision balance fan below 0.08 inch/s at design speed with filter in.

B. Service Factor for Belt Drive Applications: Multiple V-belt drive with matching fan pulley and adjustable motor sheaves and belt assembly with minimum 1.4 service factor.

C. Motors:

1. Comply with NEMA designation, temperature rating, service factor, and efficiency requirements for motors specified in Section 15058 "Common Motor Requirements for HVAC Equipment."
2. Marine Duty – TEFC.
3. Enclosure Materials: Cast iron.
4. Efficiency: Premium efficient.
   Service Factor: 1.0.

D. Mounting: Fan wheel, motor, and drives shall be mounted to fan casing with spring isolators.

2.5 COOLING COILS

A. Capacity Ratings: Comply with ASHRAE 33 and ARI 410 and coil bearing the ARI label.

B. Coil Casing Material: Manufacturer's standard material.

C. Tube Material: Copper.

D. Tube Header Material: Copper.

E. Fin Material: Aluminum.

F. Fin and Tube Joints: Mechanical bond.

G. Leak Test: Coils shall be leak tested with air underwater.

H. Refrigerant Coil Capacity Reduction: Circuit coils for interleaved control.

I. Refrigerant Coil Suction and Distributor Header Materials: Seamless copper tube with brazed joints.

J. Coating: Phenolic epoxy corrosion-protection coating after assembly.

2.6 REFRIGERATION SYSTEM

A. Comply with requirements in ASHRAE 15, "Safety Standard for Refrigeration Systems."

B. Refrigerant Charge: Factory charged with refrigerant and filled with oil.

C. Compressors: Scroll compressors with integral vibration isolators, internal overcurrent and over-temperature protection, internal pressure relief, and crankcase heater.

D. Refrigerant: R-410A.

1. Classified as Safety Group A1 according to ASHRAE 34.
2. Provide unit with operating charge of refrigerant.

E. Refrigeration System Specialties:

1. Sealed Refrigerant Circuit: Charge with R-410A refrigerant.
2. Filter-Dryer: Factory installed to clean and dehydrate the refrigerant circuit.
3. Charging Connections: Service fittings on suction and liquid for charging and testing on each circuit.
4. Reversing Valve: Four-way, solenoid-activated valve designed to be fail-safe in heating position with replaceable magnetic coil.
5. Compressor: Hermetic scroll, single-stage compressor installed on vibration isolators and housed in an acoustically treated enclosure with factory-installed safeties as follows:

    a. Antirecycle timer.
    b. High-pressure cutout.
    c. Low-pressure cutout or loss of charge switch.
    d. Internal thermal-overload protection.
    e. Condensate overflow switch to stop compressor with high condensate level in condensate drain pan.
    f. Air-coil, low-temperature switch.

6. Refrigerant Piping Materials: ASTM B 743 copper tube with wrought-copper fittings and brazed joints.
7. Pipe Insulation: Refrigerant minimum 3/8-inch- thick, flexible elastomeric insulation on piping exposed to airflow through the unit. Maximum 25/50 flame-spread/smoke-developed indexes according to ASTM E 84.
8. Refrigerant Metering Device: Thermal-expansion valve.
9. Refrigerant Metering Device: Dual-port, thermal-expansion valve to allow specified operation with entering-water temperatures from 25 to 125 deg F.
10. Hot-Gas Reheat Valve: Modulating..

F. Water Circuit:

1. Refrigerant-to-Glycol Heat Exchangers:

    a. Stainless-steel, brazed-plate heat exchanger is leak tested to 450 psig on refrigerant side and 400 psig on glycol side. Factory-mount heat exchanger in unit on resilient rubber vibration isolators.

2. Glycol-Regulating Valves: Limit glycol flow through refrigerant-to-glycol heat exchanger, and control head pressure on compressor during cooling and heating.

G. Safety Controls:
1. Overcurrent protection for compressor motor.

2.7 AIR-TO-AIR ENERGY RECOVERY MODULE

A. Low weight, cross-flow plate air-to-air heat exchanger

B. The maximum leakage to be 0.01% of air flow. Double wall aluminum plates shall be epoxy coated for corrosion protection.. Added lacquer shall be applied to reduce cross contamination.

C. Heat exchanger shall have painted framework and closed plated cutting edges. The heat exchanger shall have individual tightness test with protocol report.

D. Heat exchanger to be thermally insulated to prevent condensation on exterior walls.

2.8 OUTDOOR-AIR INTAKE HOOD

A. Type: Manufacturer's standard hood or louver.

B. Materials: Match cabinet.

C. Bird Screen: Comply with requirements in ASHRAE 62.1.

D. Configuration: Designed to inhibit wind-driven rain and snow from entering unit.

2.9 FILTERS

A. Charcoal filter – 2" thick.

B. Disposable Panel Filters:

1. Comply with NFPA 90A.
2. Factory-fabricated, viscous-coated, flat-panel type.
3. Thickness: 2 inches.
4. Minimum Efficiency: 35%, according to ASHRAE 52.2.
5. Media: Interlaced glass fibers sprayed with nonflammable adhesive.

2.10 ELECTRICAL POWER CONNECTIONS

A. General Electrical Power Connection Requirements: Factory-installed and -wired switches, motor controllers, transformers, and other necessary electrical devices shall provide a single-point field power connection to unit.

B. Enclosure: NEMA 250, Type 3R, mounted in unit with hinged access door in unit cabinet having a lock and key or padlock and key,

C. Wiring: Numbered and color-coded to match wiring diagram.

D. Wiring Location: Install factory wiring outside an enclosure in a raceway.

E. Power Interface: Field power interface shall be to NEMA KS 1, heavy-duty, nonfused disconnect switch.

F. Factory Wiring: Branch power circuit to each motor and to controls with one of the following disconnecting means:

1. UL 489, motor-circuit protector (circuit breaker) with field-adjustable, short-circuit trip coordinated with motor locked-rotor amperes.

G. Factory-Mounted, Overcurrent-Protection Service: For each motor.

H. Transformer: Factory mounted with primary and secondary fuses and sized with enough capacity to operate electrical load plus spare capacity.

I. Controls: Factory wire unit-mounted controls where indicated.

J. Lights: Factory wire unit-mounted lights.

K. Receptacle: Factory wire unit-mounted, ground fault interrupt (GFI) duplex receptacle.

L. Control Relays: Auxiliary and adjustable time-delay relays.

2.11 CONTROLS

A. Control Wiring: Factory wire connection for controls' power supply.

B. Control Devices: Sensors, transmitters, relays, switches, detectors, operators, actuators, and valves shall be manufacturer's standard items to accomplish indicated control functions.

C. Unit-Mounted LCD Status Panel with keypad.

D. Control Dampers:

1. Damper Location: Factory installed inside unit for ease of blade axle and bushing service. Arrange dampers located in a mixing box to achieve convergent airflow to minimize stratification.
2. Damper Leakage: Comply with requirements in AMCA 500-D. Leakage shall not exceed 3.0 cfm per sq. ft. at a static-pressure differential of 4.0 inches water column when a torque of 5 inch pounds per sq. ft. is applied to the damper jackshaft.
3. Damper Rating: Rated for close-off pressure equal to the fan shutoff pressure.
4. Damper Label: Bear the AMCA seal for both air leakage and performance.
5. Blade Configuration: Unless otherwise indicated, use parallel blade configuration for two-position control and equipment isolation service and use modulating control when mixing two airstreams. For other applications, use an opposed-blade configuration.
6. Damper Frame Material: Extruded aluminum.
7. Blade Type: Single-thickness metal reinforced with multiple V-grooves.
8. Blade Material: Extruded aluminum.
9. Maximum Blade Width: 6 inches.
10. Maximum Blade Length: 48 inches.
11. Blade Seals: Replaceable, continuous perimeter vinyl seals and jambs with stainless-steel compression-type seals.
12. Bearings: Thrust bearings for vertical blade axles.

E. Damper Operators:

1. Factory-installed electric operator for each damper assembly with one operator for each damper assembly mounted to the damper frame.
2. Operator capable of shutoff against fan pressure and able to operate the damper with sufficient reserve power to achieve smooth modulating action and proper speed of response at the velocity and pressure conditions to which the damper is subjected.
3. Maximum Operating Time: Open or close damper 90 degrees in 90 seconds.
4. Adjustable Stops: For both maximum and minimum positions.
5. Position Indicator and Graduated Scale: Factory installed on each actuator with words "OPEN" and "CLOSED," or similar identification, at travel limits.
6. Spring-return operator to fail-safe; either closed or open as required by application.
7. Operator Type: Direct coupled, designed for minimum 60,000 full-stroke cycles at rated torque.
8. Position feedback Signal: For remote monitoring of damper position.
9. Coupling: V-bolt and V-shaped, toothed cradle.
10. Circuitry: Electronic overload or digital rotation-sensing circuitry.

F. Integral Smoke Alarm: Smoke detector installed in supply air, provided by the electrician.

G. DDC Temperature Control: Standalone control module with Bacnet communications.

2.12 ACCESSORIES

A. Service Lights and Switch: Factory installed in each accessible section with weatherproof cover. Factory wire lights to a single-point field connection.

B. Duplex Receptacle: Factory mounted in unit supply-fan section and refrigeration section, with 20 amp 120 V GFI duplex receptacle and weatherproof cover.

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 piping, ducts, and electrical systems to verify actual locations of connections before equipment installation.

C. Examine equipment supports for suitable conditions where units will be installed.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Comply with manufacturer's rigging and installation instructions for unloading units and moving to final locations.

B. Equipment Mounting:

1. Install air units on cast-in-place concrete equipment bases. Comply with requirements for equipment bases and foundations

C. Install wall- and duct-mounted sensors furnished by manufacturer for field installation. Install control wiring and make final connections to control devices and unit control panel.

D. Install separate devices furnished by manufacturer and not factory installed.

E. Install new filters at completion of equipment installation and before testing, adjusting, and balancing.

F. Install drain pipes from unit drain pans to sanitary drain.

1. Drain Piping: Drawn-temper copper water tubing complying with ASTM B 88, Type L, with soldered joints.
2. Drain Piping: Schedule 40 PVC pipe complying with ASTM D 1785, with solvent-welded fittings.

a. PVC solvent cement shall have a VOC content of 510 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
b. Adhesive primer shall have a VOC content of 550 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
c. Solvent cement and adhesive primer shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

3. Pipe Size: Same size as condensate drain pan connection.

3.3 CONNECTIONS

A. Where installing piping adjacent to units, allow space for service and maintenance.

B. Hydronic Piping Connections:

1. Install shutoff valve and union or flange on each supply connection and install balancing valve and union or flange on each return connection.

C. Duct Connections:

1. Comply with requirements in Section 233113 "Metal Ducts."
2. Drawings indicate the general arrangement of ducts.

D. Electrical Connections: Comply with requirements for power wiring, switches, and motor controls in electrical Sections.

1. Install electrical devices furnished by unit manufacturer but not factory mounted.

3.4 STARTUP SERVICE

A. Engage a factory-authorized service representative to perform startup service.

1. Complete installation and startup checks according to manufacturer's written instructions.
2. Inspect units for visible damage.
3. Inspect units for visible damage to refrigerant compressor, condenser and evaporator coils, and fans.
4. Start refrigeration system when outdoor-air temperature is within normal operating limits and measure and record the following:
   a. Cooling coil leaving-air.
   b. Cooling coil entering-air.
5. Simulate maximum cooling demand and inspect the following:
   a. Compressor refrigerant suction and hot-gas pressures.
   b. Short-circuiting of air through outside coil or from outside coil to outdoor-air intake.
6. Inspect casing insulation for integrity, moisture content, and adhesion.
7. Verify that clearances have been provided for servicing.
8. Verify that controls are connected and operable.
9. Verify that filters are installed.
10. Clean coils and inspect for construction debris.
11. Inspect and adjust vibration isolators and seismic restraints.
12. Verify bearing lubrication.
13. Clean fans and inspect fan-wheel rotation for movement in correct direction without vibration and binding.
14. Adjust fan belts to proper alignment and tension.
15. Start unit.
16. Inspect and record performance of interlocks and protective devices including response to smoke detectors by fan controls and fire alarm.
17. Operate unit for run-in period.
18. Calibrate controls.
19. Adjust and inspect high-temperature limits.
20. Inspect isolation-air dampers for proper stroke.
21. Verify operational sequence of controls.

B. After startup, change filters, verify bearing lubrication, and adjust belt tension.

C. Remove and replace components that do not properly operate and repeat startup procedures as specified above.

D. Prepare written report of the results of startup services.

3.5 ADJUSTING

A. Adjust initial temperature and humidity set points.

B. Set field-adjustable switches and circuit-breaker trip ranges as indicated.

C. 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.

3.6 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain units.

END OF SECTION 237433

SECTION 238123 - COMPUTER-ROOM AIR-CONDITIONERS

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. Floor-mounted computer-room air conditioners, 6 tons and larger.

1.3 DEFINITION

A. BAS: Building automation system.

1.4 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Computer-room air conditioners 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."

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

B. Shop Drawings: For computer-room air conditioners. Include plans, elevations, sections, details, and attachments to other work.

1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
2. Wiring Diagrams: For power, signal, and control wiring.

1.6 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Plans, elevations, and other details, drawn to scale, using input from Installers of the items involved.

B. Seismic Qualification Certificates: For computer-room air conditioners, 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.

D. Warranty: Sample of special warranty.

1.7 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For computer-room air conditioners to include in emergency, operation, and maintenance manuals.

1.8 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. Fan Belts: One set for each belt-driven fan.
2. Filters: One set of filters for each unit.

1.9 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. ASHRAE Compliance:

1. Fabricate and label refrigeration system to comply with ASHRAE 15, "Safety Standard for Refrigeration Systems."

1.10 COORDINATION

A. Coordinate layout and installation of computer-room air conditioners and suspension system with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, fire-suppression system, and partition assemblies.

B. Coordinate installation of computer-room air conditioners with computer-room access flooring Installer.

C. Coordinate sizes and locations of concrete bases with actual equipment provided.

1.11 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of computer-room air conditioners 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 shipment.
2. Warranty Period for Humidifiers: Manufacturer's standard, but not less than one year from date startup or 18 months from shipment.
3. Warranty Period for Control Boards: Manufacturer's standard, but not less than one year from date startup or 18 months from shipment.

PART 2 - PRODUCTS

2.1 FLOOR-MOUNTED UNITS 6 TONS AND LARGER

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. United CoolAir Corp.- basis of design
2. Carrier Corporation; a United Technologies company.
3. Compu-Aire, Inc.
4. Data Aire Inc.
5. Liebert Corporation.
6. Stulz-ATS.
7. Trane; a business of Ingerosol Rand.

B. Description: Packaged, factory assembled, prewired, and prepiped; consisting of cabinet, fans, filters, humidifier, and controls.

C. Cabinet and Frame: Welded steel, braced for rigidity, and supporting compressors and other mechanical equipment and fittings.

1. Doors and Access Panels: Galvanized steel with polyurethane gaskets, hinges, and concealed fastening devices.
2. Insulation: Thermally and acoustically insulate cabinet interior with 1-inch- thick duct liner.
3. Finish of Exterior Surfaces: Baked-on, textured vinyl enamel; color as selected from manufacturer's standard colors.

D. Supply-Air Fan(s):

1. Double-inlet, forward-curved centrifugal fan(s); statically and dynamically balanced.
2. Drive: V-belt, with steel shaft with self-aligning ball bearings and cast-iron or steel sheaves, variable- and adjustable-pitch motor sheave, minimum of two matched belts, with drive rated at a minimum of two times the nameplate rating of motor.

E. Refrigeration System:
   1. Compressors: Hermetic scroll; with oil strainer, internal motor overload protection, resilient suspension system, crankcase heater, manual-reset high-pressure switch, and pump-down low-pressure switch.
   2. Refrigeration Circuits: Two; each with hot-gas mufflers, thermal-expansion valve with external equalizer, liquid-line solenoid valve, liquid-line filter-dryer, sight glass with moisture indicator, service shutoff valves, charging valves, and charge of refrigerant.
   3. Refrigerant: R-410A only.
   4. Refrigerant Evaporator Coil: Alternate-row or split-face-circuit, direct-expansion coil of seamless copper tubes expanded into aluminum fins.

      a. Mount coil assembly over stainless-steel drain pan complying with ASHRAE 62.1.

   5. Integral, Water-Cooled Refrigerant Condenser: Coaxial tube-in-tube type with liquid-line stop valve and head-pressure-actuated, three-way regulating valve. Terminate fluid connections outside cabinet.

      a. Cooling Medium: Glycol solution.

F. Electric-Resistance Heating Coil: Enclosed finned-tube electric elements arranged for minimum of two stages, with thermal safety switches, manual-reset overload protection, and branch-circuit overcurrent protection. Electric heat shall be part of single point wiring and allow for reheat dehumidification.

G. Extended-Surface, 2", 60% efficient disposable, Panel Filter: Pleated, lofted, nonwoven, reinforced cotton fabric; supported and bonded to welded-wire grid; enclosed in cardboard frame

H. Electrode Steam Humidifier: Self-contained, microprocessor-controlled unit with disposable, polypropylene-plastic cylinders, and having field-adjustable steel electrodes and stainless-steel steam dispersion tube.

   1. Plumbing Components and Valve Bodies: Plastic, linked by flexible rubber hosing, with water fill with air gap and solenoid valve incorporating built-in strainer, pressure-reducing and flow-regulating orifice, and drain with integral air gap.
   2. Control: Fully modulating to provide gradual 0 to 100 percent capacity with field-adjustable maximum capacity; with high-water probe.
   3. Drain Cycle: Field-adjustable drain duration and drain interval.

I. Integral Electrical Controls: Unit-mounted electrical enclosure with piano-hinged door, grounding lug, combination magnetic starters with overload relays, circuit breakers and cover interlock, and fusible control-circuit transformer.

J. Disconnect Switch: Nonautomatic, molded-case circuit breaker with handle accessible when panel is closed and capable of preventing access until switched to off position. Field or factory furnished/installed

K. Microprocessor-Control System: Continuously monitors operation of process cooling system; continuously displays room temperature and room relative humidity; sounds alarm on system malfunction and simultaneously displays problem. If more than one malfunction occurs, system

displays fault in sequence with room temperature and continues to display fault when malfunction is cleared until system is reset.

1. Malfunctions:

   a. Power loss.
   b. Loss of airflow.
   c. Clogged air filter.
   d. High room temperature.
   e. Low room temperature.
   f. High humidity.
   g. Low humidity.
   h. Smoke/fire.
   i. Water under floor.
   j. Supply fan overload.
   k. Compressor No. 1 - Overload.
   l. Compressor No. 1 - Low Pressure.
   m. Compressor No. 1 - High Pressure.
   n. Compressor No. 2 - Overload.
   o. Compressor No. 2 - Low Pressure.
   p. Compressor No. 2 - High Pressure.

2. Digital Display:

   a. Control power on.
   b. Humidifying.
   c. Dehumidifying.
   d. Compressor No. 1 - Operating.
   e. Compressor No. 2 - Operating.
   f. Heat operating.
   g. Economy cooling.

3. Push buttons shall stop and start process cooling system, silence audible alarm, test indicators, and display room's relative humidity.
4. BAS Interface: Factory-installed hardware and software to enable the BAS to monitor, control, and display unit status and alarms.

2.2 FAN MOTORS

A. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Section 230513 "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: Comply with requirements for electrical devices and connections specified in electrical Sections.

2.3 CAPACITIES AND CHARACTERISTICS

A. Unit Configuration:

1. Upflow.
2. Draw through.

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 hydronic piping systems to verify actual locations of piping connections before equipment installation.

C. Examine walls, floors, and roofs for suitable conditions where computer-room air conditioners will be installed.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install computer-room air conditioners level and plumb, maintaining manufacturer's recommended clearances, local and industry codes

B. Computer-Room Air-Conditioner Mounting: Install using elastomeric pad Comply with requirements for vibration isolation devices specified hein.

3.3 CONNECTIONS

A. Piping installation requirements are specified in other heating, ventilating, and air-conditioning Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to machine to allow service and maintenance.

C. Water and Drainage Connections: Comply with applicable requirements in Section 221116 "Domestic Water Piping." Provide adequate connections for water-cooled units, condensate drain, and humidifier flushing system.

D. Condenser-Water Piping: Comply with applicable requirements in Section 232113 "Hydronic Piping" and Section 232116 Hydronic Piping Specialties." Provide shutoff valves in water inlet and outlet piping on water-cooled units.

3.4 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.

B. Perform tests and inspections.

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.

C. Tests and Inspections:

1. Inspect for and remove shipping bolts, blocks, and tie-down straps.
2. After installing computer-room air conditioners and after electrical circuitry has been energized, test for compliance with requirements.
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. Computer-room air conditioners will be considered defective if they do not pass tests and inspections.

E. Prepare test and inspection reports.

F. After startup service and performance test, change filters and flush humidifier.

3.5 ADJUSTING

A. Adjust initial temperature and humidity set points.

B. Set field-adjustable switches and circuit-breaker trip ranges as indicated.

3.6 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain computer-room air conditioners.

END OF SECTION 238123

SECTION 238146.13 - WATER-TO-AIR HEAT PUMPS

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. Concealed horizontal 6 tons and smaller.
2. Exposed, floor-mounted console units.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include rated capacities, furnished specialties, and accessories for each model.

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. Include diagrams for power, signal, and control wiring.

C. Samples: For each exposed product and for each color and texture specified.

1.4 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Floor plans, reflected ceiling plans, and other details, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Suspended ceiling components.
2. Structural members to which heat pumps are attached.
3. Method of attaching hangers to building structure.
4. Size and location of initial access modules for acoustical tile.
5. Items penetrating finished ceiling, including the following:

a. Lighting fixtures.
b. Air outlets and inlets.
c. Speakers.
d. Access panels.

B. Product Certificates: For each type of water-source unitary heat pump, signed by product manufacturer.

C. Seismic Qualification Certificates: Submit certification that water-source heat pumps, accessories, and components will withstand seismic forces defined in Section 230548 "Vibration and Seismic Controls for HVAC." Include the following:

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
   a. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified, and the unit will be fully operational after the seismic event."
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.

D. Field quality-control reports.

E. Sample Warranty: For special warranty.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For water-to-air heat pumps to include in emergency, operation, and maintenance manuals.

1.6 MAINTENANCE MATERIAL SUBMITTALS

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. Two sets of filters for each unit.

1.7 QUALITY ASSURANCE

A. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1, Section 6 - "Heating, Ventilating, and Air-Conditioning."

B. Comply with NFPA 70.

C. Comply with safety requirements in UL 484 for assembly of free-delivery, water-source heat pumps.

D. Comply with safety requirements in UL 1995 for duct-system connections.

1.8 WARRANTY

A. General Warranty: The special warranty specified in this Article shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and shall be

in addition to, and run concurrent with, other warranties made by the Contractor under requirements of the Contract Documents.

B. Special Warranty: Submit a written warranty by the manufacturer, agreeing to replace components of geothermal heat pumps that fail within the specified warranty period.

1. Warranty Period: 5 years for compressors. 1 year for all other parts. Warranty period to begin at start-up or 6-months from shipping (whichever occurs first). Labor for the replacement parts during the 1st year is to be provided by the installing mechanical contractor.

PART 2 - PRODUCTS

2.1 CONCEALED WATER-SOURCE HEAT PUMPS, 6 TONS AND SMALLER

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. Florida Heat Pump.
2. WaterFurnace International, Inc.
3. McQuay International.

B. Description: Packaged water-source heat pump with temperature controls; factory assembled, tested, and rated according to ASHRAE/ARI/ISO-13256-1.

1. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a testing agency acceptable to authorities having jurisdiction, and marked for intended location and application.

C. Cabinet and Chassis: Galvanized-steel casing with the following features:

1. Access panel for access and maintenance of internal components.
2. Knockouts for electrical and piping connections.
3. Flanged duct connections.
4. Cabinet Insulation: Glass-fiber liner, minimum 1/2 inch thick, 1.5-lb/cu. ft. density. Comply with UL 181, ASTM C 1071, and ASTM G 21.
5. Units field convertible for various discharge configurations.
6. Construct cabinet with compartments, so compressor, reversing valve, and water coil are out of air stream.
7. Condensate Drainage: Stainless-steel drain pan with condensate drain piping projecting through unit cabinet.
   a. Condensate Overflow Protection Switch: Solid state electronic; mechanical float switch not permitted.
8. Sound Attenuation Package: Provide one or more of the following:
   a. Compressor wraps, ½" closed cell high density foam insulation on the interior of the cabinet. Sound attenuating blanket over compressor.
   b. Hot-gas muffler and all bulk heads with 1" of rubatex insulation.
   c. Divider panel between the air handling panel section and compressor.

D. Fan: Direct driven, centrifugal, with multispeed motor resiliently mounted in fan inlet and with inlet rings to allow wheel removal from one side without removing housing.

1. General requirements for motors are specified in Section 230513 "Common Motor Requirements for HVAC Equipment."
2. Motor: Multispeed, permanently lubricated, PSC motor for the Units 1 ton and smaller. For the units larger than 1 ton: Direct driven, centrifugal fan with permanently lubricated motor. ECM EON constant airflow microprocessor controlled DC type motor with internal programming factory set for the specific unit and featuring soft start/stop and a delay off feature for maximum efficiency and quiet operation.

E. Water Circuit:

1. Refrigerant-to-Water Heat Exchangers:

   a. Coaxial heat exchangers with inner copper water tube with enhanced heat-transfer surfaces inside a steel shell; both shell and tube are leak tested to 450 psig on refrigerant side and 400 psig on water side. Factory mounted heat exchanger in unit on resilient rubber vibration isolators.

2. Water-Regulating Valves: Limit water flow through refrigerant-to-water heat exchanger, and control head pressure on compressor during cooling and heating. Valves shall close when heat-pump compressor is not running.
3. Motorized Water Valve: Stop water flow through the unit when compressor is off.

F. Refrigerant-to-Air Heat Exchanger: Copper-tube coil with aluminum fins and Duo-Guard coil protection. Tin electroplated copper tubing with high-tech polymer coated aluminum fins to protect the evaporator coil from corrosive elements in the airstream. Leak tested to 450 psig.

G. Refrigerant Circuit Components:

1. Sealed Refrigerant Circuit: Charge with R-410A refrigerant.
2. Filter-Dryer: Factory installed to clean and dehydrate the refrigerant circuit.
3. Charging Connections: Service fittings on suction and liquid for charging and testing on each circuit.
4. Reversing Valve: Four-way, solenoid-activated valve designed to be fail-safe in heating position with replaceable magnetic coil.
5. Compressor: Hermetic compressor installed on vibration isolators and housed in an acoustically treated enclosure with factory-installed safeties as follows:

   a. Antirecycle timer.
   b. High-pressure cutout.
   c. Low-pressure cutout or loss of charge switch.
   d. Internal thermal-overload protection.
   e. Condensate overflow switch to stop compressor with high condensate level in condensate drain pan.
   f. Water-coil, low-temperature switch.
   g. Air-coil, low-temperature switch.

6. Refrigerant Piping Materials: ASTM B 743 copper tube with wrought-copper fittings and brazed joints.

7. Pipe Insulation: Refrigerant minimum 3/8-inch- thick, flexible elastomeric insulation on piping exposed to airflow through the unit. Maximum 25/50 flame-spread/smoke-developed indexes according to ASTM E 84.
8. Refrigerant Metering Device: Thermal-expansion valve.

1. Hot-Gas Reheat: Reheat valve diverts refrigerant hot gas to reheat coil when remote humidistat calls for dehumidification.

2. Hot gas bypass (all units except for those with rotary compressors). Valving shall be internal to the unit and shall be factory installed and tested. Bypass shall run off refrigerant pressure and allow unit to run on low load conditions.

3. Low water temperature package. Low water temperature package shall be factory installed and tested and shall include the following; An externally equalized thermal expansion valve, wrapped condenser and a low pressure time delay relay.

H. Filters: Disposable, glass-fiber, flat type, 1 inch thick, treated with adhesive, and having a minimum efficiency reporting value of 8 according to ASHRAE 52.2.

I. Unit Controls: Unit shall be provided with a factory mounted DDC Controller.

1. DDC Controller will be programmed with the Water to Air application software and installed in the unit to be job site ready to run. The Unit will operate in a 100% stand-alone control mode or connect to a Building Automation System (BAS) using Bacnet. The point mapping to all of these protocols can be pre-set, so that the protocol and baud rates desired can be easily field-selected without the need for any additional downloads or technical assistance. The DDC Controller also supports communications to intelligent RS Room sensors with integral humidity sensor and BACview keypad/display panels.

2. DDC Controls shall be provided with the following features:

   a. Powerful high speed microprocessor with 1MB Flash memory and 1MB of battery-backed RAM

   b. Built-in protocol support: Bacnet

   c. Built-in local access support.

   d. On-board lithium battery holds Controller time clock settings.

3. Controller shall have the following inputs:

   a. RS Room temperature sensor (Rnet)

   b. RS Room humidity sensor

   c. RS Room temperature sensor Setpoint adjust (Rnet)

   d. RS Room temperature sensor Occupancy override (Rnet)

   e. Discharge air temperature sensor

f. Leaving water temperature sensor

g. Unit Protection Module Alarm codes (7 safety shutdown alarms)

h. Unit Enable manual control (DI Enable)

4. Controller shall have the following outputs:

a. Unit Fan control

b. Reversing Valve

c. Compressor Stage 1

d. Compressor Stage 2

5. Controller parameters shall be as follows:

a. Occupancy schedule

b. System control: Schedule, Manual ON, BAS or DI Enable

c. Room temperature occupied cooling/heating setpoint

d. Room temperature unoccupied cooling/heating setpoint

e. Room humidity setpoint

f. Unit blower fan control

g. Reversing valve control

h. Comp 1 control

i. Comp 2 control

j. Unit Enable manual control (optional)

6. Status parameters shall be as follows:

a. Cooling/Heating control status

b. Cooling/Heating percentage (0-100%)

c. Room temperature

d. Room humidity

e. Discharge air temperature

f. Leaving water temperature

g. Changeover temperature

h. Fan-Hours runtime counter (filter replacement indicator)

i. Fan starts counter

j. Comp 1 starts counter

k. Comp 2 starts counter (Comp 2 Circuit)

7. Alarm parameters shall be as follows:

a. Room temperature high/low differential

b. Leaving water temperature high/low trip

c. Discharge air temperature high/low trip

d. Sensor failure alarm

e. Unit filter Runtime trip

f. Comp 1 Runtime trip

g. Low pressure sensor UPM alarm

h. High pressure sensor UPM alarm

i. Condensate overflow UPM alarm

j. High/low voltage UPM alarm

8. Local interface of the Heat Pump Factory DDC Controller operational properties are accessible with the BACview6 keyboard/display. BACview6 plugs into an Rnet connection and allows you to display and modify parameters without any computer software. The BACview6 features a numeric keypad, directional keys, and four programmable function keys. A 14-line by 40-character backlit LCD display is provided for easy reading even in poor lighting conditions. The device also includes an alarm indicator light and audible warning. One BACview6 shall be provided per (50) Heat Pump units.

9. BACview 6 Features include:

a. Can be used as hand held diagnostics tool at Room sensor or DDC Controller

b. Flexible design allows panel or wall mounting

c. Can be located up to 500 feet from the control panel

d. Can share Rnet with up to 5 RS Room temperature sensors

e. Backlit LCD display enhances reading even in poor lighting conditions

f. Allows customization of equipment parameters using industry-standard HTML

g. Password protection provides security

10. Room temperature and humidity sensor shall be model RS Pro and shall offer a local set point adjustment and override to an occupied mode and LED indication of current status. The RS Pro shall have a large LCD display and occupant controls. Sensor shall be wall mounted and shall contain a hidden communications jack provides access to the HVAC control system for commissioning and maintenance. One RSPro shall be provided shipped loose and field wired for each heat pump.

11. RSPro Features shall include:

a. LCD displays zone temperature, heating set point, cooling setpoint and local override (after-hours occupancy) time.

b. Occupancy override shall be initiated through the "Manual ON" momentary push button. Multiple pushes increases the override time, and the LCD displays precisely how long the zone will stay occupied.

c. Zone set points can be easily changed on the RS Pro by pressing the Warmer or Cooler button. LCD Panel shows what the new set point is.

J. Electrical Connection: Single electrical connection.

2.2 EXPOSED, CONSOLE WATER-SOURCE HEAT PUMPS

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. Florida Heat Pump.
2. WaterFurnace International, Inc.
3. McQuay International.

B. Description: Factory-assembled and -tested, packaged geothermal heat pumps consisting of cabinet; sealed refrigerant circuit including compressor, refrigerant to water heat exchanger, refrigerant to air heat exchanger, and reversing valve; evaporator fans; refrigeration; filters, tested, and rated according to ASHRAE/ARI/ISO-13256-1.

1. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a testing agency acceptable to authorities having jurisdiction, and marked for intended location and application.

C. Cabinet and Chassis: Manufacturer's standard-height, sloped-top, extended galvanized-steel casing with the following features:
1. Access panel for access and maintenance of internal components.
2. Knockouts for electrical and piping connections.
3. Cabinet Insulation: Glass-fiber liner, minimum 1/2 inch thick, comply with UL 181, ASTM C 1071, and ASTM G 21.
4. Cabinet shall be painted Polane T Plus polyurethane enamel paint finish.
5. Sound Attenuation Package: Provide one or more of the following:

a. Compressor wraps, ½" closed cell high density foam insulation on the interior of the cabinet. Sound attenuating blanket over compressor.
b. Hot-gas muffler and all bulk heads with 1" of rubatex insulation.
c. Divider panel between the air handling panel section and compressor.

6. Condensate Drainage: High-density polyethylene plastic or stainless-steel drain pan with condensate drain piping projecting to unit exterior and complying with ASHRAE 62.1.

   a. Condensate Overflow Protection: Solid state electronic; mechanical float switch not permitted.

7. Discharge Grille: Steel, aluminum, or plastic grille for adjustable discharge air pattern.
8. Color: Selected by Architect from manufacturer's standard color selection.
9. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.

D. Fan: Direct driven, centrifugal, with multispeed motor mounted on a removable fan-motor board.

1. General requirements for motors are specified in Section 230513 "Common Motor Requirements for HVAC Equipment."
2. Motor: Multispeed, permanently lubricated, PSC motor for the Units 1 ton and smaller.

E. Water Circuit:
1. Duo-Guard coil protection. Tin electroplated copper tubing with high-tech polymer coated aluminum fins to protect the evaporator coil from corrosive elements in the airstream.
2. Refrigerant-to-Water Heat Exchanger: Coaxial heat exchanger with copper water tube with enhanced heat-transfer surfaces inside a steel shell; both shell and tube are leak tested to 450 psig for refrigerant side and 400 psig for water side. Factory mount heat exchanger in unit on resilient rubber vibration isolators.
3. Water-Regulating Valves: Limit water flow through refrigerant-to-water heat exchanger and control head pressure on compressor during cooling and heating. Valves shall close when heat-pump compressor is not running.

F. Refrigerant-to-Air Coils: Copper tubes with aluminum fins, leak tested to 450 psig.

G. Refrigerant Circuit Components:

1. Sealed Refrigerant Circuit: Charge with R-410A refrigerant.
2. Filter-Dryer: Factory installed to clean and dehydrate the refrigerant circuit.
3. Charging Connections: Service fittings on suction and liquid for charging and testing.
4. Reversing Valve: Four-way, solenoid-activated valve designed to be fail-safe in heating position with replaceable magnetic coil.
5. Compressor: Hermetic rotary compressor installed on vibration isolators housed in an acoustically treated enclosure with factory-installed safeties as follows:

   a. Antirecycle timer.
   b. High-pressure cutout.
   c. Low-pressure cutout or loss of charge switch.
   d. Internal thermal-overload protection.

e. Freezestat to stop compressor if water-loop temperature in refrigerant-to-water heat exchanger falls below 35 deg F.
f. Condensate overflow switch to stop compressor with high condensate level in condensate drain pan.
g. Water-coil, low-temperature switch.
h. Air-coil, low-temperature switch.

6. Refrigerant Piping Materials: ASTM B 743 copper tube with wrought-copper fittings and brazed joints.
7. Pipe Insulation: Refrigerant minimum 3/8-inch- thick, flexible elastomeric insulation on piping exposed to airflow through the unit. Maximum 25/50 flame-spread/smoke-developed indexes per ASTM E 84.
8. Refrigerant Metering Device: Dual-port, thermal-expansion valve to allow specified operation with entering-water temperatures from 25 to 125 deg F.
9. Hot-Gas Reheat Valve: Pilot-operated, sliding-type valve with replaceable magnetic coil.
10. Hot gas bypass (all units except for those with rotary compressors). Valving shall be internal to the unit and shall be factory installed and tested. Bypass shall run off refrigerant pressure and allow unit to run on low load conditions.
11. Hot gas reheat. Hot gas reheat circuit shall be internal to the unit and shall be factory installed, wired and tested. Reheat shall be controlled by a humidistat and shall allow dehumidification without overcooling the space by diverting hot gas from the condenser to the unit mounted coil.

H. Filters: Disposable, pleated type, 1 inch thick and with a minimum efficiency reporting value of 7 according to ASHRAE 52.2 , or Aluminum mesh washable filter .

I. Unit Controls: Unit shall be provided with a factory mounted DDC Controller.

1. DDC Controller will be programmed with the Water to Air application software and installed in the Unit to be job site ready to run. The Unit will operate in a 100% stand-alone control mode or connect to a Building Automation System (BAS) using Bacnet. The point mapping to all of these protocols can be pre-set, so that the protocol and baud rates desired can be easily field-selected without the need for any additional downloads or technical assistance. The DDC Controller also supports communications to intelligent RS Room sensors and BACview keypad/display panels.

2. DDC Controls shall be provided with the following features:

a. Powerful high speed microprocessor with 1MB Flash memory and 1MB of battery-backed RAM

b. Built-in protocol support: Bacnet

c. Built-in local access support.

d. On-board lithium battery holds Controller time clock settings.

3. Controller shall have the following inputs:

a. RS Room temperature sensor (Rnet)

b. RS Room temperature sensor Setpoint adjust (Rnet)

c. RS Room temperature sensor Occupancy override (Rnet)

d. Discharge air temperature sensor

e. Leaving water temperature sensor

f. Unit Protection Module Alarm codes (7 safety shutdown alarms)

g. Unit Enable manual control (DI Enable)

4. Controller shall have the following outputs:

a. Unit Fan control

b. Reversing Valve

c. Compressor Stage 1

5. Controller parameters shall be as follows:

a. Occupancy schedule

b. System control: Schedule, Manual ON, BAS or DI Enable

c. Room temperature occupied cooling/heating setpoint

d. Room temperature unoccupied cooling/heating setpoint

e. Unit blower fan control

f. Reversing valve control

g. Comp 1 control

h. Unit Enable manual control (optional)

i. Auxiliary/Emergency Electric heat output control (optional)

6. Status parameters shall be as follows:

a. Cooling/Heating control status

b. Cooling/Heating percentage (0-100%)

c. Room temperature

d. Discharge air temperature

e. Leaving water temperature

f. Changeover temperature

g. Fan-Hours runtime counter (filter replacement indicator)

h. Fan starts counter

i. Comp 1 starts counter

7. Alarm parameters shall be as follows:

a. Room temperature high/low differential

b. Leaving water temperature high/low trip

c. Discharge air temperature high/low trip

d. Sensor failure alarm

e. Unit filter Runtime trip

f. Comp 1 Runtime trip

g. Low pressure sensor UPM alarm

h. High pressure sensor UPM alarm

i. Low pressure sensor UPM alarm (Comp 2 Circuit)

j. High pressure sensor UPM alarm (Comp 2 Circuit)

k. Condensate overflow UPM alarm

l. High/low voltage UPM alarm

8. Local interface of the Heat Pump Factory DDC Controller operational properties are accessible with the BACview6 keyboard/display. BACview6 plugs into an Rnet connection and allows you to display and modify parameters without any computer software. The BACview6 features a numeric keypad, directional keys, and four programmable function keys. A 14-line by 40-character backlit LCD display is provided for easy reading even in poor lighting conditions. The device also includes an alarm indicator light and audible warning. One BACview6 shall be provided per (50) Heat Pump units.

9. BACview 6 Features include:

a. Can be used as hand held diagnostics tool at Room sensor or DDC Controller

b. Flexible design allows panel or wall mounting

c. Can be located up to 500 feet from the control panel

d. Can share Rnet with up to 5 RS Room temperature sensors

e. Backlit LCD display enhances reading even in poor lighting conditions

f. Allows customization of equipment parameters using industry-standard HTML

g. Password protection provides security

10. Room temperature sensor shall be model RS Pro and shall offer a local set point adjustment and override to an occupied mode and LED indication of current status. The RS Pro shall have a large LCD display and occupant controls. Sensor shall be wall mounted and shall contain a hidden communications jack provides access to the HVAC control system for commissioning and maintenance. One RSPro shall be provided shipped loose and field wired for each heat pump.

11. RSPro Features shall include:

a. LCD displays zone temperature, heating set point, cooling setpoint and local override (after-hours occupancy) time.

b. Occupancy override shall be initiated through the "Manual ON" momentary push button. Multiple pushes increases the override time, and the LCD displays precisely how long the zone will stay occupied.

c. Zone set points can be easily changed on the RS Pro by pressing the Warmer or Cooler button. LCD Panel shows what the new set point is.

J. Electrical Connection: Single electrical connection.

2.3 HOSE KIT ASSEMBLIES

A. Hose Kit: 36 inches long flexible stainless steel braided hose with swivel and nipple, automatic self-balancing valve with two pressure temperature test ports, ported ball valves (one with pressure temperature test ports), y-strainer with blow down valve with hose connector, and 24 vac on-off valve (mounted externally to the unit).

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine roughing-in for piping and electric installations for water-source heat pumps to verify actual locations of piping connections and electrical conduits before installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install geothermal heat pumps according to manufacturer's written instructions.

1. Comply with requirements for vibration isolation and seismic control devices specified in Section 230548 "Vibration and Seismic Controls for HVAC."

B. Install units level and plumb, firmly anchored in locations indicated, and maintain manufacturer's recommended clearances.

3.3 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties. Specific connection requirements are as follows:

1. Connect supply and return hydronic piping to heat pump with unions and hose kits.
2. Connect heat-pump condensate drain pan to indirect waste connection with condensate trap of adequate depth to seal against fan pressure. Install cleanouts in piping at changes of direction.

B. Duct installation requirements are specified in other Sections. Drawings indicate general arrangement of ducts. Specific connection requirements are as follows:

C. Connect supply and return ducts to water-source heat pumps with flexible duct connectors specified in Section 233300 "Air Duct Accessories." Provide transitions to match unit duct-connection size.

D. Install electrical devices furnished by manufacturer but not specified to be factory mounted.

E. Install piping adjacent to machine to allow service and maintenance.

F. Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems."

G. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

3.4 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.

B. Heat pumps will be considered defective if they do not pass tests and inspections.

C. Prepare test and inspection reports.

3.5 STARTUP SERVICE

A. Engage a factory-authorized service representative to perform startup service.

B. Complete installation and startup checks according to manufacturer's written instructions and do the following:

1. Inspect for visible damage to unit casing.
2. Inspect for visible damage to compressor, coils, and fans.
3. Inspect internal insulation.
4. Verify that labels are clearly visible.
5. Verify that clearances have been provided for servicing.
6. Verify that controls are connected and operable.
7. Verify that filters are installed.
8. Adjust vibration isolators.
9. Inspect operation of barometric dampers.
10. Verify bearing lubrication on fan.
11. Inspect fan-wheel rotation for movement in correct direction without vibration and binding.
12. Start unit according to manufacturer's written instructions.
13. Complete startup sheets and attach copy with Contractor's startup report.
14. Inspect and record performance of interlocks and protective devices; verify sequences.
15. Operate unit for an initial period as recommended or required by manufacturer.
16. Verify thermostat and humidistat calibration.
17. Inspect outdoor-air dampers for proper stroke and interlock with return-air dampers.
18. Inspect controls for correct sequencing of heating, mixing dampers, refrigeration, and normal and emergency shutdown.

3.6 CLEANING

A. Replace filters used during construction prior to air balance or Substantial Completion.

B. After completing installation of exposed, factory-finished, water-source heat pumps, inspect exposed finishes and repair damaged finishes.

3.7 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain water-source heat pumps.

END OF SECTION 238146.13

SECTION 238233 – CONVECTORS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:
   1. Hydronic convectors.

1.3 SUBMITTALS

A. Product Data: Include rated capacities, operating characteristics, furnished specialties, and accessories for each type of product indicated.

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.

PART 2 - PRODUCTS

2.1 HOT-WATER CONVECTORS

A. 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. Sterling Hydronics; a Mestek company.
   2. Slant/Fin Corporation.
   3. Trane.

B. Convector Elements: Seamless copper tubing mechanically expanded into evenly spaced aluminum fins and rolled into cast brass headers with inlet/outlet and air vent; steel side plates and supports. Factory-pressure-test element at minimum 100 psig.

C. Cabinets shall have a one-piece front Panel: Minimum 0.0677-inch- thick steel with exposed corners rounded; removable front panels with tamper-resistant fasteners braced and reinforced for stiffness. Flanges on enclosure at sides and top shall serve as plaster stops. The front shall be sealed against the flanges with a 0.375-inch sponge rubber to help prevent air leakage and wall streaking. Front panels shall be held in place by quick opening front panel fasteners.

D. Support Brackets: Locate at maximum 36-inch spacing to support front panel and element.

E. Insulation: 1/2-inchthick, fibrous glass on inside of the back of the enclosure.

F. Finish: Baked-enamel finish in manufacturer's standard color as selected by Architect.

G. Damper: Knob-operated internal damper.

H. Access Doors: Factory made, permanently hinged with tamper-resistant fastener, minimum size 6 by 7 inches, integral with enclosure.

I. Enclosure Style: Sloped top.

1. Front Inlet Grille: Punched louver; painted to match enclosure.

a. Mill-finish aluminum.
b. Anodized finish, color as selected by Architect from manufacturer's standard custom colors.
c. Painted to match enclosure.

J. Enclosure Style: Recessed Cabinets.

1. Front Inlet Grille: Punched louver; painted to match enclosure.

a. Mill-finish aluminum.
b. Anodized finish, color as selected by Architect from manufacturer's standard colors.
c. Painted to match enclosure.

2. Front Outlet Grille: Recessed, framed louver; painted to match enclosure.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas to receive convection heating units for compliance with requirements for installation tolerances and other conditions affecting performance.

B. Examine roughing-in for hydronic-piping connections to verify actual locations before convection heating unit installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 CONVECTOR INSTALLATION

A. Install units level and plumb.

B. Install valves within reach of access door provided in enclosure.

C. Install air-seal gasketing between wall and recessing flanges or front cover of fully recessed unit.

3.3 CONNECTIONS

A. Piping installation requirements are specified in Division 23 Section "Hydronic Piping." Drawings indicate general arrangement of piping, fittings, and specialties.

B. Connect hot-water units and components to piping according to Division 23 Section "Hydronic Piping."

1. Install shutoff valves on inlet and outlet, and balancing valve on outlet.

C. Install piping adjacent to convection heating units to allow service and maintenance.

3.4 FIELD QUALITY CONTROL

A. Perform the following field tests and inspections and prepare test reports:

1. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist at no extra cost to the owner.
2. Operational Test: After electrical circuitry has been energized, start units to confirm proper convection heating unit operation.
3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

B. Remove and replace convection heating units that do not pass tests and inspections and retest as specified above.

END OF SECTION 238233

SECTION 238239.13 - CABINET UNIT HEATERS

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 cabinet unit heaters with centrifugal fans and hot-water coils.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include rated capacities, operating characteristics, furnished specialties, and accessories.

B. Shop Drawings:

1. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
2. Include location and size of each field connection.
3. Include details of anchorages and attachments to structure and to supported equipment.
4. Include equipment schedules to indicate rated capacities, operating characteristics, furnished specialties, and accessories.
5. Indicate location and arrangement of piping valves and specialties.
6. Indicate location and arrangement of integral controls.
7. Wiring Diagrams: Power, signal, and control wiring.

C. Samples: For each exposed product and for each color and texture specified.

D. Samples for Initial Selection: Finish colors for units with factory-applied color finishes.

E. Samples for Verification: Finish colors for each type of cabinet unit heater indicated with factory-applied color finishes.

F. Seismic Qualification Certificates: Submit certification that cabinet unit heaters, accessories, and components will withstand seismic forces defined in Section 230548 "Vibration and Seismic Controls for HVAC." Include the following:

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. Include detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

G. Field quality-control reports.

1.4 MAINTENANCE MATERIAL SUBMITTALS

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. Cabinet Unit-Heater Filters: Furnish one spare filter for each filter installed.

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 UTC company.
4. Dunham-Bush, Inc.
5. International Environmental Corporation.
6. Markel Products Company; TPI Corporation.
7. McQuay International.
8. Trane Inc.
9. USA Coil & Air.

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.

2.3 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Cabinet unit heaters 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 when subjected to the seismic forces specified."

2.4 CABINETS

A. Material: Steel with baked-enamel finish with manufacturer's standard paint, in color selected by Architect.
   1. Horizontal Unit, Exposed Bottom Panels: Minimum 0.0528-inch-thick galvanized sheet steel, removable panels secured with tamperproof cam fasteners and safety chain.

2.5 FILTERS

A. Minimum Arrestance: According to ASHRAE 52.1 and a minimum efficiency reporting value (MERV) according to ASHRAE 52.2.

   1. Permanent filter of durable aluminum: 70 percent arrestance and MERV 3.

2.6 COILS

A. Hot-Water Coil: Copper tube, with mechanically bonded aluminum fins spaced no closer than 0.1 inch and rated for a minimum working pressure of 200 psig and a maximum entering-water temperature of 220 deg F. Include manual air vent and drain.

2.7 CONTROLS

A. Fan and Motor Board: Removable.

   1. Fan: Forward curved, double width, centrifugal, directly connected to motor; thermoplastic or painted-steel wheels and aluminum, painted-steel, or galvanized-steel fan scrolls.
   2. Motor: Permanently lubricated, multispeed; resiliently mounted on motor board. Comply with requirements in Section 230513 "Common Motor Requirements for HVAC Equipment."
   3. Wiring Terminations: Connect motor to chassis wiring with plug connection.
   4. Two-Piece, Ball Valves: Bronze body with full-port, chrome-plated bronze ball; PTFE or TFE seats; and 600-psig minimum CWP rating and blowout-proof stem.
   5. Calibrated-Orifice Balancing Valves: Bronze body, ball type, 125-psig working pressure, 250 deg F maximum operating temperature; with calibrated orifice or venture, connection for portable differential pressure meter with integral seals, threaded ends, and equipped with a memory stop to retain set position.
   6. Y-Pattern, Hot-Water Strainers: Cast-iron body (ASTM A 126, Class B); 125-psig minimum working pressure; with threaded connections, bolted cover, perforated stainless-steel basket, and bottom drain connection. Include minimum NPS 1/2 threaded pipe and full-port ball valve in strainer drain connection.
   7. Wrought-Copper Unions: ASME B16.22.

B. Control devices and operational sequences are specified in Section 230900 "Instrumentation and Control for HVAC" and Section 230993 "Sequence of Operations for HVAC Controls."

C. Basic Unit Controls:

1. Control voltage transformer.
2. Wall-mounted thermostat with the following features:
   a. Heat-off switch.
   b. Fan on-auto switch.
   c. Manual fan-speed switch.
   d. Adjustable deadband.
3. Unoccupied period override push button.
4. Data entry and access port.
   a. Input data includes room temperature and occupied and unoccupied periods.
   b. Output data includes room temperature, supply-air temperature, entering-water temperature, operating mode, and status.

D. 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 cabinet unit heaters to comply with NFPA 90A.

B. Suspend cabinet unit heaters from structure with elastomeric hangers. Vibration isolators are specified in Section 230548 "Vibration and Seismic Controls for HVAC

C. 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.

D. Install new filters in each fan-coil unit within two weeks of Substantial Completion.

3.3 CONNECTIONS

A. Piping installation requirements are specified in Section 232113 "Hydronic Piping," Section 232116 Hydronic Piping Specialties," Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to machine to allow service and maintenance.

C. Connect piping to cabinet unit heater's factory, hot-water piping package. Install the piping package if shipped loose.

D. Comply with safety requirements in UL 1995.

E. Unless otherwise indicated, install union and gate or ball valve on supply-water connection and union and calibrated balancing valve on return-water connection of cabinet unit heater. Hydronic specialties are specified in Section 232113 "Hydronic Piping" and Section 232116 Hydronic Piping Specialties."

F. Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems."

G. 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:

1. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
2. 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.

B. 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 during other-than-normal occupancy hours for this purpose.

3.6 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain cabinet unit heaters.

END OF SECTION 238239.13

SECTION 238239.16 - PROPELLER UNIT HEATERS

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 propeller unit heaters with hot-water coils.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include rated capacities, operating characteristics, furnished specialties, and accessories.

B. Shop Drawings:

1. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
2. Include location and size of each field connection.
3. Include details of anchorages and attachments to structure and to supported equipment.
4. Include equipment schedules to indicate rated capacities, operating characteristics, furnished specialties, and accessories.
5. Indicate location and arrangement of piping valves and specialties.
6. Indicate location and arrangement of integral controls.
7. Wiring Diagrams: Power, signal, and control wiring.

1.4 INFORMATIONAL SUBMITTALS

A. Seismic Qualification Certificates: Submit certification that propeller unit heaters, accessories, and components will withstand seismic forces defined in Section 230548 "Vibration and Seismic Controls for HVAC." Include the following:

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. Include detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

B. Field quality-control reports.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For propeller 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. Trane Inc.
3. McQuay International.
4. Rosemex Products.

2.2 DESCRIPTION

A. Assembly including casing, coil, fan, and motor in horizontal discharge configuration with adjustable discharge louvers.

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. Seismic Performance: Propeller unit heaters 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 when subjected to the seismic forces specified."

2.4 HOUSINGS

A. Finish: Manufacturer's standard baked enamel applied to factory-assembled and -tested propeller unit heaters before shipping.

B. Discharge Louver: Adjustable fin diffuser for horizontal units and conical diffuser for vertical units.

2.5 COILS

A. General Coil Requirements: Test and rate hot-water propeller unit-heater coils according to ASHRAE 33.

B. Hot-Water Coil: Copper tube, minimum 0.025-inch wall thickness, with mechanically bonded aluminum fins spaced no closer than 0.1 inch and rated for a minimum working pressure of 200 psig and a maximum entering-water temperature of 325 deg F, with manual air vent. Test for leaks to 350 psig underwater.

2.6 FAN AND MOTOR

A. Fan: Propeller type with aluminum wheel directly mounted on motor shaft in the fan venturi.

B. Motor: Permanently lubricated, multispeed. Comply with requirements in Section 230513 "Common Motor Requirements for HVAC Equipment."

2.7 CONTROLS

A. Control Devices:

1. Wall-mounted fan-speed switch.
2. Wall-mounted thermostat.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas to receive propeller 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 propeller unit heaters to comply with NFPA 90A.

B. Install propeller unit heaters level and plumb.

C. Suspend propeller unit heaters from structure with all-thread hanger rods and spring hangers. Hanger rods and attachments to structure are specified in Section 230529 "Hangers and Supports for HVAC Piping and Equipment." Vibration hangers are specified in Section 230548 "Vibration and Seismic Controls for HVAC."

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. Piping installation requirements are specified in Section 232113 "Hydronic Piping," Section 232116 Hydronic Piping Specialties," Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to machine to allow service and maintenance.

C. Connect piping to propeller unit heater's factory, hot-water piping package. Install the piping package if shipped loose.

D. Comply with safety requirements in UL 1995.

E. Unless otherwise indicated, install union and gate or ball valve on supply-water connection and union and calibrated balancing valve on return-water connection of propeller unit heater. Hydronic specialties are specified in Section 232113 "Hydronic Piping" and Section 232116 Hydronic Piping Specialties."

F. Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems."

G. 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:

1. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
2. 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.

B. 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 during other-than-normal occupancy hours for this purpose.

END OF SECTION 238239.16

SECTION 260500 - COMMON WORK RESULTS FOR ELECTRICAL

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. Electrical equipment coordination and installation.
2. Sleeves for raceways and cables.
3. Sleeve seals.
4. Grout.
5. Common electrical installation requirements.

1.3 DEFINITIONS

A. EPDM: Ethylene-propylene-diene terpolymer rubber.

B. NBR: Acrylonitrile-butadiene rubber.

1.4 SUBMITTALS

A. Product Data: For sleeve seals.

1.5 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, 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, masonry walls, and other structural components as they are constructed.

C. Coordinate sleeve selection and application with selection and application of firestopping materials.

PART 2 - PRODUCTS

2.1 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. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.

C. 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.

2.2 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:

   a. Advance Products & Systems, Inc.
   b. Calpico, Inc.
   c. Metraflex Co.
   d. Pipeline Seal and Insulator, Inc.

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: 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.

2.3 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.

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.

3.2 SLEEVE INSTALLATION FOR ELECTRICAL PENETRATIONS

A. Electrical penetrations occur when raceways, penetrate concrete slabs, concrete or masonry walls, or fire-rated floor and wall assemblies.

B. 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. Size pipe sleeves to provide 1/4-inch annular clear space between sleeve and raceway or cable, unless indicated otherwise.

G. 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.

H. 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 other related divisions.

I. 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.

J. 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.

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.

END OF SECTION 260500

SECTION 260519 - LOW VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, Common Works and Division 01 Specification Sections, apply to this Section.

1.2 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.
3. Sleeves and sleeve seals for cables.

1.3 DEFINITIONS

A. EPDM: Ethylene-propylene-diene terpolymer rubber.

B. NBR: Acrylonitrile-butadiene rubber.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Qualification Data: For testing agency.

C. Field quality-control test reports.

1.5 QUALITY ASSURANCE

A. 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) as defined by OSHA in 29 CFR 1910.7, 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.

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.

1.6 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:

1. Alcan Products Corporation; Alcan Cable Division.
2. American Insulated Wire Corp.; a Leviton Company.
3. General Cable Corporation.
4. Senator Wire & Cable Company.
5. Southwire Company.

B. Copper Conductors: Comply with NEMA WC 70.

C. Conductor Insulation: Comply with NEMA WC 70 for Types THW THHN-THWN.

2.2 CONNECTORS AND SPLICES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

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.

B. Description: Factory-fabricated connectors and splices of size, ampacity rating, material, type, and class for application and service indicated.

2.3 SLEEVE SEALS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Advance Products & Systems, Inc.
2. Calpico, Inc.
3. Metraflex Co.
4. Pipeline Seal and Insulator, Inc.

B. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and cable.

1. 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.
2. Pressure Plates: Stainless steel. Include two for each sealing element.
3. 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 CONDUCTOR MATERIAL APPLICATIONS

A. Feeders: Copper Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.

B. Branch Circuits: Copper. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.

3.2 CONDUCTOR INSULATION AND MULTICONDUCTOR CABLE APPLICATIONS AND WIRING METHODS

A. Exposed Feeders: Type THHN-THWN, single conductors in raceway; Metal-clad cable, Type MC. Type XHHW-2 for Feeders larger than 30A.

B. Feeders Concealed in Ceilings, Walls, Partitions, and Crawlspaces: Type THHN-THWN, single conductors in raceway; Metal-clad cable, Type MC. Type XHHW-2 for Feeders larger than 30A.

C. Branch Circuits Concealed in Ceilings, Walls, and Partitions: Type THHN-THWN, single conductors in raceway; Metal-clad cable, Type MC. Type XHHW-2 for Branch Circuits larger than 30A.

D. Branch Circuits Installed below Raised Flooring: Type THHN-THWN, single conductors in raceway; Metal-clad cable, Type MC. Type XHHW-2 for Branch Circuits larger than 30A.

E. Class 1 Control Circuits: Type THH-THWN, in raceway.

F. Class 2 Control Circuits: Type THH-THWN, in raceway.

3.3 INSTALLATION OF CONDUCTORS AND CABLES

A. Conceal cables in finished ceilings, 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."

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.

C. Wiring at Outlets: Install conductor at each outlet, with at least 6 inches of slack.

3.5 SLEEVE INSTALLATION FOR ELECTRICAL PENETRATIONS

A. Coordinate sleeve selection and application with selection and application of firestopping materials and Common Works under this division.

3.6 FIRESTOPPING

A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly.

3.7 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections and prepare test reports.

B. Perform tests and inspections and prepare test reports.

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. Infrared Scanning: After Final Acceptance, but not more than 60 days after Final Acceptance, perform an infrared scan of each splice in cables and conductors No. 3 AWG and larger. Remove box and equipment covers so splices are accessible to portable scanner.

a. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each splice 11 months after date of Final Acceptance.
b. Instrument: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.
c. Record of Infrared Scanning: Prepare a certified report that identifies splices checked and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

D. 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.

E. Remove and replace malfunctioning units and retest as specified above.

END OF SECTION 260519

SECTION 260526 - GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes: Grounding systems and equipment.

1.3 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. Grounding for sensitive electronic equipment.

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 "Submittals," include the following:

   1. Instructions for periodic testing and inspection of grounding features at grounding connections for sensitive electronic equipment systems based on NFPA 70B:

      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.

1.4 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 on-site 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 4 inches in cross section, with 9/32-inch 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.

D. Bus-bar Connectors: Mechanical type, cast silicon bronze, solderless compression-type wire terminals, and long-barrel, two-bolt connection to ground bus bar.

PART 3 - EXECUTION

3.1 APPLICATIONS

A. Conductors: Install solid conductor for No. 8 WG and smaller, and stranded conductors for No.6 AWG and larger unless otherwise indicated.

B. Isolated Grounding Conductors: Green-colored insulation with continuous yellow stripe. On feeders with isolated ground, identify grounding conductor where visible to normal inspection, with alternating bands of green and yellow tape, with at least three bands of green and two bands of yellow.

C. Grounding Bus: Install in electrical and telephone equipment rooms, in rooms housing service equipment, and elsewhere as indicated.

1. Install bus on insulated spacers 2 inches 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. Connections to Structural Steel: Welded connectors.

3.2 EQUIPMENT GROUNDING

A. Install insulated equipment grounding conductors with all feeders and branch circuits.

B. Install insulated equipment grounding conductors with the following items, in addition to those required by NFPA 70:

1. Feeders and branch circuits.
2. Lighting circuits.
3. Receptacle circuits.
4. Single-phase motor and appliance branch circuits.
5. Three-phase motor and appliance branch circuits.
6. Flexible raceway runs.
7. Computer and Rack-Mounted Electronic Equipment Circuits: Install insulated equipment grounding conductor in branch-circuit runs from equipment-area power panels and power-distribution units.

C. Air-Duct Equipment Circuits: Install insulated equipment grounding conductor to duct-mounted 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.

D. Water Heater, Heat-Tracing, and Antifrost Heating Cables: Install a separate insulated equipment grounding conductor to each electric water heater and heat-tracing cable. Bond conductor to heater units, piping, connected equipment, and components.

E. Isolated Grounding Receptacle Circuits: Install an insulated equipment grounding conductor connected to the receptacle grounding terminal. Isolate conductor from raceway and from panelboard grounding terminals. Terminate at equipment grounding conductor terminal of the applicable derived system or service unless otherwise indicated.

F. Isolated Equipment Enclosure Circuits: For designated equipment supplied by a branch circuit or feeder, isolate equipment enclosure from supply circuit raceway with a nonmetallic raceway fitting listed for the purpose. Install fitting where raceway enters enclosure, and install a separate insulated equipment grounding conductor. Isolate conductor from raceway and from panelboard grounding terminals. Terminate at equipment grounding conductor terminal of the applicable derived system or service unless otherwise indicated.

G. 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-2-by-8-inch grounding bus.
3. Terminal Cabinets: Terminate grounding conductor on cabinet grounding terminal.

3.3 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 Bonding Common with Lightning Protection System: Comply with NFPA 780 and UL 96 when interconnecting with lightning protection system. Bond electrical power system ground directly to lightning protection system grounding conductor at closest point to electrical service grounding electrode. Use bonding conductor sized same as system grounding electrode conductor, and install in conduit.

C. 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.

D. 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.

E. Bonding Interior Metal Ducts: Bond metal air ducts to equipment grounding conductors of associated fans, blowers, electric heaters, and air cleaners. Install bonding jumper to bond across flexible duct connections to achieve continuity.

F. 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.

3.4 LABELING

A. Comply with requirements in Division 26 Section "Identification for Electrical Systems" Article for instruction signs. The label or its text shall be green.

3.5 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. Tests and Inspections:

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 ground-resistance level is specified, at service disconnect enclosure grounding terminal.

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 Distribution Units or Panelboards Serving Electronic Equipment: 3 ohm(s).

END OF SECTION 260526

SECTION 260529 - HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes 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 26 Section "Vibration And Seismic Controls For Electrical Systems" for products and installation requirements necessary for compliance with seismic criteria.

1.3 DEFINITIONS

A. EMT: Electrical metallic tubing.

B. IMC: Intermediate metal conduit.

C. RMC: Rigid metal conduit.

1.4 PERFORMANCE REQUIREMENTS

A. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

B. 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.

1.5 SUBMITTALS

A. Product Data: For the following:

1. Steel slotted support systems.
2. Nonmetallic slotted support systems.

B. Shop Drawings: 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.

1.6 QUALITY ASSURANCE

A. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

B. Comply with NFPA 70.

1.7 COORDINATION

A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases.

B. Coordinate installation of roof curbs, equipment supports, and roof penetrations.

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. 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. 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.

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. Nonmetallic Slotted Support Systems: Structural-grade, factory-formed, glass-fiber-resin channels and angles with 9/16-inch- diameter holes at a maximum of 8 inches o.c., in at least 1 surface.

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Allied Tube & Conduit.
    b. Cooper B-Line, Inc.; a division of Cooper Industries.
    c. Fabco Plastics Wholesale Limited.
    d. Seasafe, Inc.

3. Fittings and Accessories: Products of channel and angle manufacturer and designed for use with those items.
4. Fitting and Accessory Materials: Same as channels and angles, except metal items may be stainless steel.
5. Rated Strength: Selected to suit applicable load criteria.

C. Raceway and Cable Supports: As described in NECA 1 and NECA 101.

D. 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.

E. Support for Conductors in Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug or plugs for non-armored electrical conductors or cables in riser conduits. Plugs shall have number, size, and shape of conductor gripping pieces as required to suit individual conductors or cables supported. Body shall be malleable iron.

F. Structural Steel for Fabricated Supports and Restraints: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.

G. 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. 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) Hilti Inc.

2) ITW Ramset/Red Head; a division of Illinois Tool Works, Inc.
3) MKT Fastening, LLC.
4) Simpson Strong-Tie Co., Inc.; Masterset Fastening Systems Unit.

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. 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) 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.

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.

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 support system, sized so capacity can be increased by at least 25 percent in future without exceeding specified design load limits.

   1. Secure raceways and cables to these supports with two-bolt conduit clamps or single-bolt conduit clamps using spring friction action for retention in support channel.

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.

3.2 SUPPORT INSTALLATION

A. Comply with NECA 1 and NECA 101 for installation requirements except as specified in this Article.

B. Raceway Support Methods: In addition to methods described in NECA 1, EMT, IMC, and RMC may be supported by openings through structure members, as permitted in NFPA 70.

C. Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb.

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 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, Beam clamps (MSS Type 19, 21, 23, 25, or 27) complying with MSS SP-69.
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 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 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 260529

SECTION 260533 - RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes raceways, fittings, boxes, enclosures, and cabinets for electrical wiring.

B. Related Sections include the following:

1. Division 26 Section "Underfloor Raceways for Electrical Systems" for underfloor raceways, electrical connection components and underfloor construction.

1.3 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.

1.4 SUBMITTALS

A. Product Data: For surface raceways, wireways and fittings, floor boxes, hinged-cover enclosures, and cabinets.

B. Shop Drawings: For surface raceways, wireways and fittings, floor boxes, hinged-cover enclosures, and cabinets. Include plans, elevations, sections, details, and attachments to other work.

C. Coordination Drawings: Conduit routing plans, drawn to scale, on which the following items are shown and coordinated with each other, based on input from installers of the items involved:

1. Structural members in the paths of conduit groups with common supports.
2. HVAC and plumbing items and architectural features in the paths of conduit groups with common supports.

D. Manufacturer Seismic Qualification Certification: Submit certification that enclosures and cabinets and their mounting provisions, including those for internal components, will withstand seismic forces defined in Division 26 Section "Vibration and Seismic Controls for Electrical Systems." Include the following:

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.

a. The term "withstand" means "the cabinet or enclosure will remain in place without separation of any parts when subjected to the seismic forces specified and the unit will retain its enclosure characteristics, including its interior accessibility, after the seismic event."

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.

E. Qualification Data: For professional engineer and testing agency.

F. Source quality-control test reports.

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. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 METAL CONDUIT AND TUBING

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. 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.

B. Rigid Steel Conduit: ANSI C80.1.

C. IMC: ANSI C80.6.

D. PVC-Coated Steel Conduit: PVC-coated rigid steel conduit.

1. Comply with NEMA RN 1.
2. Coating Thickness: 0.040 inch, minimum.

E. EMT: ANSI C80.3.

F. FMC: Zinc-coated steel.

G. LFMC: Flexible steel conduit with PVC jacket.

H. 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: Die-cast, set-screw or compression type.
3. Coating for Fittings for PVC-Coated Conduit: Minimum thickness, 0.040 inch, with overlapping sleeves protecting threaded joints.

I. 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, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

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.

B. ENT: NEMA TC 13.

C. RNC: NEMA TC 2, Type EPC-40-PVC, unless otherwise indicated.

D. LFNC: UL 1660.

E. Fittings for ENT and RNC: NEMA TC 3; match to conduit or tubing type and material.

F. Fittings for LFNC: UL 514B.

2.3 METAL WIREWAYS

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. Cooper B-Line, Inc.
2. Hoffman.
3. Square D; Schneider Electric.

B. Description: Sheet metal sized and shaped as indicated, NEMA 250, Type 1, 12, 3R, 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: Screw-cover type.

E. Finish: Manufacturer's standard enamel finish.

2.4 NONMETALLIC WIREWAYS

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. Hoffman.
2. Lamson & Sessions; Carlon Electrical Products.

B. Description: PVC plastic, extruded and fabricated to size and shape indicated, with snap-on cover and mechanically coupled connections with plastic fasteners.

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.

2.5 SURFACE RACEWAYS

A. Surface Metal Raceways: Galvanized steel with snap-on covers. Manufacturer's standard enamel finish in color selected by Engineer.

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. Thomas & Betts Corporation.
b. Walker Systems, Inc.; Wiremold Company (The).
c. Wiremold Company (The); Electrical Sales Division.

B. Surface Nonmetallic Raceways: Two-piece construction, manufactured of rigid PVC with texture and color selected by Engineer from manufacturer's standard colors.

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. Butler Manufacturing Company; Walker Division.
b. Enduro Systems, Inc.; Composite Products Division.
c. Hubbell Incorporated; Wiring Device-Kellems Division.
d. Lamson & Sessions; Carlon Electrical Products.
e. Panduit Corp.
f. Walker Systems, Inc.; Wiremold Company (The).
g. Wiremold Company (The); Electrical Sales Division.

2.6 BOXES, ENCLOSURES, AND CABINETS

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. 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.

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. Metal Floor Boxes: Cast or sheet metal, semi-adjustable, rectangular.

F. Nonmetallic Floor Boxes: Nonadjustable, round.

G. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.

H. Cast-Metal Access, Pull, and Junction Boxes: NEMA FB 1, cast aluminum with gasketed cover.

I. Hinged-Cover Enclosures: NEMA 250, Type 1, with continuous-hinge cover with flush latch, unless otherwise indicated.

J. 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.

2.7 SLEEVES FOR RACEWAYS

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.

C. Sleeves for Rectangular Openings: Galvanized sheet steel with minimum 0.052- or 0.138-inch thickness as indicated and of length to suit application.

D. Coordinate sleeve selection and application with selection and application of firestopping materials.

2.8 SLEEVE SEALS

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. Advance Products & Systems, Inc.
2. Calpico, Inc.
3. Metraflex Co.
4. Pipeline Seal and Insulator, Inc.

B. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and cable.

1. 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.
2. Pressure Plates: Plastic or Carbon steel. Include two for each sealing element.
3. Connecting Bolts and Nuts: Carbon steel with corrosion-resistant coating of length required to secure pressure plates to sealing elements. Include one for each sealing element.

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.
3. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC.
4. Boxes and Enclosures, Aboveground: NEMA 250, Type 3R.

B. Comply with the following indoor applications, unless otherwise indicated:

1. Exposed, Not Subject to Physical Damage: EMT.
2. Exposed, Not Subject to Severe Physical Damage: EMT.
3. Exposed and Subject to Severe Physical Damage: Rigid steel conduit. Includes raceways in the following locations:
   a. Mechanical rooms.
4. Concealed in Ceilings and Interior Walls and Partitions: EMT.
5. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): FMC, except use LFMC in damp or wet locations.
6. Damp or Wet Locations: Rigid steel conduit
7. Raceways for Optical Fiber or Communications Cable in Spaces Used for Environmental Air: Plenum-type, optical fiber/communications cable raceway or EMT.
8. Boxes and Enclosures: NEMA 250, Type 1, except use NEMA 250, Type 4, stainless steel in damp or wet locations.

C. Minimum Raceway Size: 3/4-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.
2. PVC Externally Coated, Rigid Steel Conduits: Use only fittings listed for use with that material. Patch and seal all joints, nicks, and scrapes in PVC coating after installing conduits and fittings. Use sealant recommended by fitting manufacturer.

E. Do not install aluminum conduits in contact with concrete.

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 6 inches away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.

C. Complete raceway installation before starting conductor installation.

D. Support raceways as specified in Division 26 Section "Hangers and Supports for Electrical Systems."

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. 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.

I. Raceway Terminations at Locations Subject to Moisture or Vibration: Use insulating bushings to protect conductors, including conductors smaller than No. 4 AWG.

J. 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.

K. Raceways for Optical Fiber and Communications Cable: Install raceways, metallic and nonmetallic, rigid and flexible, as follows:
1. Install with a maximum of two 90-degree bends or equivalent for each length of raceway unless Drawings show stricter requirements. Separate lengths with pull or junction boxes or terminations at distribution frames or cabinets where necessary to comply with these requirements.

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. Expansion-Joint Fittings for RNC: Install in each run of aboveground conduit that is located where environmental temperature change may exceed 30 deg F, and that has straight-run length that exceeds 25 feet.

1. Install expansion-joint fittings for each of the following locations, and provide type and quantity of fittings that accommodate temperature change listed for location:

   a. Outdoor Locations Not Exposed to Direct Sunlight: 125 deg F temperature change.
   b. Outdoor Locations Exposed to Direct Sunlight: 155 deg F temperature change.
   c. Indoor Spaces: Connected with the Outdoors without Physical Separation: 125 deg F temperature change.

2. Install fitting(s) that provide expansion and contraction for at least 0.00041 inch per foot of length of straight run per deg F of temperature change.
3. Install each expansion-joint fitting with position, mounting, and piston setting selected according to manufacturer's written instructions for conditions at specific location at the time of installation.

N. Flexible Conduit Connections: Use maximum of 72 inches of flexible conduit for recessed and semirecessed lighting fixtures, 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.

O. Set metal floor boxes level and flush with finished floor surface.

P. Set nonmetallic floor boxes level. Trim after installation to fit flush with finished floor surface.

3.3 SLEEVE INSTALLATION FOR ELECTRICAL PENETRATIONS

A. Coordinate sleeve selection and application with selection and application of firestopping materials.

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. Rectangular Sleeve Minimum Metal Thickness:

1. For sleeve cross-section rectangle perimeter less than 50 inches and no side greater than 16 inches, thickness shall be 0.052 inch.
2. For sleeve cross-section rectangle perimeter equal to, or greater than, 50 inches and 1 or more sides equal to, or greater than, 16 inches, thickness shall be 0.138 inch.

E. 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.

F. Cut sleeves to length for mounting flush with both surfaces of walls.

G. Extend sleeves installed in floors 2 inches above finished floor level.

H. Size pipe sleeves to provide 1/4-inch annular clear space between sleeve and raceway unless sleeve seal is to be installed or unless seismic criteria require different clearance.

I. Seal space outside of sleeves with grout for penetrations of concrete and masonry and with approved joint compound for gypsum board assemblies.

J. Interior Penetrations of Non-Fire-Rated Walls and Floors: Seal annular space between sleeve and raceway, using joint sealant appropriate for size, depth, and location of joint.

K. Fire-Rated-Assembly Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at raceway penetrations. Install sleeves and seal with firestop materials.

L. Roof-Penetration Sleeves: Seal penetration of individual raceways with flexible, boot-type flashing units applied in coordination with roofing work.

3.4 SLEEVE-SEAL INSTALLATION

A. Install to seal underground, exterior wall penetrations.

B. Use type and number of sealing elements recommended by manufacturer for raceway material and size. Position raceway in center of sleeve. Assemble mechanical sleeve seals and install in annular space between raceway and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

3.5 FIRESTOPPING

A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly.

3.6 PROTECTION

A. Provide final protection and maintain conditions that ensure coatings, finishes, and cabinets are without damage or deterioration at time of Final Acceptance.

1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
2. Repair damage to PVC or paint finishes with matching touchup coating recommended by manufacturer.

END OF SECTION 260533

SECTION 260548 - VIBRATION AND SEISMIC CONTROLS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:
1. Spring isolators.
2. Restrained spring isolators.
3. Channel support systems.
4. Restraint cables.
5. Hanger rod stiffeners.
6. Anchorage bushings and washers.

B. Related Sections include the following:

1. Division 26 Section "Hangers And Supports For Electrical Systems" for commonly used electrical supports and installation requirements.

1.3 DEFINITIONS

A. The IBC: International Building Code.

B. ICC-ES: ICC-Evaluation Service.

C. OSHPD: Office of Statewide Health Planning and Development for the State of California.

1.4 PERFORMANCE REQUIREMENTS

A. Seismic-Restraint Loading:

1. Site Class as Defined in the IBC: **D.**
2. Assigned Seismic Use Group or Building Category as Defined in the IBC: **I.**

a. Component Importance Factor: **1.0.**
b. Component Response Modification Factor: **1.5 .**
c. Component Amplification Factor: **1.0.**

3. Design Spectral Response Acceleration at Short Periods (0.2 Second):
4. Design Spectral Response Acceleration at 1.0-Second Period:

1.5 SUBMITTALS

A. Product Data: For the following:

1. Include rated load, rated deflection, and overload capacity for each vibration isolation device.
2. Illustrate and indicate style, material, strength, fastening provision, and finish for each type and size of seismic-restraint component used.

    a. Tabulate types and sizes of seismic restraints, complete with report numbers and rated strength in tension and shear as evaluated by an agency acceptable to authorities having jurisdiction.
    b. Annotate to indicate application of each product submitted and compliance with requirements.

3. Restrained-Isolation Devices: Include ratings for horizontal, vertical, and combined loads.

B. Delegated-Design Submittal: For seismic-restraint details comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1. Design Calculations: Calculate static and dynamic loading due to equipment weight and operation, seismic forces required to select vibration isolators and seismic restraints.
2. Indicate materials and dimensions and identify hardware, including attachment and anchorage devices.
3. Field-fabricated supports.
4. Seismic-Restraint Details:

    a. Design Analysis: To support selection and arrangement of seismic restraints. Include calculations of combined tensile and shear loads.
    b. Details: Indicate fabrication and arrangement. Detail attachments of restraints to the restrained items and to the structure. Show attachment locations, methods, and spacings. Identify components, list their strengths, and indicate directions and values of forces transmitted to the structure during seismic events
    c. Preapproval and Evaluation Documentation: By an agency acceptable to authorities having jurisdiction, showing maximum ratings of restraint items and the basis for approval (tests or calculations).

C. Coordination Drawings: Show coordination of seismic bracing for electrical components with other systems and equipment in the vicinity, including other supports and seismic restraints.

D. Welding certificates.

E. Qualification Data: For professional engineer and testing agency.

F. Field quality-control test reports.

1.6 QUALITY ASSURANCE

A. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is a nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7, and that is acceptable to authorities having jurisdiction.

B. Comply with seismic-restraint requirements in the IBC unless requirements in this Section are more stringent.

C. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

D. Seismic-restraint devices shall have horizontal and vertical load testing and analysis and shall bear anchorage preapproval OPA number from OSHPD, preapproval by ICC-ES, or preapproval by another agency acceptable to authorities having jurisdiction, showing maximum seismic-restraint ratings. Ratings based on independent testing are preferred to ratings based on calculations. If preapproved ratings are not available, submittals based on independent testing are preferred. Calculations (including combining shear and tensile loads) to support seismic-restraint designs must be signed and sealed by a qualified professional engineer.

E. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 SEISMIC-RESTRAINT DEVICES

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. Amber/Booth Company, Inc.
2. California Dynamics Corporation.
3. Cooper B-Line, Inc.; a division of Cooper Industries.
4. Hilti Inc.
5. Loos & Co.; Seismic Earthquake Division.
6. Mason Industries.
7. TOLCO Incorporated; a brand of NIBCO INC.
8. Unistrut; Tyco International, Ltd.

B. General Requirements for Restraint Components: Rated strengths, features, and application requirements shall be as defined in reports by an agency acceptable to authorities having jurisdiction.

1. Structural Safety Factor: Allowable strength in tension, shear, and pullout force of components shall be at least four times the maximum seismic forces to which they will be subjected.

C. Channel Support System: MFMA-3, shop- or field-fabricated support assembly made of slotted steel channels with accessories for attachment to braced component at one end and to building

structure at the other end and other matching components and with corrosion-resistant coating; and rated in tension, compression, and torsion forces.

D. Restraint Cables: ASTM A 603 galvanized-steel cables with end connections made of steel assemblies with thimbles, brackets, swivels, and bolts designed for restraining cable service; and with a minimum of two clamping bolts for cable engagement.

E. Hanger Rod Stiffener: Steel tube or steel slotted-support-system sleeve with internally bolted connections to hanger rod. Do not weld stiffeners to rods.

F. Bushing Assemblies for Wall-Mounted Equipment Anchorage: Assemblies of neoprene elements and steel sleeves designed for rigid equipment mountings, and matched to type and size of attachment devices.

G. Resilient Isolation Washers and Bushings: One-piece, molded, oil- and water-resistant neoprene, with a flat washer face.

H. Mechanical Anchor: Drilled-in and stud-wedge or female-wedge type in zinc-coated steel for interior applications and stainless steel for exterior applications. Select anchors with strength required for anchor and as tested according to ASTM E 488. Minimum length of eight times diameter.

2.2 FACTORY FINISHES

A. Finish: Manufacturer's standard prime-coat finish ready for field painting.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and equipment to receive seismic-control devices for compliance with requirements for installation tolerances and other conditions affecting performance.

B. Examine roughing-in of reinforcement and cast-in-place anchors to verify actual locations before installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 APPLICATIONS

A. Hanger Rod Stiffeners: Install hanger rod stiffeners where required to prevent buckling of hanger rods due to seismic forces.

B. Strength of Support and Seismic-Restraint Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static and seismic loads within specified loading limits.

3.3 SEISMIC-RESTRAINT DEVICE INSTALLATION

A. Equipment and Hanger Restraints:

1. Install restrained isolators on electrical equipment.
2. Install resilient, bolt-isolation washers on equipment anchor bolts where clearance between anchor and adjacent surface exceeds 0.125 inch.
3. Install seismic-restraint devices using methods approved by an agency acceptable to authorities having jurisdiction providing required submittals for component.

B. Install bushing assemblies for mounting bolts for wall-mounted equipment, arranged to provide resilient media where equipment or equipment-mounting channels are attached to wall.

C. Attachment to Structure: If specific attachment is not indicated, anchor bracing to structure at flanges of beams, at upper truss chords of bar joists, or at concrete members.

D. Drilled-in Anchors:

1. Identify position of reinforcing steel and other embedded items prior to drilling holes for anchors. Do not damage existing reinforcing or embedded items during coring or drilling. Notify the structural engineer if reinforcing steel or other embedded items are encountered during drilling. Locate and avoid prestressed tendons, electrical and telecommunications conduit, and gas lines.
2. Do not drill holes in concrete or masonry until concrete, mortar, or grout has achieved full design strength.
3. Wedge Anchors: Protect threads from damage during anchor installation. Heavy-duty sleeve anchors shall be installed with sleeve fully engaged in the structural element to which anchor is to be fastened.
4. Set anchors to manufacturer's recommended torque, using a torque wrench.
5. Install zinc-coated steel anchors for interior and stainless-steel anchors for exterior applications.

3.4 ACCOMMODATION OF DIFFERENTIAL SEISMIC MOTION

A. Install flexible connections in runs of raceways, cables, wireways, cable trays, where they cross seismic joints, where adjacent sections or branches are supported by different structural elements, and where they terminate with connection to equipment that is anchored to a different structural element from the one supporting them as they approach equipment.

3.5 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections and prepare test reports.

B. Perform tests and inspections.

C. Tests and Inspections:

1. Provide evidence of recent calibration of test equipment by a testing agency acceptable to authorities having jurisdiction.
2. Schedule test with Owner, through Architect, before connecting anchorage device to restrained component (unless postconnection testing has been approved), and with at least seven days' advance notice.
3. Test at least four of each type and size of installed anchors and fasteners selected by Architect.
4. Test to 90 percent of rated proof load of device.
5. Measure isolator restraint clearance.
6. Measure isolator deflection.
7. Verify snubber minimum clearances.
8. If a device fails test, modify all installations of same type and retest until satisfactory results are achieved.

D. Remove and replace malfunctioning units and retest as specified above.

E. Prepare test and inspection reports.

3.6 ADJUSTING

A. Adjust isolators after isolated equipment is at operating weight.

B. Adjust limit stops on restrained spring isolators to mount equipment at normal operating height. After equipment installation is complete, adjust limit stops so they are out of contact during normal operation.

C. Adjust active height of spring isolators.

D. Adjust restraints to permit free movement of equipment within normal mode of operation.

END OF SECTION 260548

SECTION 260553 - IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Identification for raceways.
2. Identification of power and control cables.
3. Identification for conductors.
4. Warning labels and signs.
5. Instruction signs.
6. Equipment identification labels.
7. Miscellaneous identification products.

1.3 SUBMITTALS

A. Product Data: For each electrical identification product indicated.

B. Identification Schedule: An index of nomenclature of electrical equipment and system components used in identification signs and labels.

1.4 QUALITY ASSURANCE

A. Comply with ANSI A13.1 and IEEE C2.

B. Comply with NFPA 70.

C. Comply with 29 CFR 1910.144 and 29 CFR 1910.145.

D. Comply with ANSI Z535.4 for safety signs and labels.

E. Adhesive-attached labeling materials, including label stocks, laminating adhesives, and inks used by label printers, shall comply with UL 969.

1.5 COORDINATION

A. Coordinate identification names, abbreviations, colors, and other features with requirements in other Sections requiring identification applications, Drawings, 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 POWER RACEWAY IDENTIFICATION MATERIALS

A. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each raceway size.

B. Colors for Raceways Carrying Circuits at 600 V or Less:

1. Black letters on an orange field.
2. Legend: Indicate voltage and system or service type.

C. Self-Adhesive Vinyl Labels for Raceways Carrying Circuits at 600 V or Less: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound adhesive tape for securing ends of legend label.

D. Snap-Around Labels for Raceways Carrying Circuits at 600 V or Less: Slit, pretensioned, flexible, preprinted, color-coded acrylic sleeve, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.

E. Snap-Around, Color-Coding Bands for Raceways Carrying Circuits at 600 V or Less: Slit, pretensioned, flexible, solid-colored acrylic sleeve, 2 inches long, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.

F. Metal Tags: Brass or aluminum, 2 by 2 by 0.05 inch, with stamped legend, punched for use with self-locking cable tie fastener.

G. Write-On Tags: Polyester tag, 0.010 inch thick, with corrosion-resistant grommet and cable tie for attachment to conductor or cable.

1. Marker for Tags: Permanent, waterproof, black ink marker recommended by tag manufacturer.
2. Marker for Tags: Machine-printed, permanent, waterproof, black ink marker recommended by printer manufacturer.

2.2 POWER AND CONTROL CABLE IDENTIFICATION MATERIALS

A. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each raceway and cable size.

B. Self-Adhesive Vinyl Labels: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound adhesive tape for securing ends of legend label.

C. Metal Tags: Brass or aluminum, 2 by 2 by 0.05 inch, with stamped legend, punched for use with self-locking cable tie fastener.

D. Write-On Tags: Polyester tag, 0.010 inch thick, with corrosion-resistant grommet and cable tie for attachment to conductor or cable.

1. Marker for Tags: Permanent, waterproof, black ink marker recommended by tag manufacturer.
2. Marker for Tags: Machine-printed, permanent, waterproof, black ink marker recommended by printer manufacturer.

E. Snap-Around Labels: Slit, pretensioned, flexible, preprinted, color-coded acrylic sleeve, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.

F. Snap-Around, Color-Coding Bands: Slit, pretensioned, flexible, solid-colored acrylic sleeve, 2 inches long, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.

2.3 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. Self-Adhesive Vinyl Labels: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound adhesive tape for securing ends of legend label.

C. Snap-Around Labels: Slit, pretensioned, flexible, preprinted, color-coded acrylic sleeve, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.

D. Snap-Around, Color-Coding Bands: Slit, pretensioned, flexible, solid-colored acrylic sleeve, 2 inches long, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.

E. Marker Tapes: Vinyl or vinyl-cloth, self-adhesive wraparound type, with circuit identification legend machine printed by thermal transfer or equivalent process.

F. Write-On Tags: Polyester tag, 0.010 inch thick, with corrosion-resistant grommet and cable tie for attachment to conductor or cable.

1. Marker for Tags: Permanent, waterproof, black ink marker recommended by tag manufacturer.
2. Marker for Tags: Machine-printed, permanent, waterproof, black ink marker recommended by printer manufacturer.

2.4 FLOOR MARKING TAPE

A. 2-inch- wide, 5-mil pressure-sensitive vinyl tape, with black and white stripes and clear vinyl overlay.

2.5 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 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."
2. Workspace Clearance Warning: "WARNING - OSHA REGULATION - AREA IN FRONT OF ELECTRICAL EQUIPMENT MUST BE KEPT CLEAR FOR 36 INCHES."

2.6 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 with Clear Protective Overlay: Machine printed, in black, by thermal transfer or equivalent process. Minimum letter height shall be 3/8 inch. Overlay shall provide a weatherproof and UV-resistant seal for label.

2.7 EQUIPMENT IDENTIFICATION LABELS

A. Adhesive Film Label with Clear Protective Overlay: Machine printed, in black, by thermal transfer or equivalent process. Minimum letter height shall be 3/8 inch. Overlay shall provide a weatherproof and UV-resistant seal for label.

B. Self-Adhesive, Engraved, Laminated Acrylic or Melamine Label: Adhesive backed, with white letters on a dark-gray background. Minimum letter height shall be 3/8 inch.

C. Engraved, Laminated Acrylic or Melamine Label: Punched or drilled for screw mounting. White letters on a dark-gray background. Minimum letter height shall be 3/8 inch.

2.8 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.

2.9 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. System Identification Color-Coding Bands for Raceways and Cables: Each color-coding band shall completely encircle cable or conduit. Place adjacent bands of two-color markings in contact, side by side. Locate bands at changes in direction, at penetrations of walls and floors, at 50-foot maximum intervals in straight runs, and at 25-foot maximum intervals in congested areas.

G. Aluminum Wraparound Marker Labels and Metal Tags: Secure tight to surface of conductor or cable at a location with high visibility and accessibility.

H. 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.

3.2 IDENTIFICATION SCHEDULE

A. Accessible Raceways and Metal-Clad Cables, 600 V or Less, for Service, Feeder, and Branch Circuits More Than 30A, and 120 V to ground: Identify with self-adhesive vinyl label. Install labels at 10-foot maximum intervals.

B. Accessible Raceways and Cables within Buildings: Identify the covers of each junction and pull box of the following systems with self-adhesive vinyl labels with the wiring system legend and system voltage. System legends shall be as follows:

1. Emergency Power.
2. Normal Power.
3. UPS.

C. Power-Circuit Conductor Identification, 600 V or Less: For conductors in vaults, pull and junction boxes, 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 feeder and ranch-circuit conductors.

   a. Color shall be factory applied.
   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. Install instructional sign including the color-code for grounded and ungrounded conductors using adhesive-film-type labels.

E. Conductors to Be Extended in the Future: Attach write-on tags to conductors and list source.

F. 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.

G. Workspace Indication: Install floor marking tape to show working clearances in the direction of access to live parts. Workspace shall be as required by NFPA 70 and 29 CFR 1926.403 unless otherwise indicated. Do not install at flush-mounted panelboards and similar equipment in finished spaces.

H. Warning Labels for Indoor Cabinets, Boxes, and Enclosures for Power and Lighting: Baked-enamel warning signs.

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.

I. 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.

J. Emergency Operating Instruction Signs: Install instruction signs with white legend on a red background with minimum 3/8-inch- high letters for emergency instructions at equipment used for power transfer.

K. 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. Indoor Equipment: Self-adhesive, engraved, laminated acrylic or melamine label. Unless otherwise indicated, provide a single line of text with 1/2-inch- high letters on 1-1/2-inch- high label; where two lines of text are required, use labels 2 inches high.
    b. Outdoor Equipment: Engraved, laminated acrylic or melamine label.
    c. Elevated Components: Increase sizes of labels and letters to those appropriate for viewing from the floor.
    d. 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. Emergency system boxes and enclosures.
    g. Enclosed controllers.
    h. Variable-speed controllers.

i. Push-button stations.
j. Power transfer equipment.
k. Contactors.
l. Remote-controlled switches, dimmer modules, and control devices.
m. Battery-inverter units.
n. Battery racks.
o. Power-generating units.
p. Monitoring and control equipment.
q. UPS equipment.

END OF SECTION 260553

SECTION 260923 - LIGHTING CONTROL DEVICES

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. Time switches.
2. Photoelectric switches.
3. Lighting contactors.

B. Related Requirements:

1. Section 262726 "Wiring Devices" for wall-box dimmers, wall-switch occupancy sensors, and manual light switches.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: Show installation details for occupancy and light-level sensors.

1. Interconnection diagrams showing field-installed wiring.
2. Include diagrams for power, signal, and control wiring.

1.4 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For each type of lighting control device to include in emergency, operation, and maintenance manuals.

PART 2 - PRODUCTS

2.1 TIME SWITCHES

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. Cooper Industries, Inc.
2. Intermatic, Inc.
3. Invensys Controls.
4. Leviton Manufacturing Co., Inc.
5. NSi Industries LLC; TORK Products.
6. Tyco Electronics; ALR Brand.

B. Electronic Time Switches: Solid state, programmable, with alphanumeric display; complying with UL 917.

1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
2. Contact Configuration: DPDT.
3. Contact Rating: 30-A inductive or resistive, 240-V ac.
4. Programs: Eight on-off set points on a 24-hour schedule and an annual holiday schedule that overrides the weekly operation on holidays.
5. Programs: Two on-off set points on a 24-hour schedule, allowing different set points for each day of the week and an annual holiday schedule that overrides the weekly operation on holidays.
6. Circuitry: Allow connection of a photoelectric relay as substitute for on-off function of a program on selected channels.
7. Astronomic Time: All channels.
8. Automatic daylight savings time changeover.
9. Battery Backup: Not less than seven days reserve, to maintain schedules and time clock.

2.2 OUTDOOR PHOTOELECTRIC SWITCHES

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. Cooper Industries, Inc.
2. Intermatic, Inc.
3. NSi Industries LLC; TORK Products.
4. Tyco Electronics; ALR Brand.

B. Description: Solid state, with DPST dry contacts rated for 1800-VA tungsten or 1000-VA inductive, to operate connected relay, contactor coils, or microprocessor input; complying with UL 773A.

1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2. Light-Level Monitoring Range: 1.5 to 10 fc (16.14 to 108 lux), with an adjustment for turn-on and turn-off levels within that range, and a directional lens in front of the photocell to prevent fixed light sources from causing turn-off.
3. Time Delay: Fifteen second minimum, to prevent false operation.
4. Surge Protection: Metal-oxide varistor.
5. Mounting: Twist lock complies with NEMA C136.10, with base-and-stem mounting or stem-and-swivel mounting accessories as required to direct sensor to the north sky exposure.

2.3 LIGHTING CONTACTORS

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. Allen-Bradley/Rockwell Automation.
2. ASCO Power Technologies, LP.
3. Eaton Corporation.
4. General Electric Company; GE Consumer & Industrial - Electrical Distribution; Total Lighting Control.
5. Square D.

B. Description: Electrically operated and mechanically 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 total harmonic distortion 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.

C. BAS Interface: Provide hardware interface to enable the BAS to monitor and control lighting contactors.

1. Monitoring: On-off status.
2. Control: On-off operation.

2.4 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 CONTACTOR INSTALLATION

A. 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.

3.2 WIRING INSTALLATION

A. Wiring Method: Comply with Section 260519 "Low-Voltage Electrical Power Conductors and Cables." Minimum conduit size is 1/2 inch (13 mm).

B. Wiring within Enclosures: Comply with NECA 1. Separate power-limited and nonpower-limited conductors according to conductor manufacturer's written instructions.

C. Size conductors according to lighting control device manufacturer's written instructions unless otherwise indicated.

D. Splices, Taps, and Terminations: Make connections only on numbered terminal strips in junction, pull, and outlet boxes; terminal cabinets; and equipment enclosures.

3.3 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.

3.4 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to evaluate lighting control devices and 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:

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.

D. Lighting control devices will be considered defective if they do not pass tests and inspections.

E. Prepare test and inspection reports.

END OF SECTION 260923

SECTION 260936 - MODULAR DIMMING CONTROLS

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. Manual modular dimming controls.
2. Integrated, multipreset modular dimming controls.

1.3 DEFINITIONS

A. Fade Rate: The time it takes each zone to arrive at the next scene, dependent on the degree of change in lighting level.

B. Low Voltage: As defined in NFPA 70 for circuits and equipment operating at less than 50 V or for remote-control, signaling and power-limited circuits.

C. Scene: The lighting effect created by adjusting several zones of lighting to the desired intensity.

D. SCR: Silicon-controlled rectifier.

E. Zone: A fixture or group of fixtures controlled simultaneously as a single entity. Also known as a "channel."

1.4 SUBMITTALS

A. Product Data: For each type of product indicated.

1. For modular dimming controls; include elevation, dimensions, features, characteristics, ratings, and labels.
2. Device plates and plate color and material.
3. Ballasts and lamp combinations compatible with dimmers.
4. Wiring Diagrams: Power, signal, and control wiring.

B. Samples for Initial Selection: For master and remote-control stations, and faceplates with factory-applied color finishes and technical features.

C. Samples for Verification: For master and remote-control stations, and faceplates with factory-applied color finishes and technical features.

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. Comply with NFPA 70.

1.6 COORDINATION

A. Coordinate features of devices specified in this Section with systems and components specified in other Sections to form an integrated system of compatible components. Match components and interconnections for optimum performance of specified functions. Include coordination with the following:

1. Division 26 Section "Interior Lighting."

PART 2 - PRODUCTS

2.1 GENERAL DIMMING DEVICE REQUIREMENTS

A. Compatibility: Dimming control components shall be compatible with other elements of lighting fixtures, ballasts, transformers, and lighting controls.

B. Dimmers and Dimmer Modules: Comply with UL 508.

1. Audible Noise and Radio-Frequency Interference Suppression: Solid-state dimmers shall operate smoothly over their operating ranges without audible lamp or dimmer noise or radio-frequency interference. Modules shall include integral or external filters to suppress audible noise and radio-frequency interference.
2. Dimmer or Dimmer-Module Rating: Not less than 125 percent of connected load unless otherwise indicated.

2.2 MANUAL MODULAR MULTISCENE DIMMING CONTROLS

A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or a comparable product by one of the following:

1. Lehigh Lighting Company Inc.
2. Lightolier Controls; a division of Lightolier; a Genlyte Group.
3. Lutron Electronics, Inc.
4. Leviton Mfg. Company Inc.

B. Description: Factory-fabricated equipment providing manual modular dimming control consisting of a wall-box-mounted, master-scene controller and indicated number of wall-box zone stations. Controls and dimmers shall be integrated for mounting in one-, two-, or three-gang wall box under a single wall plate. Each zone station shall be adjustable to indicated number of scenes, which shall be recorded on the zone controller.

C. Operation: Automatically change variable dimmer settings of indicated number of zones simultaneously from one preset scene to another when a push button is operated.

D. Each manual modular multiscene dimming controller shall include a master control and remote controls.

E. Each zone shall be configurable to control the following:
1. Incandescent lamps.
2. Low-voltage incandescent lamps.

F. Memory: Retain preset scenes through power failures for at least seven days.

G. Device Plates: Style, material, and color shall comply with Division 26 Section "Wiring Devices."

H. Master-Scene Controller: Suitable for mounting in a single flush wall box.

1. Switches: Master off, group dim, group bright, and selectors for each scene.
2. LED indicator lights, one associated with each scene switch, and one for the master off switch.

I. Incandescent Zone Dimmer: Suitable for operating incandescent lamps at line-voltage or low-voltage lamps connected to a transformer and arranged to dim number of scenes indicated for the master-scene controller. Scene selection shall be at the master-scene controller for setting light levels of each zone associated with scene.

1. Switch: Slider style for setting the light level for each scene.
2. LED indicator lights, one associated with each scene.
3. Voltage Regulation: Dimmer shall maintain a constant light level, with no visible flicker, when the source voltage varies plus or minus 2 percent in RMS voltage.

2.3 INTEGRATED, MULTIPRESET MODULAR DIMMING CONTROLS

A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or a comparable product by one of the following:

1. Lehigh Lighting Company.
2. Leviton Mfg. Company Inc.
3. Lightolier Controls; a division of Lightolier; a Genlyte Group.
4. Lithonia Lighting.
5. Lutron Electronics, Inc.
6. Marlin Controls.
7. Douglas Lighting Controls.

B. Description: Factory-fabricated, microprocessor-based, solid-state controls providing manual dimming control consisting of a master station and multiple wall-box, remote-control stations.

C. Operation: Automatically changes variable dimmer settings of indicated number of zones simultaneously from one preset scene to another when a push button is operated.

D. Each zone shall be configurable to control the following:
1. Incandescent lamps.
2. Low-voltage incandescent lamps.

E. Memory: Retain preset scenes and fade settings through power failures by retaining physical settings of controls.

F. Master Station:

1. Contains control panel and multiple control and dimmer modules.
2. Controls and commands adjustment of each dimmer-zone setting for each scene change from one preset scene to another.
    a. Master zone raises and lowers lighting level.
    b. Adjustable fade rate for each scene from 1 to 60 seconds.
3. Rear-illuminated, scene-select buttons.
4. Lighting-level setting and fade-rate setting shall be graphically shown using LEDs or backlighted bar-graph indicator.
5. Mounting: Flush wall box with manufacturer's standard faceplate.

G. Remote-Control Stations:

1. Numbered push buttons to select scenes.
2. Off switch to turn master station off.
3. On switch turns all scenes of master station to full bright.
4. Control Wiring: NFPA 70, Class 2.
5. Mounting: Single flush wall box with manufacturer's standard faceplate.

H. Dimmers: Modular, plug-in type, with circuit breaker to protect the dimmer and branch circuit.

1. Dimming Circuit: Two SCR dimmers, in inverse parallel configuration.
2. Dimming Curve: Modified "square law" as specified in IESNA's "IESNA Lighting Handbook"; control voltage is 0- to 10-V dc.
3. Dimming Range: 0 to 100 percent, full output voltage not less than 98 percent of line voltage.
4. Voltage Regulation: Dimmer shall maintain a constant light level, with no visible flicker, when the source voltage varies plus or minus 2 percent in RMS voltage.
5. Short-Circuit Rating: 10 kA for 120 V.

2.4 CONDUCTORS AND CABLES

A. Wiring to Supply Side of Remote-Control Power Sources: Not smaller than No. 12 AWG. Comply with requirements in Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

B. Class 2 Control Cable: Multiconductor cable with stranded-copper conductors not smaller than No. 22 AWG. Comply with requirements in Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

PART 3 - EXECUTION

3.1 WIRING INSTALLATION

A. Comply with NECA 1.

B. Wiring Method: Comply with requirements in Division 26 Section "Low-Voltage Electrical Power Conductors and Cables." Minimum conduit size shall be 1/2 inch.

C. Wiring within Enclosures: Bundle, lace, and train conductors to terminal points. Separate power-limited and nonpower-limited 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.

3.2 IDENTIFICATION

A. Comply with requirements in Division 26 Section "Identification for Electrical Systems" for identifying components and power and control wiring.

B. Label each dimmer module with a unique designation.

C. Label each scene control button with approved scene description.

3.3 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections. Report results in writing.

B. Perform tests and inspections and prepare test reports.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

C. Tests and Inspections:

1. Continuity tests of circuits.
2. Operational Test: Set and operate controls to demonstrate their functions and capabilities in a methodical sequence that cues and reproduces actual operating functions.

   a. Include testing of modular dimming control equipment under conditions that simulate actual operational conditions. Record control settings, operations, cues, and functional observations.

D. Remove and replace malfunctioning modular dimming control components and retest as specified above.

E. Test Labeling: After satisfactory completion of tests and inspections, apply a label to tested components indicating test results, date, and responsible agency and representative.

F. Reports: Written reports of tests and observations. Record defective materials and workmanship and unsatisfactory test results. Record repairs and adjustments.

3.4 DEMONSTRATION

A. Owner's maintenance personnel to adjust, operate, and maintain modular dimming controls.

END OF SECTION 260936

SECTION 262200 - LOW-VOLTAGE TRANSFORMERS

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 types of dry-type transformers rated 600 V and less, with capacities up to 1000 kVA:

1. Distribution transformers.

1.3 SUBMITTALS

A. Product Data: Include rated nameplate data, capacities, weights, dimensions, minimum clearances, installed devices and features, and performance for each type and size of transformer 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.

1. Wiring Diagrams: Power, signal, and control wiring.

C. Manufacturer Seismic Qualification Certification: Submit certification that transformers, accessories, and components will withstand seismic forces defined in Division 26 Section "Electrical Supports and Seismic Restraints." Include the following:

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.

a. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified."

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.

D. Qualification Data: For testing agency.

E. Source quality-control test reports.

F. Field quality-control test reports.

G. Operation and Maintenance Data: For transformers to include in emergency, operation, and maintenance manuals.

1.4 QUALITY ASSURANCE

A. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is a nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7.

B. Source Limitations: Obtain each transformer type through one source from a single manufacturer.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

D. Comply with IEEE C57.12.91, "Test Code for Dry-Type Distribution and Power Transformers."

1.5 DELIVERY, STORAGE, AND HANDLING

A. Temporary Heating: Apply temporary heat according to manufacturer's written instructions within the enclosure of each ventilated-type unit, throughout periods during which equipment is not energized and when transformer is not in a space that is continuously under normal control of temperature and humidity.

1.6 COORDINATION

A. Coordinate size and location of concrete bases with actual transformer provided. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 3.

B. Coordinate installation of wall-mounting and structure-hanging supports with actual transformer provided.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. ACME Electric Corporation; Power Distribution Products Division.
2. Challenger Electrical Equipment Corp.; a division of Eaton Corp.
3. Controlled Power Company.

4. Eaton Electrical Inc.; Cutler-Hammer Products.
5. Federal Pacific Transformer Company; Division of Electro-Mechanical Corp.
6. General Electric Company.
7. Hammond Co.; Matra Electric, Inc.
8. Magnetek Power Electronics Group.
9. Micron Industries Corp.
10. Myers Power Products, Inc.
11. Siemens Energy & Automation, Inc.
12. Sola/Hevi-Duty.
13. Square D; Schneider Electric.

2.2 GENERAL TRANSFORMER REQUIREMENTS

A. Description: Factory-assembled and -tested, air-cooled units for 60-Hz service.

B. Cores: Grain-oriented, non-aging silicon steel.

C. Coils: Continuous windings without splices except for taps.

1. Internal Coil Connections: Brazed or pressure type.
2. Coil Material: Aluminum.

2.3 DISTRIBUTION TRANSFORMERS

A. Comply with NEMA ST 20, and list and label as complying with UL 1561.

B. Provide transformers that are constructed to withstand seismic forces specified in Division 26 Section "Vibration and Seismic Controls for Electrical System."

C. Cores: One leg per phase.

D. Enclosure: Ventilated, NEMA 250, Type 2.

1. Core and coil shall be encapsulated within resin compound, sealing out moisture and air.

E. Transformer Enclosure Finish: Comply with NEMA 250.

1. Finish Color: Gray.

F. Taps for Transformers 25 kVA and Larger: Two 2.5 percent taps above and two 2.5 percent taps below normal full capacity.

G. Insulation Class: 220 deg C, UL-component-recognized insulation system with a maximum of 150 deg C rise above 40 deg C ambient temperature.

H. Energy Efficiency for Transformers Rated 15 kVA and Larger:

1. Complying with NEMA TP 1, Class 1 efficiency levels.
2. Tested according to NEMA TP 2.

I. Wall Brackets: Manufacturer's standard brackets.

J. Fungus Proofing: Permanent fungicidal treatment for coil and core.

K. Low-Sound-Level Requirements: Minimum of 3 dBA less than NEMA ST 20 standard sound levels when factory tested according to IEEE C57.12.91.

2.4 IDENTIFICATION DEVICES

A. Nameplates: Engraved, laminated-plastic or metal nameplate for each distribution transformer, mounted with corrosion-resistant screws. Nameplates and label products are specified in Division 26 Section "Identification for Electrical Systems."

2.5 SOURCE QUALITY CONTROL

A. Test and inspect transformers according to IEEE C57.12.91.

B. Factory Sound-Level Tests: Conduct sound-level tests on equipment for this Project.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine conditions for compliance with enclosure- and ambient-temperature requirements for each transformer.

B. Verify that field measurements are as needed to maintain working clearances required by NFPA 70 and manufacturer's written instructions.

C. Examine walls, floors, roofs, and concrete bases for suitable mounting conditions where transformers will be installed.

D. Verify that ground connections are in place and requirements in Division 26 Section "Grounding and Bonding for Electrical Systems" have been met. Maximum ground resistance shall be 5 ohms at location of transformer.

E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install wall-mounting transformers level and plumb with wall brackets fabricated by transformer manufacturer.

1. Brace wall-mounting transformers as specified in Division 26 Section "Vibration and Seismic Controls for Electrical Systems."

3.3 CONNECTIONS

A. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."

B. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

3.4 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections and prepare test reports.

B. 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.

C. 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.

D. Tests and Inspections:

1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.

E. Remove and replace units that do not pass tests or inspections and retest as specified above.

F. Infrared Scanning: Two months after Final Acceptance, perform an infrared scan of transformer connections.

1. Use an infrared-scanning device designed to measure temperature or detect significant deviations from normal values. Provide documentation of device calibration.
2. Perform 2 follow-up infrared scans of transformers, one at 4 months and the other at 11 months after Final Acceptance.
3. Prepare a certified report identifying transformer checked and describing results of scanning. Include notation of deficiencies detected, remedial action taken, and scanning observations after remedial action.

G. Test Labeling: On completion of satisfactory testing of each unit, attach a dated and signed "Satisfactory Test" label to tested component.

3.5 ADJUSTING

A. Record transformer secondary voltage at each unit for at least 48 hours of typical occupancy period. Adjust transformer taps to provide optimum voltage conditions at secondary terminals.

Optimum is defined as not exceeding nameplate voltage plus 10 percent and not being lower than nameplate voltage minus 3 percent at maximum load conditions. Submit recording and tap settings as test results.

B. Output Settings Report: Prepare a written report recording output voltages and tap settings.

3.6 CLEANING

A. Vacuum dirt and debris; do not use compressed air to assist in cleaning.

END OF SECTION 262200

SECTION 262413 - SWITCHBOARDS

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. Service and distribution switchboards rated 600 V and less.
2. Transient voltage suppression devices.
3. Disconnecting and overcurrent protective devices.
4. Instrumentation.
5. Control power.
6. Accessory components and features.
7. Identification.
8. Mimic bus.

1.3 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Switchboards shall withstand the effects of earthquake motions determined according to SEI/ASCE 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 ACTION SUBMITTALS

A. Product Data: For each type of switchboard, overcurrent protective device, transient voltage suppression device, ground-fault protector, accessory, and component indicated. Include dimensions and manufacturers' technical data on features, performance, electrical characteristics, ratings, accessories, and finishes.

B. Shop Drawings: For each switchboard and related equipment.

1. Include dimensioned plans, elevations, sections, and details, including required clearances and service space around equipment. Show tabulations of installed devices, equipment features, and ratings.
2. Detail enclosure types for types other than NEMA 250, Type 1.

3. Detail bus configuration, current, and voltage ratings.
4. Detail short-circuit current rating of switchboards and overcurrent protective devices.
5. Include descriptive documentation of optional barriers specified for electrical insulation and isolation.
6. Detail utility company's metering provisions with indication of approval by utility company.
7. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.
8. Include time-current coordination curves for each type and rating of overcurrent protective device included in switchboards. Submit on translucent log-log graft paper; include selectable ranges for each type of overcurrent protective device.
9. Include diagram and details of proposed mimic bus.
10. Include schematic and wiring diagrams for power, signal, and control wiring.

C. Samples: Representative portion of mimic bus with specified material and finish, for color selection.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified Installer.

B. Seismic Qualification Certificates: Submit certification that switchboards, overcurrent protective devices, accessories, and components will withstand seismic forces.

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. Test procedures used.
2. Test results that comply with requirements.
3. Results of failed tests and corrective action taken to achieve test results that comply with requirements.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For switchboards and components to include in emergency, operation, and maintenance manuals:

1. Routine maintenance requirements for switchboards and all installed components.
2. Manufacturer's written instructions for testing and adjusting overcurrent protective devices.

3. Time-current coordination curves for each type and rating of overcurrent protective device included in switchboards. Submit on translucent log-log graft paper; include selectable ranges for each type of overcurrent protective device.

1.7 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Potential Transformer Fuses: Equal to 10 percent of quantity installed for each size and type, but no fewer than two 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. Fuses and Fusible Devices for Fused Circuit Breakers: Equal to 10 percent of quantity installed for each size and type, but no fewer than three of each size and type..
4. 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.
5. Fuses for Fused Power-Circuit Devices: Equal to 10 percent of quantity installed for each size and type, but no fewer than three of each size and type.
6. Indicating Lights: Equal to 10 percent of quantity installed for each size and type, but no fewer than one of each size and type.

1.8 QUALITY ASSURANCE

A. Installer Qualifications: An employer of workers qualified as defined in NEMA PB 2.1 and trained in electrical safety as required by NFPA 70E.

B. Testing Agency Qualifications: Member company of NETA or an NRTL.

1. Testing Agency's Field Supervisor: Currently certified by NETA to supervise on-site testing.

C. Source Limitations: Obtain switchboards, overcurrent protective devices, components, and accessories from single source from single manufacturer.

D. Product Selection for Restricted Space: Drawings indicate maximum dimensions for switchboards including clearances between switchboards and adjacent surfaces and other items. Comply with indicated maximum dimensions.

E. 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.

F. Comply with NEMA PB 2.

G. Comply with NFPA 70.

H. Comply with UL 891.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Deliver switchboards in sections or lengths that can be moved past obstructions in delivery path.

B. Remove loose packing and flammable materials from inside switchboards and connect factory-installed space heaters to temporary electrical service to prevent condensation.

C. Handle and prepare switchboards for installation according to NECA 400, NEMA PB 2.1.

1.10 PROJECT CONDITIONS

A. Installation Pathway: Remove and replace access fencing, doors, lift-out panels, and structures to provide pathway for moving switchboards into place.

B. Environmental Limitations:

1. Do not deliver or install switchboards until spaces are enclosed and weathertight, wet work in spaces is complete and dry, work above switchboards 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.
2. Rate equipment for continuous operation under the following conditions unless otherwise indicated:

   a. Ambient Temperature: Not exceeding 104 deg F.
   b. Altitude: Not exceeding 6600 feet.

C. Service Conditions: NEMA PB 2, usual service conditions, as follows:

1. Ambient temperatures within limits specified.
2. Altitude not exceeding 6600 feet.

D. Interruption of Existing Electric Service: 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 Owner no fewer than seven days in advance of proposed interruption of electric service.
2. Indicate method of providing temporary electric service.
3. Do not proceed with interruption of electric service without Owner's written permission.
4. Comply with NFPA 70E.

1.11 COORDINATION

A. Coordinate layout and installation of switchboards 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.

B. Coordinate sizes and locations of concrete bases with actual equipment provided. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified with concrete.

1.12 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace transient voltage suppression devices that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURED UNITS

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. 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.

B. Front-Connected, Front-Accessible Switchboards:

1. Main Devices: Fixed, individually mounted.
2. Branch Devices: Panel mounted.
3. Sections front and rear aligned.

C. Front- and Side-Accessible Switchboards:

1. Main Devices: Fixed, individually mounted.
2. Branch Devices: Panel mounted.
3. Sections front and rear aligned.

D. Nominal System Voltage: 480Y/277 V.

E. Main-Bus Continuous: 1200 A.

F. Seismic Requirements: Fabricate and test switchboards according to IEEE 344 to withstand seismic forces. .

G. Indoor Enclosures: Steel, NEMA 250, Type 1.

H. Enclosure Finish for Indoor Units: Factory-applied finish in manufacturer's standard gray finish over a rust-inhibiting primer on treated metal surface.

I. Barriers: Between adjacent switchboard sections.

J. Insulation and isolation for main bus of main section and main and vertical buses of feeder sections.

K. Cubical Space Heaters: Factory-installed electric space heaters of sufficient wattage in each vertical section to maintain enclosure temperature above expected dew point.

1. Space-Heater Control: Thermostats to maintain temperature of each section above expected dew point.
2. Space-Heater Power Source: Transformer, factory installed in switchboard, 120-V external branch circuit.

L. Bus Transition and Incoming Pull Sections: Matched and aligned with basic switchboard.

M. Removable, Hinged Rear Doors and Compartment Covers: Secured by captive thumb screws or standard bolts, for access to rear interior of switchboard.

N. Hinged Front Panels: Allow access to circuit breaker, metering, accessory, and blank compartments.

O. Buses and Connections: Three phase, four wire unless otherwise indicated.

1. Phase- and Neutral-Bus Material: Hard-drawn copper of 98 percent conductivity, silver-plated, with tin-plated aluminum or copper feeder circuit-breaker line connections.
2. Phase- and Neutral-Bus Material: Tin-plated, high-strength, electrical-grade aluminum alloy with tin-plated aluminum circuit-breaker line connections.
3. Phase- and Neutral-Bus Material: Hard-drawn copper of 98 percent conductivity, silver-plated, or tin-plated, high-strength, electrical-grade aluminum alloy.
4. Load Terminals: Insulated, rigidly braced, runback bus extensions, of same material as through buses, equipped with mechanical connectors for outgoing circuit conductors. Provide load terminals for future circuit-breaker positions at full-ampere rating of circuit-breaker position.
5. Ground Bus: 1/4-by-2-inch, Minimum-size required by UL 891, hard-drawn copper of 98 percent conductivity, equipped with mechanical connectors for feeder and branch-circuit ground conductors. For busway feeders, extend insulated equipment grounding cable to busway ground connection and support cable at intervals in vertical run.
6. Main Phase Buses and Equipment Ground Buses: Uniform capacity for entire length of switchboard's main and distribution sections. Provide for future extensions from both ends.
7. Neutral Buses: 100 percent of the ampacity of phase buses unless otherwise indicated, equipped with mechanical connectors for outgoing circuit neutral cables. Brace bus extensions for busway feeder neutral bus.
8. Isolation Barrier Access Provisions: Permit checking of bus-bolt tightness.

P. Future Devices: Equip compartments with mounting brackets, supports, bus connections, and appurtenances at full rating of circuit-breaker compartment.

Q. Bus-Bar Insulation: Factory-applied, flame-retardant, tape wrapping of individual bus bars or flame-retardant, spray-applied insulation. Minimum insulation temperature rating of 105 deg C.

R. Fungus Proofing: Permanent fungicidal treatment for overcurrent protective devices and other components including instruments and instrument transformers.

2.2 TRANSIENT VOLTAGE SUPPRESSION DEVICES

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. 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.

B. Surge Protection Device Description: IEEE C62.41-compliant, integrally mounted, plug-in solid-state, parallel-connected, modular (with field-replaceable modules type, with sine-wave tracking suppression and filtering modules, UL 1449, second edition, short-circuit current rating matching or exceeding the switchboard short-circuit rating, and with the following features and accessories:

1. Fuses, rated at 200-kA interrupting capacity.
2. Fabrication using bolted compression lugs for internal wiring.
3. Integral disconnect switch.
4. Redundant suppression circuits.
5. Redundant replaceable modules.
6. Arrangement with wire connections to phase buses, neutral bus, and ground bus.
7. LED indicator lights for power and protection status.
8. Audible alarm, with silencing switch, to indicate when protection has failed.
9. Form-C contacts rated at 5 A and 250-V ac, one normally open and one normally closed, for remote monitoring of system operation. Contacts shall reverse position on failure of any surge diversion module. Coordinate with building power monitoring and control system.
10. Six -digit, transient-event counter set to totalize transient surges.

C. Peak Single-Impulse Surge Current Rating: 160 kA per mode/320 kA per phase.

D. Withstand Capabilities: 12,000 IEEE C62.41, Category C3 (10 kA), 8-by-20-mic.sec. surges with less than 5 percent change in clamping voltage.

E. Protection modes and UL 1449 SVR for grounded wye circuits with 208Y/120 V, three-phase, four-wire circuits shall be as follows:

1. Line to Neutral: 400 V for 208Y/120.

2. Line to Ground 400 V for 208Y/120.
3. Neutral to Ground: 400 V for 208Y/120.

F. Protection modes and UL 1449 SVR for 240/120-V, three-phase, four-wire circuits with high leg shall be as follows:

1. Line to Neutral: 400 V, 800 V from high leg.
2. Line to Ground: 400 V.
3. Neutral to Ground: 400 V.

G. Protection modes and UL 1449 SVR for 240-, 480-, or 600-V, three-phase, three-wire, delta circuits shall be as follows:

1. Line to Line: 1000 V for 240 V.
2. Line to Ground: 800 V for 240 V.

2.3 DISCONNECTING AND OVERCURRENT PROTECTIVE DEVICES

A. Molded-Case Circuit Breaker (MCCB): Comply with UL 489, fully rated to meet available fault currents.

1. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads, and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.
2. Adjustable Instantaneous-Trip Circuit Breakers: Magnetic trip element with front-mounted, field-adjustable trip setting.
3. Electronic trip circuit breakers with 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 I^2t response.
4. GFCI Circuit Breakers: Single- and two-pole configurations with Class A ground-fault protection (6-mA trip).
5. Ground-Fault Equipment Protection (GFEP) Circuit Breakers: Class B ground-fault protection (30-mA trip).
6. 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 material.
    c. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HID for feeding fluorescent and high-intensity discharge (HID) lighting circuits.
    d. Ground-Fault Protection: Integrally mounted relay and trip unit with adjustable pickup and time-delay settings, push-to-test feature, and ground-fault indicator.

e. Zone-Selective Interlocking: Integral with electronic trip unit; for interlocking ground-fault protection function.
f. Communication Capability: Integral communication module with functions and features compatible with power monitoring and control system.
g. Shunt Trip: 120-V trip coil energized from separate circuit, set to trip at **55** percent of rated voltage.
h. Undervoltage Trip: Set to operate at 35 to 75 percent of rated voltage without intentional time delay.
i. Auxiliary Contacts: Two SPDT switches with "a" and "b" contacts; "a" contacts mimic circuit-breaker contacts, "b" contacts operate in reverse of circuit-breaker contacts.
j. Key Interlock Kit: Externally mounted to prohibit circuit-breaker operation; key shall be removable only when circuit breaker is in off 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; bar or window 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.

C. Ammeters, Voltmeters, and Power-Factor Meters: ANSI C39.1.

1. Meters: 4-inch diameter or 6 inches square, flush or semiflush, with antiparallax 250-degree scales and external zero adjustment.
2. Voltmeters: Cover an expanded-scale range of nominal voltage plus 10 percent.

D. Instrument Switches: Rotary type with off position.

1. Voltmeter Switches: Permit reading of all phase-to-phase voltages and, where a neutral is indicated, phase-to-neutral voltages.
2. Ammeter Switches: Permit reading of current in each phase and maintain current-transformer secondaries in a closed-circuit condition at all times.

E. Feeder Ammeters: 2-1/2-inch minimum size with 90- or 120-degree scale. Meter and transfer device with off position, located on overcurrent device door for indicated feeder circuits only.

F. Watt-Hour Meters and Wattmeters:

1. Comply with ANSI C12.1.
2. Three-phase induction type with two stators, each with current and potential coil, rated 5 A, 120 V, 60 Hz.
3. Suitable for connection to three- and four-wire circuits.
4. Potential indicating lamps.
5. Adjustments for light and full load, phase balance, and power factor.
6. Four-dial clock register.
7. Integral demand indicator.
8. Contact devices to operate remote impulse-totalizing demand meter.
9. Ratchets to prevent reverse rotation.
10. Removable meter with drawout test plug.
11. Semiflush mounted case with matching cover.
12. Appropriate multiplier tag.

G. Impulse-Totalizing Demand Meter:

1. Comply with ANSI C12.1.
2. Suitable for use with switchboard watt-hour meter, including two-circuit totalizing relay.
3. Cyclometer.
4. Four-dial, totalizing kilowatt-hour register.
5. Positive chart drive mechanism.
6. Capillary pen holding a minimum of one month's ink supply.
7. Roll chart with minimum 31-day capacity; appropriate multiplier tag.
8. Capable of indicating and recording 30 minute integrated demand of totalized system.

2.5 CONTROL POWER

A. Control Circuits: 120-V ac, supplied through secondary disconnecting devices from control-power transformer.

B. Control Circuits: 120-V ac, supplied from remote branch circuit.

C. Electrically Interlocked Main and Tie Circuit Breakers: Two control-power transformers in separate compartments, with interlocking relays, connected to the primary side of each control-power transformer at the line side of the associated main circuit breaker. 120-V secondaries connected through automatic transfer relays to ensure a fail-safe automatic transfer scheme.

D. Control-Power Fuses: Primary and secondary fuses for current-limiting and overload protection of transformer and fuses for protection of control circuits.

E. Control Wiring: Factory installed, with bundling, lacing, and protection included. Provide flexible conductors for No. 8 AWG and smaller, for conductors across hinges, and for conductors for interconnections between shipping units.

2.6 ACCESSORY COMPONENTS AND FEATURES

A. Accessory Set: Include tools and miscellaneous items required for overcurrent protective device test, inspection, maintenance, and operation.

B. Portable Test Set: For testing functions of solid-state trip devices without removing from switchboard. Include relay and meter test plugs suitable for testing switchboard meters and switchboard class relays.

C. Portable Circuit-Breaker Lifting Device: Floor-supported, roller-based, elevating carriage arranged for movement of circuit breakers in and out of compartments for present and future circuit breakers.

D. Overhead Circuit-Breaker Lifting Device: Mounted at top front of switchboard, with hoist and lifting yokes matching each drawout circuit breaker.

E. Spare-Fuse Cabinet: Suitably identified, wall-mounted, lockable, compartmented steel box or cabinet. Arrange for wall mounting.

2.7 IDENTIFICATION

A. Mimic Bus: Entire single-line switchboard bus work, as depicted on factory record drawing, on a photoengraved nameplate.

1. Nameplate: At least 0.032-inch- thick anodized aluminum, located at eye level on front cover of the switchboard incoming service section.

B. Mimic Bus: Entire single-line switchboard bus work, as depicted on factory record drawing, on an engraved laminated-plastic (Gravoply) nameplate.

1. Nameplate: At least 0.0625-inch- thick laminated plastic (Gravoply), located at eye level on front cover of the switchboard incoming service section.

C. Mimic Bus: Continuously integrated mimic bus factory applied to front of switchboard. Arrange in single-line diagram format, using symbols and letter designations consistent with final mimic-bus diagram.

D. Coordinate mimic-bus segments with devices in switchboard sections to which they are applied. Produce a concise visual presentation of principal switchboard components and connections.

E. Presentation Media: Painted graphics in color contrasting with background color to represent bus and components, complete with lettered designations.

F. Service Equipment Label: NRTL labeled for use as service equipment for switchboards with one or more service disconnecting and overcurrent protective devices.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Receive, inspect, handle, and store switchboards according to NECA 400, NEMA PB 2.1.

B. Examine switchboards before installation. Reject switchboards that are moisture damaged or physically damaged.

C. Examine elements and surfaces to receive switchboards 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 switchboards and accessories according to NECA 400 NEMA PB 2.1.

B. Equipment Mounting: Install switchboards on concrete base, 4-inch nominal thickness.

1. 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 concrete base.
2. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
3. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
4. Install anchor bolts to elevations required for proper attachment to switchboards.

C. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from switchboard units and components.

D. Comply with mounting and anchoring requirements specified in Section 260548.16 "Seismic Controls for Electrical Systems."

E. Operating Instructions: Frame and mount the printed basic operating instructions for switchboards, including control and key interlocking sequences and emergency procedures. Fabricate frame of finished wood or metal and cover instructions with clear acrylic plastic. Mount on front of switchboards.

F. Install filler plates in unused spaces of panel-mounted sections.

G. Install overcurrent protective devices, transient voltage suppression devices, and instrumentation.

1. Set field-adjustable switches and circuit-breaker trip ranges.

H. Install spare-fuse cabinet.

I. Comply with NECA 1.

3.3 IDENTIFICATION

A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs complying with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

B. Switchboard Nameplates: Label each switchboard compartment with a nameplate complying with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

C. Device Nameplates: Label each disconnecting and overcurrent protective device and each meter and control device mounted in compartment doors with a nameplate complying with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

3.4 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. 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.

D. Acceptance Testing Preparation:

1. Test insulation resistance for each switchboard bus, component, connecting supply, feeder, and control circuit.
2. Test continuity of each circuit.

E. 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. Perform the following infrared scan tests and inspections and prepare reports:

   a. Initial Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each switchboard. Remove front panels so joints and connections are accessible to portable scanner.
   b. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each switchboard 11 months after date of Substantial Completion.
   c. Instruments and Equipment:

      1) Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.

4. Test and adjust controls, remote monitoring, and safeties. Replace damaged and malfunctioning controls and equipment.

F. Switchboard will be considered defective if it does not pass tests and inspections.

G. Prepare test and inspection reports, including a certified report that identifies switchboards included and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

3.5 ADJUSTING

A. Adjust moving parts and operable components to function smoothly, and lubricate as recommended by manufacturer.

3.6 PROTECTION

A. Temporary Heating: Apply temporary heat, to maintain temperature according to manufacturer's written instructions, until switchboard is ready to be energized and placed into service.

3.7 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain switchboards, overcurrent protective devices, instrumentation, and accessories, and to use and reprogram microprocessor-based trip, monitoring, and communication units.

END OF SECTION 262413

SECTION 262416 - PANELBOARDS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Lighting and appliance branch-circuit panelboards.

2. Distribution panelboards.

1.3 DEFINITIONS

A. SVR: Suppressed voltage rating.

B. TVSS: Transient voltage surge suppressor.

1.4 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Panelboards shall withstand the effects of earthquake motions determined according to SEI/ASCE 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."

1.5 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. Include evidence of NRTL listing for series rating of installed devices.
6. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.
7. Include wiring diagrams for power, signal, and control wiring.
8. 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. Seismic Qualification Certificates: Submit certification that panelboards, overcurrent protective devices, accessories, and components will withstand seismic forces defined in Division 26 Section "Vibration and Seismic Controls for Electrical Systems." Include the following:

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.

E. 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.

F. Panelboard Schedules: For installation in panelboards. Submit final versions after load balancing.

G. Operation and Maintenance Data: For panelboards and components to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 1 Section "Submittals," include the following:

1. Manufacturer's written instructions for testing overcurrent protective devices.
2. Time-current curves, including selectable ranges for each type of overcurrent protective device that allows adjustments.

1.6 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 on-site testing.

B. Source Limitations: Obtain panelboards, overcurrent protective devices, components, and accessories from single source from single manufacturer.

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 NEMA PB 1.

E. Comply with NFPA 70.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Remove loose packing and flammable materials from inside panelboards; install temporary electric heating (250 W per panelboard) to prevent condensation.

B. Handle and prepare panelboards for installation according to NEMA PB 1.

1.8 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.
2. Rate equipment for continuous operation under the following conditions unless otherwise indicated:

    a. Ambient Temperature: Not exceeding minus 22 deg F to plus 104 deg F.
    b. Altitude: Not exceeding 6600 feet.

B. Service Conditions: NEMA PB 1, usual service conditions, as follows:

1. Ambient temperatures within limits specified.
2. Altitude not exceeding 6600 feet.

C. Interruption of Existing Electric Service: 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 Construction Manager no fewer than seven days in advance of proposed interruption of electric service.
2. Do not proceed with interruption of electric service without Owner's/Engineer's written permission.
3. Comply with NFPA 70E.

1.9 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.

1.10 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace transient voltage suppression devices that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Five years from date of Final Acceptance.

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. Keys: Two spares for each type of panelboard cabinet lock.
2. Circuit Breakers Including GFCI and Ground Fault Equipment Protection (GFEP) Types: Two spares for each panelboard.

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 16 Section "Vibration and Seismic Controls for Electrical Systems."

B. Enclosures: Flush- and surface-mounted cabinets.

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. Skirt for Surface-Mounted Panelboards: Same gage and finish as panelboard front with flanges for attachment to panelboard, wall, and ceiling or floor.
5. Gutter Extension and Barrier: Same gage and finish as panelboard enclosure; integral with enclosure body. Arrange to isolate individual panel sections.

6. 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: Same finish as panels and trim.
   c. Fungus Proofing: Permanent fungicidal treatment for overcurrent protective devices and other components.

7. Directory Card: Inside panelboard door, mounted in metal frame with transparent protective cover.

C. Incoming Mains Location: Top or bottom.

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.
4. Extra-Capacity Neutral Bus: Neutral bus rated 200 percent of phase bus and UL listed as suitable for nonlinear loads.
5. Split Bus: Vertical buses divided into individual vertical sections.

E. Conductor Connectors: Suitable for use with conductor material and sizes.

1. Material: Tin-plated aluminum.
2. Main and Neutral Lugs: Compression type.
3. Ground Lugs and Bus-Configured Terminators: Compression type.
4. Subfeed (Double) Lugs: Compression type suitable for use with conductor material. Locate at same end of bus as incoming lugs or main device.
5. Gutter-Tap Lugs: Compression type suitable for use with conductor material. Locate at same end of bus as incoming lugs or main device.
6. Extra-Capacity Neutral Lugs: Rated 200 percent of phase lugs mounted on extra-capacity neutral bus.

F. Panelboard Short-Circuit Current Rating: Fully rated to interrupt symmetrical short-circuit current available at terminals.

G. Future Devices: Mounting brackets, bus connections, filler plates, and necessary appurtenances required for future installation of devices.

2.2 DISTRIBUTION PANELBOARDS

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:

B. Panelboards: NEMA PB 1, power and feeder distribution type.

C. Doors: Secured with vault-type latch with tumbler lock; keyed alike.

1. For doors more than 36 inches high, provide two latches, keyed alike.

D. Mains: Circuit breaker.

E. Branch Overcurrent Protective Devices for Circuit-Breaker Frame Sizes 125 A and Smaller: Bolt-on circuit breakers.

F. Branch Overcurrent Protective Devices for Circuit-Breaker Frame Sizes Larger Than 125 A: Bolt-on circuit breakers; plug-in circuit breakers where individual positive-locking device requires mechanical release for removal.

G. Contactors in Main Bus: NEMA ICS 2, Class A, mechanically held, general-purpose controller, with same short-circuit interrupting rating as panelboard.

2.3 LIGHTING AND APPLIANCE BRANCH-CIRCUIT PANELBOARDS

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. 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.

B. Panelboards: NEMA PB 1, lighting and appliance branch-circuit type.

C. Mains: Circuit breaker.

D. Branch Overcurrent Protective Devices: Bolt-on circuit breakers, replaceable without disturbing adjacent units.

E. Doors: Concealed hinges; secured with flush latch with tumbler lock; keyed alike.

F. Column-Type Panelboards: Narrow gutter extension, with cover, to overhead junction box equipped with ground and neutral terminal buses.

2.4 DISCONNECTING AND OVERCURRENT PROTECTIVE DEVICES

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. 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.

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.

2. Current-Limiting Circuit Breakers: Frame sizes 400 A and smaller; let-through ratings less than NEMA FU 1, RK-5.
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: Compression style, suitable for number, size, trip ratings, and conductor materials.
   c. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HID for feeding fluorescent and high-intensity discharge (HID) lighting circuits.
   d. Ground-Fault Protection: Integrally mounted relay and trip unit with adjustable pickup and time-delay settings, push-to-test feature, and ground-fault indicator.

C. Fused Switch: NEMA KS 1, Type HD; clips to accommodate specified fuses; lockable handle.

1. Fused Switch Features and Accessories: Standard ampere ratings and number of poles.

2.5 PANELBOARD SUPPRESSORS

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. Current Technology; a subsidiary of Danahar Corporation.
2. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
3. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
4. Liebert Corporation.
5. Siemens Energy & Automation, Inc.
6. Square D; a brand of Schneider Electric.

B. Surge Protection Device: IEEE C62.41-compliant, integrally mounted, solid-state, parallel-connected, non-modular type, with sine-wave tracking suppression and filtering modules, UL 1449, second edition, short-circuit current rating matching or exceeding the panelboard short-circuit rating, and with the following features and accessories:

1. Accessories:

   a. LED indicator lights for power and protection status.
   b. Audible alarm, with silencing switch, to indicate when protection has failed.

c. One set of dry contacts rated at 5 A and 250-V ac, for remote monitoring of protection status.

2. Peak Single-Impulse Surge Current Rating: 120 kA per mode/240 kA per phase.
3. Minimum single-impulse current ratings, using 8-by-20-mic.sec. waveform described in IEEE C62.41.2.

   a. Line to Neutral: 70,000 A.
   b. Line to Ground: 70,000 A.
   c. Neutral to Ground: 50,000 A.

4. Withstand Capabilities: 12,000 IEEE C62.41, Category C3 (10 kA), 8-by-20-mic.sec. surges with less than 5 percent change in clamping voltage.
5. Protection modes and UL 1449 SVR for grounded wye circuits with 208Y/120-V, 480Y/277-V three-phase, four-wire circuits shall be as follows:

   a. Line to Neutral: 400 V for 208Y/120, 800 V for 480Y/277V.
   b. Line to Ground: 400 V for 208Y/120, 800 V for 480Y/277V.
   c. Neutral to Ground: 400 V for 208Y/120, 800 V for 480Y/277V.

2.6 ACCESSORY COMPONENTS AND FEATURES

A. Accessory Set: Include tools and miscellaneous items required for overcurrent protective device test, inspection, maintenance, and operation.

B. Portable Test Set: For testing functions of solid-state trip devices without removing from panelboard. Include relay and meter test plugs suitable for testing panelboard meters and switchboard class relays.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Receive, inspect, handle, and store panelboards according to 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 NEMA PB 1.1.

B. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from panelboards.

C. Comply with mounting and anchoring requirements specified in Division 26 Section "Vibration and Seismic Controls for Electrical Systems."

D. Mount top of trim 90 inches above finished floor unless otherwise indicated.

E. 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.

F. Install overcurrent protective devices and controllers not already factory installed.

G. Install filler plates in unused spaces.

H. Arrange conductors in gutters into groups and bundle and wrap with wire ties after completing load balancing.

I. Comply with NECA 1.

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 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."

3.4 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. 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.

D. Acceptance Testing Preparation:

1. Test insulation resistance for each panelboard bus, component, connecting supply, feeder, and control circuit.

2. Test continuity of each circuit.

E. 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. Perform the following infrared scan tests and inspections and prepare reports:

a. Initial Infrared Scanning: After Final Acceptance, but not more than 60 days after Final Acceptance, perform an infrared scan of each panelboard. Remove front panels so joints and connections are accessible to portable scanner.
b. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each panelboard 11 months after date of Final Acceptance.
c. Instruments and Equipment:

1) Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.

F. Panelboards will be considered defective if they do not pass tests and inspections.

G. Prepare test and inspection reports, including a certified report that identifies panelboards included and that describes scanning results. 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 Final Acceptance, 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.

3.6 PROTECTION

A. Temporary Heating: Apply temporary heat to maintain temperature according to manufacturer's written instructions.

END OF SECTION 262416

SECTION 262419 - MOTOR-CONTROL CENTERS

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 MCCs for use with ac circuits rated 600 V and less and having the following factory-installed components:

1. Incoming main lugs and OCPDs.
2. Full-voltage magnetic controllers.
3. Instrumentation.
4. Auxiliary devices.

1.3 DEFINITIONS

A. BAS: Building automation system.

B. CE: Conformite Europeene (European Compliance).

C. CPT: Control power transformer.

D. EMI: Electromagnetic interference.

E. GFCI: Ground fault circuit interrupting.

F. IGBT: Insulated-gate bipolar transistor.

G. LAN: Local area network.

H. LED: Light-emitting diode.

I. MCC: Motor-control center.

J. MCCB: Molded-case circuit breaker.

K. MCP: Motor-circuit protector.

L. NC: Normally closed.

M. NO: Normally open.

N. OCPD: Overcurrent protective device.

O. PCC: Point of common coupling.

P. PID: Control action, proportional plus integral plus derivative.

Q. PT: Potential transformer.

R. PWM: Pulse-width modulated.

S. RFI: Radio-frequency interference.

T. SCR: Silicon-controlled rectifier.

U. TDD: Total demand (harmonic current) distortion.

V. THD(V): Total harmonic voltage demand.

W. TVSS: Transient voltage surge suppressor.

X. VFC: Variable-frequency controller.

1.4 PERFORMANCE REQUIREMENTS

A. Seismic Performance: MCCs 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."

1.5 ACTION SUBMITTALS

A. Product Data: For each type of controller and each type of MCC. Include shipping and operating weights, features, performance, electrical ratings, operating characteristics, and furnished specialties and accessories.

B. Shop Drawings: For each MCC, manufacturer's approval drawings as defined in UL 845. In addition to requirements specified in UL 845, include dimensioned plans, elevations, and sections; and conduit entry locations and sizes, mounting arrangements, and details, including required clearances and service space around equipment.

1. Show tabulations of installed devices, equipment features, and ratings. Include the following:

a. Each installed unit's type and details.

b. Factory-installed devices.
c. Enclosure types and details.
d. Nameplate legends.
e. Short-circuit current (withstand) rating of complete MCC, and for bus structure and each unit.
f. Features, characteristics, ratings, and factory settings of each installed controller and feeder device, and installed devices.
g. Specified optional features and accessories.

2. Schematic Wiring Diagrams: For power, signal, and control wiring for each installed controller.
3. Nameplate legends.
4. Vertical and horizontal bus capacities.
5. Features, characteristics, ratings, and factory settings of each installed unit.

1.6 INFORMATIONAL SUBMITTALS

A. Standard Drawings: For each MCC, as defined in UL 845.

B. Production Drawings: For each MCC, as defined in UL 845.

C. Coordination Drawings: Floor plans, drawn to scale, showing dimensioned layout, required working clearances, and required area above and around MCCs where pipe and ducts are prohibited. Show MCC layout and relationships between electrical components and adjacent structural and mechanical elements. Show support locations, type of support, and weight on each support. Indicate field measurements.

D. Seismic Qualification Certificates: For MCCs, 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.

E. Qualification Data: For qualified testing agency.

F. Product Certificates: For each MCC, from manufacturer.

G. Source quality-control reports.

H. Field quality-control reports.

I. Load-Current and List of Settings of Adjustable Overload Relays: Compile after motors have been installed, and arrange to demonstrate that switch settings for motor running overload protection suit actual motors to be protected.

J. Warranty: Sample of special warranty.

1.7 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For MCCs, all installed devices, and components to include in emergency, operation, and maintenance manuals. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:

1. Manufacturer's Record Drawings: As defined in UL 845. In addition to requirements specified in UL 845, include field modifications incorporated during construction by manufacturer, Contractor, or both.
2. Manufacturer's written instructions for testing and adjusting circuit breaker and MCP trip settings.
3. Manufacturer's written instructions for setting field-adjustable overload relays.
4. Manufacturer's written instructions for testing, adjusting, and reprogramming reduced-voltage, solid-state controllers.
5. Manufacturer's written instructions for testing, adjusting, and reprogramming microprocessor control modules.
6. Manufacturer's written instructions for setting field-adjustable timers, controls, and status and alarm points.

1.8 MAINTENANCE MATERIAL SUBMITTALS

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. Power Fuses: 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.

1.9 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 on-site testing.

B. Source Limitations: Obtain MCCs and controllers of a single type from single source from single manufacturer.

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 NFPA 70.

E. IEEE Compliance: Fabricate and test enclosed controllers according to IEEE 344 to withstand seismic forces defined in Section 260548.16 "Seismic Controls for Electrical Systems."

1.10 DELIVERY, STORAGE, AND HANDLING

A. Deliver MCCs in shipping splits of lengths that can be moved past obstructions in delivery paths.

B. Handle MCCs according to the following:

1. NEMA ICS 2.3, "Instructions for the Handling, Installation, Operation, and Maintenance of Motor Control Centers Rated Not More Than 600 Volts."
2. NECA 402, "Recommended Practice for Installing and Maintaining Motor Control Centers."

C. If stored in space that is not permanently enclosed and air conditioned, remove loose packing and flammable materials from inside MCCs; connect factory-installed space heaters to temporary electrical service.

1.11 PROJECT CONDITIONS

A. Environmental Limitations: Rate equipment for continuous operation under the following conditions unless otherwise indicated:

1. Ambient Temperature: Less than 0 deg F (minus 18 deg C) or exceeding 104 deg F (40 deg C), with an average value exceeding 95 deg F (35 deg C) over a 24-hour period.
2. Ambient Storage Temperature: Not less than minus 4 deg F (minus 20 deg C) and not exceeding 140 deg F (60 deg C).
3. Humidity: Less than 95 percent (noncondensing).

B. Product Selection for Restricted Space: Drawings indicate maximum dimensions for MCCs, including clearances between MCCs and adjacent surfaces and other items.

1.12 COORDINATION

A. Coordinate sizes and locations of concrete bases. Cast anchor-bolt inserts into bases.

B. Coordinate features of MCCs, installed units, and accessory devices with remote pilot devices and control circuits to which they connect.

C. Coordinate features, accessories, and functions of each MCC, each controller, and each installed unit with ratings and characteristics of supply circuits, motors, required control sequences, and duty cycle of motors and loads.

1.13 WARRANTY

1. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURED UNITS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. ABB; Control Products.
2. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
3. General Electric Company; GE Industrial Systems.
4. Rockwell Automation, Inc.; Allen-Bradley Brand.
5. Siemens Energy & Automation, Inc.; Power Distribution.
6. Square D; a brand of Schneider Electric.

B. General Requirements for MCCs: Comply with NEMA ICS 18 and UL 845.

2.2 FUNCTIONAL FEATURES

A. Description: Modular arrangement of main units, controller units, control devices, feeder-tap units, instruments, metering, auxiliary devices, and other items mounted in vertical sections of MCC.

B. Future Units: Compartments fully bused and equipped with guide rails or equivalent.

C. Spare Units: Installed in compartments indicated "spare."

2.3 INCOMING MAINS

A. Incoming Mains Location: Top.

B. MCCB: Comply with UL 489, with interrupting capacity to meet available fault currents.
   1. MCCB Features and Accessories:
      a. Standard frame sizes, trip ratings, and number of poles.
      b. Lugs: Compression style, suitable for number, size, trip ratings, and conductor material.
      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. Zone-Selective Interlocking: Integral with electronic trip unit; for interlocking ground-fault protection function.
      e. Shunt Trip: 120-V trip coil energized from separate circuit, set to trip at 55 percent of rated voltage.
      f. Undervoltage Trip: Set to operate at 35 to 75 percent of rated voltage without intentional time delay.
      g. Auxiliary Contacts: Two SPDT switches with "a" and "b" contacts; "a" contacts mimic circuit-breaker contacts, "b" contacts operate in reverse of circuit-breaker contacts.
      h. Key Interlock Kit: Externally mounted to prohibit circuit-breaker operation; key shall be removable only when circuit breaker is in off position.

2.4 COMBINATION CONTROLLERS

A. Full-Voltage Controllers:
   1. General Requirements for Full-Voltage Enclosed Controllers: Comply with NEMA ICS 2, general purpose, Class A.
   2. Magnetic Controllers: Full voltage, across the line, electrically held.
      a. Configuration: Nonreversing and reversing.

B. Disconnecting Means and OCPDs:
   1. MCP Disconnecting Means:
      a. UL 489, NEMA AB 1, and NEMA AB 3, with interrupting capacity to comply with available fault currents, instantaneous-only circuit breaker with front-mounted, field-adjustable, short-circuit trip coordinated with motor locked-rotor amperes.
      b. Lockable Handle: Accepts three padlocks and interlocks with cover in closed position.
      c. Auxiliary contacts "a" and "b" arranged to activate with MCP handle.
      d. NC alarm contact that operates only when MCP has tripped.
   2. MCCB Disconnecting Means:

a. UL 489, NEMA AB 1, and NEMA AB 3, with interrupting capacity to comply with available fault currents; thermal-magnetic MCCB, with inverse time-current element for low-level overloads and instantaneous magnetic trip element for short circuits.
b. Lockable Handle: Accepts three padlocks and interlocks with cover in closed position.
c. Auxiliary contacts "a" and "b" arranged to activate with MCCB handle.
d. NO alarm contact that operates only when MCCB has tripped.

C. Overload Relays:

1. Solid-State Overload Relays:

a. Switch or dial selectable for motor running overload protection.
b. Sensors in each phase.
c. Class 10/20 selectable tripping characteristic selected to protect motor against voltage and current unbalance and single phasing.
d. Class II ground-fault protection, with start and run delays to prevent nuisance trip on starting.
e. Analog communication module.

2. NO isolated overload alarm contact.
3. External overload reset push button.

D. Control Power:

1. Control Circuits: 120-V ac; obtained from integral CPT, with primary and secondary fuses, with CPT control power source of sufficient capacity to operate integral devices and remotely located pilot, indicating, and control devices.

a. CPT Spare Capacity: 100 VA.

2.5 MCC CONTROL POWER

A. Control Circuits: 120-V ac, supplied through secondary disconnecting devices from CPT.

B. Electrically Interlocked Main and Tie Circuit Breakers: Two CPTs in separate compartments, with interlocking relays, connected to the primary side of each CPT at the line side of the associated main circuit breaker. 120-V secondaries connected through automatic transfer relays to ensure a fail-safe automatic transfer scheme.

C. Control Power Fuses: Primary and secondary fuses for current-limiting and overload protection of transformer and fuses for protection of control circuits.

D. Control Wiring: Factory installed, with bundling, lacing, and protection included. Provide flexible conductors for No. 8 AWG and smaller, for conductors across hinges, and for conductors for interconnections between shipping units.

2.6 ENCLOSURES

A. Indoor Enclosures: Freestanding steel cabinets unless otherwise indicated. NEMA 250, Type 12 unless otherwise indicated to comply with environmental conditions at installed location.

B. Space Heaters: Factory-installed electric space heaters of sufficient wattage in each vertical section to maintain enclosure temperature above expected dew point.

1. Space-Heater Control: Thermostats to maintain temperature of each section above expected dew point.
2. Space-Heater Power Source: Transformer, factory installed in MCC.

C. Enclosure Finish for Indoor Units: Factory-applied finish in manufacturer's standard gray finish over a rust-inhibiting primer on treated metal surface.

D. Compartments: Modular; individual doors with concealed hinges and quick-captive screw fasteners. Interlocks on units requiring disconnecting means in off position before door can be opened or closed, except by operating a permissive release device.

E. Interchangeability: Compartments constructed to allow for removal of units without opening adjacent doors, disconnecting adjacent compartments, or disturbing operation of other units in MCC; same size compartments to permit interchangeability and ready rearrangement of units, such as replacing three single units with a unit requiring three spaces, without cutting or welding.

F. Wiring Spaces:

1. Vertical wireways in each vertical section for vertical wiring to each unit compartment; supports to hold wiring in place.
2. Horizontal wireways in bottom and top of each vertical section for horizontal wiring between vertical sections; supports to hold wiring in place.

2.7 AUXILIARY DEVICES

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 type.

a. Push Buttons: Lockable Shielded types; momentary contact unless otherwise indicated.
b. Pilot Lights: LED types; push to test.
c. Selector Switches: Rotary type.

B. Reversible NC/NO contactor 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. Space heaters, with NC auxiliary contacts, to mitigate condensation in enclosures installed outdoors or in unconditioned interior spaces subject to humidity and temperature swings.

F. Spare control-wiring terminal blocks; unwired.

G. Spare-Fuse Cabinet: Identified and compartmented steel box.

2.8 CHARACTERISTICS AND RATINGS

A. Wiring: NEMA ICS 18, Class I, Type B.

B. Control and Load Wiring: Factory installed, with bundling, lacing, and protection included. Provide flexible conductors for No. 8 AWG and smaller, for conductors across hinges, and for conductors for interconnections between shipping units.

C. Nominal System Voltage: 480 V, three phase, three wire

D. Short-Circuit Current Rating for Each Unit: Fully rated

E. Short-Circuit Current Rating of MCC: Fully rated

F. Environmental Ratings:

1. Ambient Temperature Rating: Not less than 0 deg F (minus 18 deg C) and not exceeding 104 deg F (40 deg C), with an average value not exceeding 95 deg F (35 deg C) over a 24-hour period.
2. Ambient Storage Temperature Rating: Not less than minus 4 deg F (minus 20 deg C) and not exceeding 140 deg F (60 deg C)
3. Humidity Rating: Less than 95 percent (noncondensing).
4. Altitude Rating: Not exceeding 6600 feet (2000 m), or 3300 feet (1000 m) if MCC includes solid-state devices.

G. Main-Bus Continuous Rating: 600 A.

H. Vertical-Bus Minimum Rating: 600 A.

I. Horizontal and Vertical Bus Bracing (Short-Circuit Current Rating): Match MCC short-circuit current rating.

J. Main Horizontal and Equipment Ground Buses: Uniform capacity for entire length of MCC's main and vertical sections. Provide for future extensions from both ends.

K. Vertical Phase and Equipment Ground Buses: Uniform capacity for entire usable height of vertical sections, except for sections incorporating single units.

L. Phase-Bus Material: Hard-drawn copper of 98 percent conductivity, silver plated.

M. Ground Bus: Minimum size required by UL 845, hard-drawn copper of 98 percent conductivity, equipped with compression connectors for feeder and branch-circuit equipment grounding conductors.

N. Front-Connected, Front-Accessible MCCs:

1. Main Devices: Fixed mounted.
2. Controller Units: Fixed mounted.
3. Sections front and rear aligned.

O. Bus Transition and Incoming Pull Sections: Matched and aligned with basic MCC.

P. Pull Box on Top of an MCC:

1. Adequate ventilation to maintain temperature in pull box within same limits as MCC.
2. Set back from front to clear circuit-breaker removal mechanism.
3. Removable covers forming top, front, and sides. Top covers at rear easily removable for drilling and cutting.
4. Insulated bottom of fire-resistive material with separate holes for cable drops into MCC.
5. Cable supports arranged to facilitate cabling and adequate to support cables, including those for future installation.
6. Isolation Barrier Access Provisions: Permit checking of bus-bolt tightness.

Q. Future Devices: Equip compartments with mounting brackets, supports, bus connections, and appurtenances at full rating of unit.

R. Bus-Bar Insulation: Factory-applied, flame-retardant, tape wrapping of individual bus bars or flame-retardant, spray-applied insulation. Minimum insulation temperature rating of 105 deg C.

S. Fungus Proofing: Permanent fungicidal treatment for OCPDs and other components including instruments and instrument transformers.

2.9 SOURCE QUALITY CONTROL

A. MCC Testing: Inspect and test MCCs according to requirements in NEMA ICS 18.

B. MCCs will be considered defective if they do not pass tests and inspections.

C. Prepare test and inspection reports.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and surfaces to receive MCCs, with Installer present, for compliance with requirements for installation tolerances, 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. Coordinate layout and installation of MCCs with other construction including conduit, piping, equipment, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

B. Floor-Mounting Controllers: Install MCCs on 4-inch (100-mm) nominal thickness concrete base. Comply with requirements for concrete base specified in Section 033000 "Cast-in-Place Concrete."

1. 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 concrete base.
2. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
3. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
4. Install anchor bolts to elevations required for proper attachment to supported equipment.

C. Seismic Bracing: Comply with requirements specified in Section 260548.16 "Seismic Controls for Electrical Systems."

D. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.

E. Install fuses in control circuits if not factory installed. Comply with requirements in Section 262813 "Fuses."

F. Install, connect, and fuse thermal-protector monitoring relays furnished with motor-driven equipment.

G. Comply with NECA 1.

3.3 IDENTIFICATION

A. Comply with requirements in Section 260553 "Identification for Electrical Systems" for identification of MCC, MCC components, and control wiring.

1. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs.
2. Label MCC and each cubicle with engraved nameplate.
3. Label each enclosure-mounted control and pilot device.
4. Mark up a set of manufacturer's connection wiring diagrams with field-assigned wiring identifications and return to manufacturer for inclusion in Record Drawings.

B. Operating Instructions: Frame printed operating instructions for MCCs, including control sequences and emergency procedures. Fabricate frame of finished metal, and cover instructions with clear acrylic plastic. Mount on front of MCCs.

3.4 CONTROL WIRING INSTALLATION

A. Install wiring between enclosed controller or master terminal boards and remote devices.

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 within 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 CONNECTIONS

A. Comply with requirements for installation of conduit in Section 260533 "Raceways and Boxes for Electrical Systems." Drawings indicate general arrangement of conduit, fittings, and specialties.

B. Comply with requirements in Section 260526 "Grounding and Bonding for Electrical Systems."

3.6 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. 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.

D. Acceptance Testing Preparation:

1. Test insulation resistance for each enclosed controller, component, connecting supply, feeder, and control circuit.
2. Test continuity of each circuit.

E. Tests and Inspections:

1. Inspect controllers, wiring, components, connections, and equipment installation.
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 10 percent of motor nameplate rated voltages. If outside this range for any motor, notify Owner 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. Perform the following infrared (thermographic) scan tests and inspections and prepare reports:

    a. Initial Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each multipole enclosed controller. Remove front panels so joints and connections are accessible to portable scanner.
    b. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each multipole enclosed controller 11 months after date of Substantial Completion.
    c. Instruments and Equipment: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.

9. Test and adjust controls, remote monitoring, and safeties. Replace damaged and malfunctioning controls and equipment.
10. Mark up a set of manufacturer's drawings with all field modifications incorporated during construction and return to manufacturer for inclusion in Record Drawings.

F. Enclosed controllers will be considered defective if they do not pass tests and inspections.

G. 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.

3.7 STARTUP SERVICE

A. Perform startup service.

1. Complete installation and startup checks according to manufacturer's written instructions.

3.8 ADJUSTING

A. Set field-adjustable switches, auxiliary relays, time-delay relays, timers, and overload-relay pickup and trip ranges.

B. Adjust overload relay heaters or settings if power factor correction capacitors are connected to the load side of the overload relays.

C. Adjust the trip settings of MCPs and thermal-magnetic circuit breakers with adjustable, instantaneous trip elements. Initially adjust to six times the motor nameplate full-load amperes and attempt to start motors several times, allowing for motor cool-down between starts. If tripping occurs on motor inrush, adjust settings in increments until motors start without tripping. Do not exceed eight times the motor full-load amperes (or 11 times for NEMA Premium Efficient motors if required). Where these maximum settings do not allow starting of a motor, notify Owner before increasing settings.

D. Set field-adjustable switches and program microprocessors for required start and stop sequences in reduced-voltage, solid-state controllers.

3.9 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.

3.10 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain enclosed controllers.

END OF SECTION 262419

SECTION 262726 - WIRING DEVICES

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. Receptacles and associated device plates.
2. Isolated-ground receptacles.
3. Snap switches and wall-box dimmers.
4. Solid-state fan speed controls.
5. Wall-switch.
6. Communications outlets.
7. Floor service outlets and multioutlet assemblies.

1.3 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.

E. UTP: Unshielded twisted pair.

1.4 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.

1.5 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.

1.6 COORDINATION

A. Receptacles for Owner-Furnished Equipment: Match plug configurations.

1. Cord and Plug Sets: Match equipment requirements.

1.7 EXTRA MATERIALS

A. Furnish extra materials described in subparagraphs below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Floor Service Outlet Assemblies: One for every 10, but no fewer than one.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers' Names: 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).

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.

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
2. Products: Subject to compliance with requirements, provide one of the following:

    a. Cooper; 5351 (single), 5352 (duplex).
    b. Hubbell; HBL5351 (single), CR5352 (duplex).
    c. Leviton; 5891 (single), 5352 (duplex).
    d. Pass & Seymour; 5381 (single), 5352 (duplex).

B. Hospital-Grade, Duplex Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 configuration 5-20R, and UL 498 Supplement SD.

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
2. Products: Subject to compliance with requirements, provide one of the following:

    a. Cooper; 8300 (duplex).
    b. Hubbell; HBL8310 (single), HBL8300H (duplex).
    c. Leviton; 8310 (single), 8300 (duplex).
    d. Pass & Seymour; 9301-HG (single), 9300-HG (duplex).

C. Isolated-Ground, Duplex Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 configuration 5-20R, and UL 498.

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
2. Products: Subject to compliance with requirements, provide one of the following:

    a. Hubbell; CR 5253IG.
    b. Leviton; 5362-IG.
    c. Pass & Seymour; IG6300.

3. Description: Straight blade; equipment grounding contacts shall be connected only to the green grounding screw terminal of the device and with inherent electrical isolation from mounting strap. Isolation shall be integral to receptacle construction and not dependent on removable parts.

2.3 CORD AND PLUG SETS

A. Description: Match voltage and current ratings and number of conductors to requirements of equipment being connected.

1. Cord: Rubber-insulated, stranded-copper conductors, with Type SOW-A jacket; with green-insulated grounding conductor and equipment-rating ampacity plus a minimum of 30 percent.
2. Plug: Nylon body and integral cable-clamping jaws. Match cord and receptacle type for connection.

2.4 SNAP SWITCHES

A. Comply with NEMA WD 1 and UL 20.

B. Switches, 120/277 V, 20 A:

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
2. Products: Subject to compliance with requirements, provide one of the following:

a. Cooper; 2221 (single pole), 2222 (two pole), 2223 (three way), 2224 (four way).
b. Hubbell; CS1221 (single pole), CS1222 (two pole), CS1223 (three way), CS1224 (four way).
c. Leviton; 1221-2 (single pole), 1222-2 (two pole), 1223-2 (three way), 1224-2 (four way).
d. Pass & Seymour; 20AC1 (single pole), 20AC2 (two pole), 20AC3 (three way), 20AC4 (four way).

2.5 WALL-BOX DIMMERS

A. Dimmer Switches: Modular, full-wave, solid-state units with integral, quiet on-off switches, with audible frequency and EMI/RFI suppression filters.

B. Control: Continuously adjustable slider; with single-pole or three-way switching. Comply with UL 1472.

C. Incandescent Lamp Dimmers: 120 V; control shall follow square-law dimming curve. On-off switch positions shall bypass dimmer module.

1. 600 W; dimmers shall require no derating when ganged with other devices. Illuminated when "OFF."

D. Fluorescent Lamp Dimmer Switches: Modular; compatible with dimmer ballasts; trim potentiometer to adjust low-end dimming; dimmer-ballast combination capable of consistent dimming with low end not greater than 20 percent of full brightness.

2.6 FAN SPEED CONTROLS

A. Modular, 120-V, full-wave, solid-state units with integral, quiet on-off switches and audible frequency and EMI/RFI filters. Comply with UL 1917.

1. Continuously adjustable slider, 5 A.
2. Three-speed adjustable slider, 1.5 A.

2.7 OCCUPANCY SENSORS

A. Wall-Switch Sensors:

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
2. Products: Subject to compliance with requirements, provide one of the following:

    a. Cooper; 6111 for 120 V, 6117 for 277 V.
    b. Hubbell; WS1277.
    c. Leviton; ODS 10-ID.
    d. Pass & Seymour; WS3000.
    e. Watt Stopper (The); WS-200.

3. Description: Passive-infrared type, 120/277 V, adjustable time delay up to 30 minutes, 180-degree field of view, with a minimum coverage area of 900 sq. ft..

B. Wall-Switch Sensors:

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
2. Products: Subject to compliance with requirements, provide one of the following:

    a. Hubbell; AT120 for 120 V, AT277 for 277 V.
    b. Leviton; ODS 15-ID.

3. Description: Adaptive-technology type, 120/277 V, adjustable time delay up to 20 minutes, 180-degree field of view, with a minimum coverage area of 900 sq. ft..

C. Long-Range Wall-Switch Sensors:

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
2. Products: Subject to compliance with requirements, provide one of the following:

    a. Hubbell; ATP1600WRP.
    b. Leviton; ODWWV-IRW.
    c. Pass & Seymour; WA1001.
    d. Watt Stopper (The); CX-100.

3. Description: Passive-infrared type, 120/277 V, adjustable time delay up to 30 minutes, 110-degree field of view, with a minimum coverage area of 1200 sq. ft..

D. Long-Range Wall-Switch Sensors:

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
2. Products: Subject to compliance with requirements, provide one of the following:

    a. Hubbell; ATD1600WRP.
    b. Leviton; ODW12-MRW.
    c. Watt Stopper (The); DT-200.

3. Description: Dual technology, with both passive-infrared- and ultrasonic-type sensing, 120/277 V, adjustable time delay up to 30 minutes, 110-degree field of view, and a minimum coverage area of 1200 sq. ft..

E. Wide-Range Wall-Switch Sensors:

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
2. Products: Subject to compliance with requirements, provide one of the following:

   a. Hubbell; ATP120HBRP.
   b. Leviton; ODWHB-IRW.
   c. Pass & Seymour; HS1001.
   d. Watt Stopper (The); CX-100-3.

3. Description: Passive-infrared type, 120/277 V, adjustable time delay up to 30 minutes, 150-degree field of view, with a minimum coverage area of 1200 sq. ft..

2.8 COMMUNICATIONS OUTLETS

A. Telephone Outlet:

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
2. Products: Subject to compliance with requirements, provide one of the following:

   a. Cooper; 3560-6.
   b. Leviton; 40649.

3. Description: Single RJ-45 jack for terminating 100-ohm, balanced, four-pair UTP; TIA/EIA-568-B.1; complying with Category 5e. Comply with UL 1863.

B. Combination TV and Telephone Outlet:

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
2. Products: Subject to compliance with requirements, provide one of the following:

   a. Cooper; 3562.
   b. Leviton; 40595.

3. Description: Single RJ-45 jack for 100-ohm, balanced, four-pair UTP; TIA/EIA-568-B.1; complying with Category 5e; and one Type F coaxial cable connector.

2.9 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: Smooth, high-impact thermoplastic 0.035-inch thick.
3. Material for Unfinished Spaces: Galvanized steel.
4. Material for Damp Locations: Thermoplastic 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 weather-resistant die-cast aluminum with lockable cover.

2.10 FLOOR SERVICE FITTINGS

A. Type: Modular, flush-type, dual-service units suitable for wiring method used.

B. Compartments: Barrier separates power from voice and data communication cabling.

C. Service Plate: Rectangular with satin finish.

D. Power Receptacle: NEMA WD 6 configuration 5-20R, gray finish, unless otherwise indicated.

E. Voice and Data Communication Outlet: Blank cover with bushed cable opening.

2.11 MULTIOUTLET ASSEMBLIES

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. Hubbell Incorporated; Wiring Device-Kellems.
2. Wiremold Company (The).

C. Components of Assemblies: Products from a single manufacturer designed for use as a complete, matching assembly of raceways and receptacles.

D. Raceway Material: Metal, with manufacturer's standard finish.

E. Wire: No. 12 AWG.

2.12 FINISHES

A. Color: Wiring device catalog numbers in Section Text do not designate device color.

1. Wiring Devices Connected to Normal Power System: Almond, unless otherwise indicated or required by NFPA 70 or device listing.
2. Wiring Devices Connected to Emergency Power System: Red.
3. Isolated-Ground Receptacles: Orange.

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 insure 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.
4. Existing Conductors:

    a. Cut back and pigtail, or replace all damaged conductors.
    b. Straighten conductors that remain and remove corrosion and foreign matter.
    c. Pigtailing existing conductors is permitted provided the outlet box is large enough.

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.

E. Receptacle Orientation:

1. Install ground pin of vertically mounted receptacles down, and on horizontally mounted receptacles to the right.
2. Install hospital-grade receptacles in patient-care areas with the ground pin or neutral blade at the top.

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.

G. Dimmers:

1. Install dimmers within terms of their listing.
2. Verify that dimmers used for fan speed control are listed for that application.
3. Install unshared neutral conductors on line and load side of dimmers according to manufacturers' device listing conditions in the written instructions.

H. 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.

I. Adjust locations of floor service outlets and service poles to suit arrangement of partitions and furnishings.

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.

C. Test straight blade hospital-grade convenience outlets for the retention force of the grounding blade according to NFPA 99. Retention force shall be not less than 4 oz..

END OF SECTION 262726

SECTION 262923 - VARIABLE-FREQUENCY MOTOR CONTROLLERS

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 separately enclosed, pre-assembled, combination VFCs, rated 600 V and less, for speed control of three-phase, squirrel-cage induction motors.

1.3 DEFINITIONS

A. BCS: Building controls system.

B. LAN: Local area network.

C. LED: Light-emitting diode.

D. MCP: Motor-circuit protector.

E. NC: Normally closed.

F. NO: Normally open.

G. OCPD: Overcurrent protective device.

H. PCC: Point of common coupling.

I. PID: Control action, proportional plus integral plus derivative.

J. PWM: Pulse-width modulated.

K. TDD: Total demand (harmonic current) distortion.

L. THD(V): Total harmonic voltage demand.

M. VFC: Variable-frequency motor controller.

1.4 PERFORMANCE REQUIREMENTS

A. Seismic Performance: VFCs 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."

1.5 SUBMITTALS

A. Product Data: For each type and rating of VFC indicated. Include features, performance, electrical ratings, operating characteristics, shipping and operating weights, and furnished specialties and accessories.

B. Shop Drawings: For each VFC indicated. Include dimensioned plans, elevations, and sections; and conduit entry locations and sizes, mounting arrangements, and details, including required clearances and service space around equipment.

1. Show tabulations of installed devices, equipment features, and ratings. Include the following:

a. Each installed unit's type and details.
b. Factory-installed devices.
c. Enclosure types and details.
d. Nameplate legends.
e. Short-circuit current (withstand) rating of enclosed unit.
f. Features, characteristics, ratings, and factory settings of each VFC and installed devices.
g. Specified modifications.

2. Schematic and Connection Wiring Diagrams: For power, signal, and control wiring.

C. Harmonic Analysis Study and Report: Comply with IEEE 399 and NETA Acceptance Testing Specification; identify the effects of nonlinear loads and their associated harmonic contributions on the voltages and currents throughout the electrical system.

D. Coordination Drawings: Floor plans, drawn to scale, showing dimensioned layout, required working clearances, and required area above and around VFCs. Show VFC layout and relationships between electrical components and adjacent structural and mechanical elements. Show support locations, type of support, and weight on each support. Indicate field measurements.

E. Qualification Data: For qualified testing agency.

F. Seismic Qualification Certificates: For VFCs, 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.

G. Product Certificates: For each VFC, from manufacturer.

H. Source quality-control reports.

I. Field quality-control reports.

J. Operation and Maintenance Data: For VFCs 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 thermal-magnetic circuit breaker and MCP trip settings.
2. Manufacturer's written instructions for setting field-adjustable overload relays.
3. Manufacturer's written instructions for testing, adjusting, and reprogramming microprocessor control modules.
4. Manufacturer's written instructions for setting field-adjustable timers, controls, and status and alarm points.

K. 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.

L. Load-Current and List of Settings of Adjustable Overload Relays: Compile after motors have been installed and arrange to demonstrate that switch settings for motor-running overload protection suit actual motors to be protected.

1.6 QUALITY ASSURANCE

A. Testing Agency Qualifications: Member company of NETA or an NRTL.

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 VFC according to IEEE 344 to withstand seismic forces defined in Division 26 Section "Vibration and Seismic Controls for Electrical Systems."

1.7 DELIVERY, STORAGE, AND HANDLING

A. If stored in space that is not permanently enclosed and air conditioned, remove loose packing and flammable materials from inside controllers and install temporary electric heating, with at least 250 W per controller.

1.8 PROJECT CONDITIONS

A. Environmental Limitations: Rate equipment for continuous operation, capable of driving full load without derating, under the following conditions unless otherwise indicated:

1. Ambient Temperature: Not less than 14 deg F and not exceeding 104 deg F.
2. Ambient Storage Temperature: Not less than minus 4 deg F and not exceeding 140 deg F
3. Humidity: Less than 95 percent (noncondensing).
4. Altitude: Not exceeding 3300 feet.

B. Interruption of Existing Electrical Systems: Do not interrupt electrical systems in 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 Building Manager and Contracting Officer no fewer than four days in advance of proposed interruption of electrical systems.
2. Indicate method of providing temporary electrical service.
3. Do not proceed with interruption of electrical systems without Building Manager and Contracting Officer written permission.
4. Comply with NFPA 70E.

C. Product Selection for Restricted Space: Drawings indicate maximum dimensions for VFCs, including clearances between VFCs, and adjacent surfaces and other items.

1.9 COORDINATION

A. Coordinate features of motors, load characteristics, installed units, and accessory devices to be compatible with the following:

1. Torque, speed, and horsepower requirements of the load.
2. Ratings and characteristics of supply circuit and required control sequence.
3. Ambient and environmental conditions of installation location.

B. Coordinate sizes and locations of concrete bases with actual equipment provided. Cast anchor-bolt inserts into bases.

C. Coordinate sizes and locations of roof curbs, equipment supports, and roof penetrations with actual equipment provided.

1.10 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace VFCs that fail in materials or workmanship within specified warranty period.

1.11 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. Power Fuses: 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 MANUFACTURED UNITS

A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

1. ABB.
2. Baldor Electric Company.
3. Danfoss Inc.; Danfoss Drives Div.
4. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
5. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
6. Rockwell Automation, Inc.; Allen-Bradley Brand.
7. Siemens Energy & Automation, Inc.
8. Square D; a brand of Schneider Electric.
9. Toshiba International Corporation.
10. Yaskawa Electric America, Inc; Drives Division.

B. General Requirements for VFCs: Comply with NEMA ICS 7, NEMA ICS 61800-2, and UL 508C .

C. Application: Constant torque and variable torque.

D. VFC Description: Variable-frequency power converter (rectifier, dc bus, and IGBT, PWM inverter) factory packaged in an enclosure, with integral disconnecting means and overcurrent and overload protection; listed and labeled by an NRTL as a complete unit; arranged to provide self-protection, protection, and variable-speed control of one or more three-phase induction motors by adjusting output voltage and frequency.

1. Units suitable for operation of NEMA MG 1, Design A and Design B motors as defined by NEMA MG 1, Section IV, Part 30, "Application Considerations for Constant Speed Motors Used on a Sinusoidal Bus with Harmonic Content and General Purpose Motors Used with Adjustable-Voltage or Adjustable-Frequency Controls or Both."

2. Units suitable for operation of inverter-duty motors as defined by NEMA MG 1, Section IV, Part 31, "Definite-Purpose Inverter-Fed Polyphase Motors."
3. Listed and labeled for integrated short-circuit current (withstand) rating by an NRTL acceptable to authorities having jurisdiction.

E. Design and Rating: Match load type, such as fans, blowers, and pumps; and type of connection used between motor and load such as direct or through a power-transmission connection.

F. Output Rating: Three-phase; 10 to 66 Hz, with torque constant as speed changes; maximum voltage equals input voltage.

G. Unit Operating Requirements:

1. Input AC Voltage Tolerance: Plus 10 and minus 10 percent of VFC input voltage rating.
2. Input AC Voltage Unbalance: Not exceeding 3 percent.
3. Input Frequency Tolerance: Plus or minus 3 percent of VFC frequency rating.
4. Minimum Efficiency: 96 percent at 60 Hz, full load.
5. Minimum Displacement Primary-Side Power Factor: 96 percent under any load or speed condition.
6. Minimum Short-Circuit Current (Withstand) Rating: 22 kA.
7. Ambient Temperature Rating: Not less than 14 deg F and not exceeding 104 deg F.
8. Ambient Storage Temperature Rating: Not less than minus 4 deg F and not exceeding 140 deg F
9. Humidity Rating: Less than 95 percent (noncondensing).
10. Altitude Rating: Not exceeding 3300 feet.
11. Vibration Withstand: Comply with IEC 60068-2-6.
12. Overload Capability: 1.1 times the base load current for 60 seconds; minimum of 1.8 times the base load current for three seconds.
13. Starting Torque: Minimum 100 percent of rated torque from 3 to 60 Hz.
14. Speed Regulation: Plus or minus 5 percent.
15. Output Carrier Frequency: Selectable; 0.5 to 15 kHz.
16. Stop Modes: Programmable; includes fast, free-wheel, and dc injection braking.
17. 18 Pulse to meet IEEE 519 guidelines for harmonics mitigation for motors 30HP and higher.

H. Inverter Logic: Microprocessor based, 16 or 32 bit, isolated from all power circuits.

I. Isolated Control Interface: Allows VFCs to follow remote-control signal over a minimum 40:1 speed range.

1. Signal: Electrical.

J. Internal Adjustability Capabilities:

1. Minimum Speed: 5 to 25 percent of maximum rpm.
2. Maximum Speed: 80 to 100 percent of maximum rpm.
3. Acceleration: 0.1 to 999.9 seconds.
4. Deceleration: 0.1 to 999.9 seconds.
5. Current Limit: 30 to minimum of 150 percent of maximum rating.

K. Self-Protection and Reliability Features:

1. Input transient protection by means of surge suppressors to provide three-phase protection against damage from supply voltage surges 10 percent or more above nominal line voltage.
2. Loss of Input Signal Protection: Selectable response strategy, including speed default to a percent of the most recent speed, a preset speed, or stop; with alarm.
3. Under- and overvoltage trips.
4. Inverter overcurrent trips.
5. VFC and Motor Overload/Overtemperature Protection: Microprocessor-based thermal protection system for monitoring VFCs and motor thermal characteristics, and for providing VFC overtemperature and motor overload alarm and trip; settings selectable via the keypad; NRTL approved.
6. Critical frequency rejection, with three selectable, adjustable deadbands.
7. Instantaneous line-to-line and line-to-ground overcurrent trips.
8. Loss-of-phase protection.
9. Reverse-phase protection.
10. Short-circuit protection.
11. Motor overtemperature fault.

L. Automatic Reset/Restart: Attempt three restarts after drive fault or on return of power after an interruption and before shutting down for manual reset or fault correction; adjustable delay time between restart attempts.

M. Power-Interruption Protection: To prevent motor from re-energizing after a power interruption until motor has stopped, unless "Bidirectional Autospeed Search" feature is available and engaged.

N. Bidirectional Autospeed Search: Capable of starting VFC into rotating loads spinning in either direction and returning motor to set speed in proper direction, without causing damage to drive, motor, or load.

O. Torque Boost: Automatically varies starting and continuous torque to at least 1.5 times the minimum torque to ensure high-starting torque and increased torque at slow speeds.

P. Motor Temperature Compensation at Slow Speeds: Adjustable current fall-back based on output frequency for temperature protection of self-cooled, fan-ventilated motors at slow speeds.

Q. Integral Input Disconnecting Means and OCPD: NEMA AB 1, instantaneous-trip circuit breaker with pad-lockable, door-mounted handle mechanism.
1. Disconnect Rating: Not less than 115 percent of NFPA 70 motor full-load current rating or VFC input current rating, whichever is larger.
2. Auxiliary Contacts: NO/NC, arranged to activate before switch blades open.

2.2 CONTROLS AND INDICATION

A. Status Lights: Door-mounted LED indicators displaying the following conditions:

1. Power on.
2. Run.
3. Overvoltage.
4. Line fault.
5. Overcurrent.
6. External fault.

B. Panel-Mounted Operator Station: Manufacturer's standard front-accessible, sealed keypad and plain-English language digital display; allows complete programming, program copying, operating, monitoring, and diagnostic capability.

1. Keypad: In addition to required programming and control keys, include keys for HAND, OFF, and AUTO modes.
2. Security Access: Provide electronic security access to controls through identification and password with at least three levels of access: View only; view and operate; and view, operate, and service.

    a. Control Authority: Supports at least four conditions: Off, local manual control at VFC, local automatic control at VFC, and automatic control through a remote source.

C. Historical Logging Information and Displays:

1. Real-time clock with current time and date.
2. Running log of total power versus time.
3. Total run time.
4. Fault log, maintaining last four faults with time and date stamp for each.

D. Indicating Devices: Digital display, mounted flush in VFC door and connected to display VFC parameters including, but not limited to:

1. Output frequency (Hz).
2. Motor speed (rpm).
3. Motor status (running, stop, fault).
4. Motor current (amperes).
5. Motor torque (percent).
6. Fault or alarming status (code).
7. PID feedback signal (percent).
8. DC-link voltage (V dc).
9. Set point frequency (Hz).
10. Motor output voltage (V ac).

E. Control Signal Interfaces:

1. Electric Input Signal Interface:

    a. A minimum of two programmable analog inputs: 0- to 10-V dc, 4- to 20-mA dc.
    b. A minimum of six multifunction programmable digital inputs.
2. Remote Signal Inputs: Capability to accept any of the following speed-setting input signals from the BAS or other control systems:

a. 0- to 10-V dc.
b. 4- to 20-mA dc.
c. Potentiometer using up/down digital inputs.
d. Fixed frequencies using digital inputs.

3. Output Signal Interface: A minimum of two programmable analog output signal(s) (0- to 10-V dc, 4- to 20-mA dc), which can be configured for any of the following:

a. Output frequency (Hz).
b. Output current (load).
c. DC-link voltage (V dc).
d. Motor torque (percent).
e. Motor speed (rpm).
f. Set point frequency (Hz).

F. BCS Interface: Factory-installed hardware and software to enable the BCAS to monitor, control, and display VFC status, alarms, and energy usage. Allows VFC to be used with an external system within a multidrop LAN configuration; settings retained within VFC's nonvolatile memory.

1. Network Communications Ports: Ethernet and RS-422/485.

2.3 LINE CONDITIONING AND FILTERING

A. Input Line Conditioning: Based on the harmonic analysis study and report, provide input filtering, as required, to limit TDD and THD(V) at the defined PCC per IEEE 519.

B. EMI/RFI Filtering: CE marked; certify compliance with IEC 61800-3 for Category C2.

2.4 BYPASS SYSTEMS

A. Bypass Operation: Safely transfers motor between power converter output and bypass circuit, manually, automatically, or both. Selector switches set modes and indicator lights indicate mode selected. Unit is capable of stable operation (starting, stopping, and running) with motor completely disconnected from power converter.

B. Bypass Mode: Field-selectable automatic or manual, allows local and remote transfer between power converter and bypass contactor and retransfer, either via manual operator interface or automatic control system feedback.

C. Bypass Controller: Three-contactor-style bypass allows motor operation via the power converter or the bypass controller; with input isolating switch and barrier] arranged to isolate the power converter input and output and permit safe testing[and troubleshooting] of the power converter, both energized and de-energized, while motor is operating in bypass mode.
1. Bypass Contactor: Load-break, NEMA-rated contactor.
2. Input and Output Isolating Contactors: Non-load-break, NEMA-rated contactors.
3. Isolating Switch: Non-load-break switch arranged to isolate power converter and permit safe troubleshooting and testing of the power converter, both energized and de-energized,

while motor is operating in bypass mode; pad-lockable, door-mounted handle mechanism.

D. Bypass Contactor Configuration: Full-voltage (across-the-line) type.

1. NORMAL/BYPASS selector switch.
2. HAND/OFF/AUTO selector switch.
3. NORMAL/TEST Selector Switch: Allows testing and adjusting of VFC while the motor is running in the bypass mode.
4. Contactor Coils: Pressure-encapsulated type.

a. Operating Voltage: Depending on contactor NEMA size and line-voltage rating, manufacturer's standard matching control power or line voltage.
b. Power Contacts: Totally enclosed, double break, and 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, with CPT of sufficient capacity to operate all integral devices and remotely located pilot, indicating, and control devices.

6. Overload Relays: NEMA ICS 2.

a. Melting-Alloy Overload Relays:

1) Inverse-time-current characteristic.
2) Class 10 tripping characteristic.
3) Heaters in each phase matched to nameplate full-load current of actual protected motor and with appropriate adjustment for duty cycle.

b. Solid-State Overload Relays:

1) Switch or dial selectable for motor-running overload protection.
2) Sensors in each phase.
3) Class 10/20 selectable tripping characteristic selected to protect motor against voltage and current unbalance and single phasing.
4) Class II ground-fault protection, with start and run delays to prevent nuisance trip on starting.
5) Analog communication module.

c. NC isolated overload alarm contact.
d. External overload reset push button.

2.5 ENCLOSURES

A. VFC Enclosures: NEMA 250, to comply with environmental conditions at installed location.

1. Dry and Clean Indoor Locations: Type 1.
2. Outdoor Locations: Type 3R.

3. Other Wet or Damp Indoor Locations: Type 4.
4. Indoor Locations Subject to Dust, Falling Dirt, and Dripping Noncorrosive Liquids: Type 12.

B. Plenum Rating: UL 1995; NRTL certification label on enclosure, clearly identifying VFC as "Plenum Rated."

2.6 ACCESSORIES

A. General Requirements for Control-Circuit and Pilot Devices: NEMA ICS 5; factory installed in VFC enclosure cover unless otherwise indicated.

1. Push Buttons, Pilot Lights, and Selector Switches: Standard-duty, type.

a. Push Buttons: Recessed types;
b. Pilot Lights: LED types;
c. Selector Switches: Rotary type.
d. Stop and Lockout Push-Button Station: Momentary-break, push-button station with a factory-applied hasp arranged so padlock can be used to lock push button in depressed position with control circuit open.

B. Reversible NC/NO bypass contactor 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.

1. Current Transformers: Continuous current rating, basic impulse insulating level (BIL) rating, burden, and accuracy class suitable for connected circuitry. Comply with IEEE C57.13.

2.7 SOURCE QUALITY CONTROL

A. Testing: Test and inspect VFCs according to requirements in NEMA ICS 61800-2.

1. Test each VFC while connected to its specified motor.
2. Verification of Performance: Rate VFCs according to operation of functions and features specified.

B. VFCs will be considered defective if they do not pass tests and inspections.

C. Prepare test and inspection reports.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas, surfaces, and substrates to receive VFCs, with Installer present, for compliance with requirements for installation tolerances, and other conditions affecting performance.

B. Examine VFC before installation. Reject VFCs that are wet, moisture damaged, or mold damaged.

C. Examine roughing-in for conduit systems to verify actual locations of conduit connections before VFC installation.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 HARMONIC ANALYSIS STUDY

A. Perform a harmonic analysis study to identify the effects of nonlinear loads and their associated harmonic contributions on the voltages and currents throughout the electrical system. Analyze possible operating scenarios, including recommendations for VFC input filtering to limit TDD and THD(V) at each VFC to specified levels.

B. Prepare a harmonic analysis study and report complying with IEEE 399 and NETA Acceptance Testing Specification.

3.3 INSTALLATION

A. Coordinate layout and installation of VFCs with other construction including conduit, piping, equipment, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

B. Wall-Mounting Controllers: Install VFCs on walls with tops at uniform height and with disconnect operating handles not higher than 79 inches above finished floor unless otherwise indicated, and by bolting units to wall or mounting on lightweight structural-steel channels bolted to wall. For controllers not on walls, provide freestanding racks complying with Division 26 Section "Hangers and Supports for Electrical Systems."

C. Seismic Bracing: Comply with requirements specified in Division 26 Section "Vibration and Seismic Controls for Electrical Systems."

D. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.

E. Install fuses in control circuits if not factory installed.

F. Install, connect, and fuse thermal-protector monitoring relays furnished with motor-driven equipment.

G. Comply with NECA 1.

3.4 IDENTIFICATION

A. Identify VFCs, 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 VFC with engraved nameplate.
3. Label each enclosure-mounted control and pilot device.

B. Operating Instructions: Frame printed operating instructions for VFCs, including control sequences and emergency procedures. Fabricate frame of finished metal, and cover instructions with clear acrylic plastic. Mount on front of VFC units.

3.5 CONTROL WIRING INSTALLATION

A. Install wiring between VFCs 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 devices where applicable.

1. Connect selector switches to bypass only those manual- and automatic control devices that have no safety functions when switches are in manual-control position.
2. Connect selector switches with control 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.

3.6 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 VFC element, bus, component, connecting supply, feeder, and control circuit.
2. Test continuity of each circuit.

C. Tests and Inspections:

1. Inspect VFC, wiring, components, connections, and equipment installation. Test and adjust controllers, components, and equipment.

2. Test insulation resistance for each VFC element, component, connecting motor supply, feeder, and control circuits.
3. Test continuity of each circuit.
4. Verify that voltages at VFC locations are within 10 percent of motor nameplate rated voltages. If outside this range for any motor, notify Owner or Engineer 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. Perform the following infrared (thermographic) scan tests and inspections and prepare reports:

    a. Initial Infrared Scanning: After Final Acceptance, but not more than 60 days after Final Acceptance, perform an infrared scan of each VFC. Remove front panels so joints and connections are accessible to portable scanner.
    b. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each VFC 11 months after date of Final Acceptance.
    c. Instruments and Equipment: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.

9. Test and adjust controls, remote monitoring, and safeties. Replace damaged and malfunctioning controls and equipment.

D. VFCs will be considered defective if they do not pass tests and inspections.

E. Prepare test and inspection reports, including a certified report that identifies the VFC and describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations made after remedial action.

3.7 STARTUP SERVICE

A. Perform startup service.

1. Complete installation and startup checks according to manufacturer's written instructions.

3.8 ADJUSTING

A. Program microprocessors for required operational sequences, status indications, alarms, event recording, and display features. Clear events memory after final acceptance testing and prior to Final Acceptance.

B. Set field-adjustable switches, auxiliary relays, time-delay relays, timers, and overload-relay pickup and trip ranges.

C. Adjust the trip settings of MCPs and thermal-magnetic circuit breakers with adjustable, instantaneous trip elements. Initially adjust to six times the motor nameplate full-load amperes and attempt to start motors several times, allowing for motor cool-down between starts. If tripping occurs on motor inrush, adjust settings in increments until motors start without tripping. Do not exceed eight times the motor full-load amperes (or 11 times for NEMA Premium Efficient motors if required). Where these maximum settings do not allow starting of a motor, notify Owner or Engineer before increasing settings.

D. Set the taps on reduced-voltage autotransformer controllers.

3.9 PROTECTION

A. Temporary Heating: Apply temporary heat to maintain temperature according to manufacturer's written instructions until controllers are ready to be energized and placed into service.

B. Replace VFCs whose interiors have been exposed to water or other liquids prior to Final Accpetance.

3.10 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, reprogram, and maintain VFCs.

END OF SECTION 262923

SECTION 263600 - TRANSFER SWITCHES

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 transfer switches rated 600 V and less, including the following:

1. Automatic transfer switches.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include rated capacities, weights, operating characteristics, furnished specialties, and accessories.

B. Shop Drawings: Dimensioned plans, elevations, sections, and details showing minimum clearances, conductor entry provisions, gutter space, installed features and devices, and material lists for each switch specified.

1. Single-Line Diagram: Show connections between transfer switch, bypass/isolation switch, power sources, and load; and show interlocking provisions for each combined transfer switch and bypass/isolation switch.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For manufacturer.

B. Manufacturer Seismic Qualification Certification: Submit certification that transfer switches accessories, and components will withstand seismic forces defined in Section 260548.16 "Seismic Controls for Electrical Systems." Include the following:

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.

a. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."

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.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For each type of product to include in emergency, operation, and maintenance manuals. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:

1. Features and operating sequences, both automatic and manual.
2. List of all factory settings of relays; provide relay-setting and calibration instructions, including software, where applicable.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: Maintain a service center capable of providing training, parts, and emergency maintenance repairs within a response period of less than eight hours from time of notification.

B. 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) as defined by OSHA in 29 CFR 1910.7, 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.

C. Source Limitations: Obtain automatic transfer switches through one source from a single manufacturer.

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 ICS 1.

F. Comply with NFPA 70.

G. Comply with NFPA 99.

H. Comply with NFPA 110.

I. Comply with UL 1008 unless requirements of these Specifications are stricter.

1.7 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 Construction Manager no fewer than two days in advance of proposed interruption of electrical service.
2. Do not proceed with interruption of electrical service without Owner's written permission.

1.8 COORDINATION

A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Section 033000 "Cast-in-Place Concrete."

PART 2 - PRODUCTS

2.1 MANUFACTURED UNITS

A. Contactor Transfer Switches:

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. AC Data Systems, Inc.
b. Caterpillar; Engine Div.
c. Emerson; ASCO Power Technologies, LP.
d. Generac Power Systems, Inc.
e. GE Zenith Controls.
f. Kohler Power Systems; Generator Division.
g. Onan/Cummins Power Generation; Industrial Business Group.
h. Russelectric, Inc.
i. Spectrum Detroit Diesel.

2.2 GENERAL TRANSFER-SWITCH PRODUCT REQUIREMENTS

A. Switch shall be utilized in a configuration with two normal power sources. Transfer shall be made upon loss of one of the two sources, with no preferred source. Programming and labeling shall be applicable to this configuration.

B. 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.

C. Tested Fault-Current Closing and Withstand Ratings: Adequate for duty imposed by protective devices at installation locations in Project under the fault conditions indicated, based on testing according to UL 1008.

1. Where transfer switch includes internal fault-current protection, rating of switch and trip unit combination shall exceed indicated fault-current value at installation location.

D. Solid-State Controls: Repetitive accuracy of all settings shall be plus or minus 2 percent or better over an operating temperature range of minus 20 to plus 70 deg C.

E. Resistance to Damage by Voltage Transients: Components shall meet or exceed voltage-surge withstand capability requirements when tested according to IEEE C62.41. Components shall meet or exceed voltage-impulse withstand test of NEMA ICS 1.

F. Electrical Operation: Accomplish by a nonfused, momentarily energized solenoid or electric-motor-operated mechanism, mechanically and electrically interlocked in both directions.

G. 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 insulated-case circuit-breaker components are not acceptable.
2. Switch Action: Double throw; mechanically held in both directions.
3. Contacts: Silver composition or silver alloy for load-current switching. Conventional automatic transfer-switch units, rated 225 A and higher, shall have separate arcing contacts.

H. Neutral Switching. Where four-pole switches are indicated, provide overlapping neutral contacts.

I. Neutral Terminal: Solid and fully rated, unless otherwise indicated.

J. Factory Wiring: Train and bundle factory wiring and label, consistent with Shop Drawings, either by color-code or by numbered or lettered wire and cable tape markers at terminations. Color-coding and wire and cable tape markers are specified in Section 260553 "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.

K. Enclosures: General-purpose NEMA 250, Type 12, complying with NEMA ICS 6 and UL 508, unless otherwise indicated.

2.3 AUTOMATIC TRANSFER SWITCHES

A. Switching Arrangement: Double-throw type, incapable of pauses or intermediate position stops during normal functioning, unless otherwise indicated.

B. Manual Switch Operation: Under load, with door closed and with either or both sources energized. Transfer time is same as for electrical operation. Control circuit automatically disconnects from electrical operator during manual operation.

C. Manual Switch Operation: Unloaded. Control circuit automatically disconnects from electrical operator during manual operation.

D. Signal-Before-Transfer Contacts: A set of normally open/normally closed dry contacts operates in advance of retransfer to normal source. Interval is adjustable from 1 to 30 seconds.

E. Automatic Closed-Transition Transfer Switches: Include the following functions and characteristics:

1. Fully automatic make-before-break operation.
2. Load transfer without interruption, through momentary interconnection of both power sources not exceeding 100 ms.
3. Initiation of No-Interruption Transfer: Controlled by in-phase monitor and sensors confirming both sources are present and acceptable.

    a. Initiation occurs without active control of either source. No preferred source.
    b. Controls ensure that closed-transition load transfer closure occurs only when the 2 sources are within plus or minus 5 electrical degrees maximum, and plus or minus 5 percent maximum voltage difference.

4. Failure of power source serving load initiates automatic break-before-make transfer.

F. In-Phase Monitor: Factory-wired, internal relay controls transfer so it occurs only when the two sources are synchronized in phase. Relay compares phase relationship and frequency difference between normal and emergency sources and initiates transfer when both sources are within 15 electrical degrees, and only if transfer can be completed within 60 electrical degrees. Transfer is initiated only if both sources are within 2 Hz of nominal frequency and 70 percent or more of nominal voltage.

G. Motor Disconnect and Timing Relay: Controls designate starters so they disconnect motors before transfer and reconnect them selectively at an adjustable time interval after transfer. Control connection to motor starters is through wiring external to automatic transfer switch. Time delay for reconnecting individual motor loads is adjustable between 1 and 60 seconds, and settings are as indicated. Relay contacts handling motor-control circuit inrush and seal currents are rated for actual currents to be encountered.

H. Programmed Neutral Switch Position: Switch operator has a programmed neutral position arranged to provide a midpoint between the two working switch positions, with an intentional, time-controlled pause at midpoint during transfer. Pause is adjustable from 0.5 to 30 seconds minimum and factory set for 0.5 second, unless otherwise indicated. Time delay occurs for both transfer directions. Pause is disabled unless both sources are live.

I. Automatic Transfer-Switch Features:

1. Undervoltage Sensing for Each Phase of Normal Source: Sense low phase-to-ground voltage on each phase. Pickup voltage shall be adjustable from 85 to 100 percent of

nominal, and dropout voltage is adjustable from 75 to 98 percent of pickup value. Factory set for pickup at 90 percent and dropout at 85 percent.

2. Adjustable Time Delay: For override of normal-source voltage sensing to delay transfer and engine start signals. Adjustable from zero to six seconds, and factory set for one second.
3. Time Delay for Retransfer to Alternate Source: Adjustable from 0 to 30 minutes, and factory set for 10 minutes to automatically defeat delay on loss of voltage or sustained undervoltage of emergency source, provided normal supply has been restored.
4. Test Switch: Simulate normal-source failure.
5. Switch-Position Pilot Lights: Indicate source to which load is connected.
6. Source-Available Indicating Lights: Supervise sources via transfer-switch normal- and emergency-source sensing circuits.

    a. Normal Power Supervision: Green light with nameplate engraved "Normal Source Available."
    b. Emergency Power Supervision: Red light with nameplate engraved "Alternate Source Available."

7. Unassigned Auxiliary Contacts: Two normally open, single-pole, double-throw contacts for each switch position, rated 10 A at 240-V ac.
8. Transfer Override Switch: Overrides automatic retransfer control so automatic transfer switch will remain connected to alternate power source regardless of condition of normal source. Pilot light indicates override status.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Design each fastener and support to carry load indicated by seismic requirements and according to seismic-restraint details. See Section 260548.16 "Seismic Controls for Electrical Systems."

B. Identify components according to Section 260553 "Identification for Electrical Systems."

C. Set field-adjustable intervals and delays, and relays.

3.2 CONNECTIONS

A. Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems."

B. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

3.3 FIELD QUALITY CONTROL

A. Perform the following tests and inspections with the assistance of a factory-authorized service representative:

1. After installing equipment and after electrical circuitry has been energized, test for compliance with requirements.
2. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
3. Measure insulation resistance phase-to-phase and phase-to-ground with insulation-resistance tester. Include external annunciation and control circuits. Use test voltages and procedure recommended by manufacturer. Comply with manufacturer's specified minimum resistance.

    a. Check for electrical continuity of circuits and for short circuits.
    b. Inspect for physical damage, proper installation and connection, and integrity of barriers, covers, and safety features.
    c. Verify that manual transfer warnings are properly placed.
    d. Perform manual transfer operation.

4. After energizing circuits, demonstrate interlocking sequence and operational function for each switch at least three times.

    a. Simulate power failures of normal source to automatic transfer switches and of alternate 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 transfer-switch operations.
    f. Perform contact-resistance test across main contacts and correct values exceeding 500 microhms and values for 1 pole deviating by more than 50 percent from other poles.

5. Ground-Fault Tests: Coordinate with testing of ground-fault protective devices for power delivery from both sources.

    a. Verify grounding connections and locations and ratings of sensors.

3.4 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain transfer switches and related equipment as specified below. Refer to Section 017900 "Demonstration and Training."

B. Coordinate this training with that for generator equipment.

END OF SECTION 263600

SECTION 265100 - INTERIOR LIGHTING

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. Interior lighting fixtures, lamps, and ballasts.
2. Emergency lighting units.
3. Exit signs.
4. Lighting fixture supports.

B. Related Sections:
1. Division 26 Section "Modular Dimming Controls" for architectural dimming systems.
2. Division 26 Section "Wiring Devices" for manual wall-box dimmers, wall mounted occupancy sensors.

1.3 DEFINITIONS

A. BF: Ballast factor.

B. CCT: Correlated color temperature.

C. CRI: Color-rendering index.

D. HID: High-intensity discharge.

E. LER: Luminaire efficacy rating.

F. Lumen: Measured output of lamp and luminaire, or both.

G. Luminaire: Complete lighting fixture, including ballast housing if provided.

1.4 SUBMITTALS

A. Product Data: For each type of lighting fixture, arranged in order of fixture designation. Include data on features, accessories, finishes, and the following:

1. Physical description of lighting fixture including dimensions.

2. Emergency lighting units including battery and charger.
3. Ballast, including BF.
4. Energy-efficiency data.
5. Life, output (lumens, CCT, and CRI), and energy-efficiency data for lamps.
6. Photometric data and adjustment factors based on laboratory tests, complying with IESNA Lighting Measurements Testing & Calculation Guides, of each lighting fixture type. The adjustment factors shall be for lamps, ballasts, and accessories identical to those indicated for the lighting fixture as applied in this Project.
   a. Manufacturer Certified Data: Photometric data shall be certified by a manufacturer's laboratory with a current accreditation under the National Voluntary Laboratory Accreditation Program for Energy Efficient Lighting Products.

B. Samples: For each lighting fixture indicated in the Interior Lighting Fixture Schedule. Each Sample shall include the following:

1. Lamps and ballasts, installed.
2. Pendant support system.

C. Installation instructions.

D. Coordination Drawings: Reflected ceiling plan(s) and other details, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Lighting fixtures.
2. Suspended ceiling components.
3. Partitions and millwork that penetrate the ceiling or extends to within 12 inches of the plane of the luminaires.
4. Ceiling-mounted projectors.
5. Structural members to which suspension systems for lighting fixtures will be attached.
6. Other items in finished ceiling including the following:

   a. Air outlets and inlets.
   b. Speakers.
   c. Sprinklers.
   d. Smoke and fire detectors.
   e. Occupancy sensors.
   f. Access panels.

7. Perimeter moldings.

E. Qualification Data: For qualified agencies providing photometric data for lighting fixtures.

F. Product Certificates: For each type of ballast for bi-level and dimmer-controlled fixtures, from manufacturer.

G. Field quality-control reports.

H. Operation and Maintenance Data: For lighting equipment and fixtures to include in emergency, operation, and maintenance manuals.

1. Provide a list of all lamp types used on Project; use ANSI and manufacturers' codes.

I. Warranty: Sample of special warranty.

1.5 QUALITY ASSURANCE

A. Luminaire Photometric Data Testing Laboratory Qualifications: Provided by manufacturers' laboratories that are accredited under the National Volunteer Laboratory Accreditation Program for Energy Efficient Lighting Products.

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.

1.6 COORDINATION

A. Coordinate layout and installation of lighting fixtures and suspension system with other construction that penetrates ceilings or is supported by them, including HVAC equipment, fire-suppression system, and partition assemblies.

1.7 WARRANTY

A. Special Warranty for Emergency Lighting Batteries: Manufacturer's standard form in which manufacturer of battery-powered emergency lighting unit agrees to repair or replace components of rechargeable batteries that fail in materials or workmanship within specified warranty period.

1. Warranty Period for Emergency Lighting Unit Batteries: 10 years from date of Final Acceptance. Full warranty shall apply for first year, and prorated warranty for the remaining nine years.
2. Warranty Period for Emergency Fluorescent Ballast and Self-Powered Exit Sign Batteries: Seven years from date of Final Acceptance. Full warranty shall apply for first year, and prorated warranty for the remaining six years.

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. Lamps: 10 for every 100 of each type and rating installed. Furnish at least one of each type.

2. Plastic Diffusers and Lenses: One for every 100 of each type and rating installed. Furnish at least one of each type.
3. Ballasts: One for every 100 of each type and rating installed. Furnish at least one of each type.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, product(s) indicated on Drawings.

2.2 GENERAL REQUIREMENTS FOR LIGHTING FIXTURES AND COMPONENTS

A. Recessed Fixtures: Comply with NEMA LE 4 for ceiling compatibility for recessed fixtures.

B. LED Fixtures: Comply with UL 1598. Where LER is specified, test according to NEMA LE 5A.

C. Fluorescent Fixtures: Comply with UL 1598. Where LER is specified, test according to NEMA LE 5 and NEMA LE 5A as applicable.

D. Metal Parts: Free of burrs and sharp corners and edges.

E. Sheet Metal Components: Steel unless otherwise indicated. Form and support to prevent warping and sagging.

F. 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.

G. Diffusers and Globes:

1. Acrylic Lighting Diffusers: 100 percent virgin acrylic plastic. High resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.

    a. Lens Thickness: At least 0.125 inch minimum unless otherwise indicated.
    b. UV stabilized.

H. Factory-Applied Labels: Comply with UL 1598. Include recommended lamps and ballasts. Labels shall be located where they will be readily visible to service personnel, but not seen from normal viewing angles when lamps are in place.

1. Label shall include the following lamp and ballast characteristics:

    a. "USE ONLY" and include specific lamp type.

b. Lamp diameter code (T-4, T-5, T-8, T-12, etc.), tube configuration (twin, quad, triple, etc.), base type, and nominal wattage for fluorescent and compact fluorescent luminaires.
c. Lamp type, wattage, bulb type (ED17, BD56, etc.) and coating (clear or coated) for HID luminaires.
d. Start type (preheat, rapid start, instant start, etc.) for fluorescent and compact fluorescent luminaires.
e. ANSI ballast type (M98, M57, etc.) for HID luminaires.
f. CCT and CRI for all luminaires.

I. Electromagnetic-Interference Filters: Factory installed to suppress conducted electromagnetic interference as required by MIL-STD-461E. Fabricate lighting fixtures with one filter on each ballast indicated to require a filter.

2.3 BALLASTS FOR LINEAR FLUORESCENT LAMPS

A. General Requirements for Electronic Ballasts:

1. Comply with UL 935 and with ANSI C82.11.
2. Designed for type and quantity of lamps served.
3. Ballasts shall be designed for full light output unless another BF, dimmer, or bi-level control is indicated.
4. Sound Rating: Class A.
5. Total Harmonic Distortion Rating: Less than 10 percent.
6. Transient Voltage Protection: IEEE C62.41.1 and IEEE C62.41.2, Category A or better.
7. Operating Frequency: 42 kHz or higher.
8. Lamp Current Crest Factor: 1.7 or less.
9. BF: 0.88 or higher.
10. Power Factor: 0.95 or higher.
11. Parallel Lamp Circuits: Multiple lamp ballasts shall comply with ANSI C82.11 and shall be connected to maintain full light output on surviving lamps if one or more lamps fail.

B. luminaires controlled by occupancy sensors shall have programmed-start ballasts.

C. Electronic Programmed-Start Ballasts for T5, T8 and T5HO Lamps: Comply with ANSI C82.11 and the following:

1. Lamp end-of-life detection and shutdown circuit for T5 diameter lamps.
2. Automatic lamp starting after lamp replacement.

D. Ballasts for Dimmer-Controlled Lighting Fixtures: Electronic type.

1. Dimming Range: 100 to 5 percent of rated lamp lumens.
2. Ballast Input Watts: Can be reduced to 20 percent of normal.
3. Compatibility: Certified by manufacturer for use with specific dimming control system and lamp type indicated.
4. Control: Coordinate wiring from ballast to control device to ensure that the ballast, controller, and connecting wiring are compatible.

2.4 BALLASTS FOR COMPACT FLUORESCENT LAMPS

A. Description: Electronic-programmed rapid-start type, complying with UL 935 and with ANSI C 82.11, designed for type and quantity of lamps indicated. Ballast shall be designed for full light output unless dimmer or bi-level control is indicated:

1. Lamp end-of-life detection and shutdown circuit.
2. Automatic lamp starting after lamp replacement.
3. Sound Rating: Class A.
4. Total Harmonic Distortion Rating: Less than 20 percent.
5. Transient Voltage Protection: IEEE C62.41.1 and IEEE C62.41.2, Category A or better.
6. Operating Frequency: 20 kHz or higher.
7. Lamp Current Crest Factor: 1.7 or less.
8. BF: 0.95 or higher unless otherwise indicated.
9. Power Factor: 0.95 or higher.
10. Interference: Comply with 47 CFR 18, Ch. 1, Subpart C, for limitations on electromagnetic and radio-frequency interference for nonconsumer equipment.

2.5 EMERGENCY FLUORESCENT POWER UNIT

A. Internal Type: Self-contained, modular, battery-inverter unit, factory mounted within lighting fixture body and compatible with ballast. Comply with UL 924.

1. Emergency Connection: Operate one fluorescent lamp(s) continuously at an output of 1100 lumens each. Connect unswitched circuit to battery-inverter unit and switched circuit to fixture ballast.
2. Nightlight Connection: Operate one fluorescent lamp continuously.
3. Test Push Button and Indicator Light: Visible and accessible without opening fixture or entering ceiling space.

    a. Push Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.
    b. Indicator Light: LED indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.

4. Battery: Sealed, maintenance-free, nickel-cadmium type.
5. Charger: Fully automatic, solid-state, constant-current type with sealed power transfer relay.
6. Integral Self-Test: Factory-installed electronic device automatically initiates code-required test of unit emergency operation at required intervals. Test failure is annunciated by an integral audible alarm and a flashing red LED.

B. External Type: Self-contained, modular, battery-inverter unit, suitable for powering one or more fluorescent lamps, remote mounted from lighting fixture. Comply with UL 924.

1. Emergency Connection: Operate one fluorescent lamp continuously. Connect unswitched circuit to battery-inverter unit and switched circuit to fixture ballast.
2. Nightlight Connection: Operate one fluorescent lamp in a remote fixture continuously.
3. Battery: Sealed, maintenance-free, nickel-cadmium type.

4. Charger: Fully automatic, solid-state, constant-current type.
5. Housing: NEMA 250, Type 1 enclosure.
6. Test Push Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.
7. LED Indicator Light: Indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.
8. Integral Self-Test: Factory-installed electronic device automatically initiates code-required test of unit emergency operation at required intervals. Test failure is annunciated by an integral audible alarm and a flashing red LED.

2.6 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.

B. Internally Lighted Signs:
1. Lamps for AC Operation: LEDs, 50,000 hours minimum rated lamp life.
2. Self-Powered Exit Signs (Battery Type): Integral automatic charger in a self-contained power pack.

a. Battery: Sealed, maintenance-free, nickel-cadmium type.
b. Charger: Fully automatic, solid-state type with sealed transfer relay.
c. Operation: Relay automatically energizes lamp from battery when circuit voltage drops to 80 percent of nominal voltage or below. When normal voltage is restored, relay disconnects lamps from battery, and battery is automatically recharged and floated on charger.
d. Test Push Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.
e. LED Indicator Light: Indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.
f. Integral Self-Test: Factory-installed electronic device automatically initiates code-required test of unit emergency operation at required intervals. Test failure is annunciated by an integral audible alarm and a flashing red LED.

2.7 EMERGENCY LIGHTING UNITS

A. General Requirements for Emergency Lighting Units: Self-contained units complying with UL 924.

1. Battery: Sealed, maintenance-free, lead-acid type.
2. Charger: Fully automatic, solid-state type with sealed transfer relay.
3. Operation: Relay automatically turns lamp on when power-supply circuit voltage drops to 80 percent of nominal voltage or below. Lamp automatically disconnects from battery when voltage approaches deep-discharge level. When normal voltage is restored, relay disconnects lamps from battery, and battery is automatically recharged and floated on charger.
4. Test Push Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.

5. LED Indicator Light: Indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.
6. Wire Guard: Heavy-chrome-plated wire guard protects lamp heads or fixtures.
7. Integral Time-Delay Relay: Holds unit on for fixed interval of 15 minutes when power is restored after an outage.
8. Integral Self-Test: Factory-installed electronic device automatically initiates code-required test of unit emergency operation at required intervals. Test failure is annunciated by an integral audible alarm and a flashing red LED.

2.8 FLUORESCENT LAMPS

A. T8 rapid-start lamps, rated 31 W maximum, nominal length of 48 inches (1220 mm), 2800 initial lumens (minimum), CRI 75 (minimum), color temperature 3500 K, and average rated life 20,000 hours unless otherwise indicated.

B. T8 rapid-start lamps, rated 31 W maximum, nominal length of 24 inches (610 mm), 1300 initial lumens (minimum), CRI 75 (minimum), color temperature 3500 K, and average rated life of 20,000 hours unless otherwise indicated.

C. Compact Fluorescent Lamps: 4-Pin, CRI 80 (minimum), color temperature 3500 K, average rated life of 10,000 hours at three hours operation per start, and suitable for use with dimming ballasts unless otherwise indicated.

1. 13 W: T4, double or triple tube, rated 900 initial lumens (minimum).
2. 18 W: T4, double or triple tube, rated 1200 initial lumens (minimum).
3. 26 W: T4, double or triple tube, rated 1800 initial lumens (minimum).

2.9 LIGHTING FIXTURE SUPPORT COMPONENTS

A. Comply with Division 26 Section "Hangers and Supports for Electrical Systems" for channel- and angle-iron supports and nonmetallic channel and angle supports.

B. Single-Stem Hangers: 1/2-inch steel tubing with swivel ball fittings and ceiling canopy. Finish same as fixture.

C. Twin-Stem Hangers: Two, 1/2-inch steel tubes with single canopy designed to mount a single fixture. Finish same as fixture.

D. Wires: ASTM A 641/A 641M, Class 3, soft temper, zinc-coated steel, 12 gage

E. Rod Hangers: 3/16-inch (5-mm) minimum diameter, cadmium-plated, threaded steel rod.

F. Hook Hangers: Integrated assembly matched to fixture and line voltage and equipped with threaded attachment, cord, and locking-type plug.

2.10 LED LIGHTING FIXTURES

A. General:

1. LED light fixtures shall be in accordance with IES, NFPA, UL, as shown on the drawings, and as specified.

2. LED light fixtures shall be Reduction of Hazardous Substances (RoHS)-compliant.

3. LED drivers shall include the following features unless otherwise indicated:
   a. Minimum efficiency: 85% at full load.
   b. Minimum Operating Ambient Temperature: -20° C. (-4° F.)
   c. Input Voltage: 120 - 277V (±10%) at 60 Hz.
   d. Integral short circuit, open circuit, and overload protection.
   e. Power Factor: ≥ 0.95.
   f. Total Harmonic Distortion: ≤ 20%.
   g. Comply with FCC 47 CFR Part 15.

4. LED modules shall include the following features unless otherwise indicated:
   a. Comply with IES LM-79 and LM-80 requirements.
   b. Minimum CRI 80 and color temperature 3000° K unless otherwise specified in LIGHTING FIXTURE SCHEDULE.
   c. Minimum Rated Life: 50,000 hours per IES L70.
   d. Light output lumens as indicated in the LIGHTING FIXTURE SCHEDULE.

B. LED Downlights:

1. Housing, LED driver, and LED module shall be products of the same manufacturer.

C. LED Troffers:

1. LED drivers, modules, and reflector shall be accessible, serviceable, and replaceable from below the ceiling.

2. Housing, LED driver, and LED module shall be products of the same manufacturer.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Lighting fixtures:

1. Set level, plumb, and square with ceilings and walls unless otherwise indicated.
2. Install lamps in each luminaire.

B. Temporary Lighting: If it is necessary, and approved by Architect, to use permanent luminaires for temporary lighting, install and energize the minimum number of luminaires necessary. When construction is sufficiently complete, remove the temporary luminaires, disassemble, clean thoroughly, install new lamps, and reinstall.

C. Remote Mounting of Ballasts: Distance between the ballast and fixture shall not exceed that recommended by ballast manufacturer. Verify, with ballast manufacturers, maximum distance between ballast and luminaire.

D. Lay-in Ceiling Lighting Fixtures Supports: Use grid as a support element.

1. Install ceiling support system rods or wires, independent of the ceiling suspension devices, for each fixture. Locate not more than 6 inches from lighting fixture corners.
2. Support Clips: Fasten to lighting fixtures and to ceiling grid members at or near each fixture corner with clips that are UL listed for the application.
3. Install at least one independent support rod or wire from structure to a tab on lighting fixture. Wire or rod shall have breaking strength of the weight of fixture at a safety factor of 3.

E. Suspended Lighting Fixture Support:

1. Pendants and Rods: Where longer than 48 inches, brace to limit swinging.
2. Stem-Mounted, Single-Unit Fixtures: Suspend with twin-stem hangers.
3. Continuous Rows: Use tubing or stem for wiring at one point and tubing or rod for suspension for each unit length of fixture chassis, including one at each end.
4. Do not use grid as support for pendant luminaires. Connect support wires or rods to building structure.

F. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

3.2 IDENTIFICATION

A. Install labels with panel and circuit numbers on concealed junction and outlet boxes. Comply with requirements for identification specified in Division 26 Section "Identification for Electrical Systems."

3.3 FIELD QUALITY CONTROL

A. Test for Emergency Lighting: Interrupt power supply to demonstrate proper operation. Verify transfer from normal power to battery and retransfer to normal.

B. Verify that self-luminous exit signs are installed according to their listing and the requirements in NFPA 101.

C. Prepare a written report of tests, inspections, observations, and verifications indicating and interpreting results. If adjustments are made to lighting system, retest to demonstrate compliance with standards.

3.4 STARTUP SERVICE

A. Burn-in all lamps that require specific aging period to operate properly, prior to occupancy by Owner. Burn-in fluorescent and compact fluorescent lamps intended to be dimmed, for at least 100 hours at full voltage.

END OF SECTION 265100

SECTION 283111 - DIGITAL, ADDRESSABLE FIRE-ALARM SYSTEM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
1. Manual fire-alarm boxes.
2. System smoke detectors.
3. Air-sampling smoke detectors.
4. Nonsystem smoke detectors.
5. Heat detectors.
6. Notification appliances.
7. Device guards.
8. Magnetic door holders.
9. Digital alarm communicator transmitter.
10. Network communications.

1.3 DEFINITIONS

A. EMT: Electrical Metallic Tubing.

B. FACP: Fire Alarm Control Panel.

C. HLI: High Level Interface.

D. NICET: National Institute for Certification in Engineering Technologies.

E. PC: Personal computer.

F. VESDA: Very Early Smoke-Detection Apparatus.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product, including furnished options and accessories.

1. Include construction details, material descriptions, dimensions, profiles, and finishes.
2. Include rated capacities, operating characteristics, and electrical characteristics.

B. Shop Drawings: For fire-alarm system.

1. Comply with recommendations and requirements in the "Documentation" section of the "Fundamentals" chapter in NFPA 72.
2. Include plans, elevations, sections, details, and attachments to other work.
3. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and locations. Indicate conductor sizes, indicate termination locations and requirements, and distinguish between factory and field wiring.
4. Detail assembly and support requirements.
5. Include voltage drop calculations for notification-appliance circuits.
6. Include battery-size calculations.
7. Include input/output matrix.
8. Include statement from manufacturer that all equipment and components have been tested as a system and meet all requirements in this Specification and in NFPA 72.
9. Include performance parameters and installation details for each detector.
10. Verify that each duct detector is listed for complete range of air velocity, temperature, and humidity possible when air-handling system is operating.
11. Provide program report showing that air-sampling detector pipe layout balances pneumatically within the airflow range of the air-sampling detector.
12. Include plans, sections, and elevations of heating, ventilating, and air-conditioning ducts, drawn to scale; coordinate location of duct smoke detectors and access to them.
    a. Show critical dimensions that relate to placement and support of sampling tubes, detector housing, and remote status and alarm indicators.
    b. Show field wiring required for HVAC unit shutdown on alarm.
    c. Show field wiring and equipment required for HVAC unit shutdown on alarm and override by firefighters' control system.
    d. Show field wiring and equipment required for HVAC unit shutdown on alarm and override by firefighters' smoke-evacuation system.
    e. Locate detectors according to manufacturer's written recommendations.
    f. Show air-sampling detector pipe routing.
13. Include voice/alarm signaling-service equipment rack or console layout, grounding schematic, amplifier power calculation, and single-line connection diagram.
14. Include floor plans to indicate final outlet locations showing address of each addressable device. Show size and route of cable and conduits and point-to-point wiring diagrams.

C. General Submittal Requirements:

1. Submittals shall be approved by authorities having jurisdiction prior to submitting them to Architect.
2. Shop Drawings shall be prepared by persons with the following qualifications:
    a. Trained and certified by manufacturer in fire-alarm system design.
    b. NICET-certified, fire-alarm technician; **Level IV** minimum.
    c. Licensed or certified by authorities having jurisdiction.

D. Delegated-Design Submittal: For notification appliances and smoke and heat detectors, in addition to submittals listed above, indicate compliance with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1. Drawings showing the location of each notification appliance and smoke and heat detector, ratings of each, and installation details as needed to comply with listing conditions of the device.
2. Design Calculations: Calculate requirements for selecting the spacing and sensitivity of detection, complying with NFPA 72. Calculate spacing and intensities for strobe signals and sound-pressure levels for audible appliances.
3. Indicate audible appliances required to produce square wave signal per NFPA 72.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Seismic Qualification Certificates: For fire-alarm control unit, 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.

1.6 Sample Warranty: For special warranty.

1.7 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For fire-alarm systems and components to include in emergency, operation, and maintenance manuals.

1. Include the following and deliver copies to authorities having jurisdiction:

a. Comply with the "Records" section of the "Inspection, Testing and Maintenance" chapter in NFPA 72.
b. Provide "Fire Alarm and Emergency Communications System Record of Completion Documents" according to the "Completion Documents" Article in the "Documentation" section of the "Fundamentals" chapter in NFPA 72.
c. Complete wiring diagrams showing connections between all devices and equipment. Each conductor shall be numbered at every junction point with indication of origination and termination points.
d. Riser diagram.
e. Device addresses.
f. Air-sampling system sample port locations and modeling program report showing layout meets performance criteria.
g. Record copy of site-specific software.

h. Provide "Inspection and Testing Form" according to the "Inspection, Testing and Maintenance" chapter in NFPA 72, and include the following:

1) Equipment tested.
2) Frequency of testing of installed components.
3) Frequency of inspection of installed components.
4) Requirements and recommendations related to results of maintenance.
5) Manufacturer's user training manuals.

i. Manufacturer's required maintenance related to system warranty requirements.
j. Abbreviated operating instructions for mounting at fire-alarm control unit and each annunciator unit.

B. Software and Firmware Operational Documentation:

1. Software operating and upgrade manuals.
2. Program Software Backup: On magnetic media or compact disk, complete with data files.
3. Device address list.
4. Printout of software application and graphic screens.

1.8 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. Lamps for Remote Indicating Lamp Units: Quantity equal to 10 percent of amount installed, but no fewer than one unit.
2. Lamps for Strobe Units: Quantity equal to 10 percent of amount installed, but no fewer than one unit.
3. Smoke Detectors, Fire Detectors, and Flame Detectors: Quantity equal to 10 percent of amount of each type installed, but no fewer than one unit of each type.
4. Detector Bases: Quantity equal to two percent of amount of each type installed, but no fewer than one unit of each type.
5. Keys and Tools: One extra set for access to locked or tamperproofed components.
6. Audible and Visual Notification Appliances: One of each type installed.
7. Fuses: Two of each type installed in the system. Provide in a box or cabinet with compartments marked with fuse types and sizes.
8. Filters for Air-Sampling Detectors: Quantity equal to two percent of amount of each type installed, but no fewer than one unit of each type.
9. Air-Sampling Fan: Quantity equal to one for every five detectors, but no fewer than one unit of each type.

1.9 QUALITY ASSURANCE

A. Installer Qualifications: Personnel shall be trained and certified by manufacturer for installation of units required for this Project.

B. Installer Qualifications: Installation shall be by personnel certified by NICET as fire-alarm Level III technician.

C. NFPA Certification: Obtain certification according to NFPA 72 by an NRTL (nationally recognized testing laboratory).

D. NFPA Certification: Obtain certification according to NFPA 72 by a UL-listed alarm company.

E. NFPA Certification: Obtain certification according to NFPA 72 in the form of a placard by an FM Global-approved alarm company.

F. NFPA Certification: Obtain certification according to NFPA 72.

1.10 PROJECT CONDITIONS

A. Perform a full test of the existing system prior to starting work. Document any equipment or components not functioning as designed.

B. 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 Owner no fewer than seven days in advance of proposed interruption of fire-alarm service.
2. Do not proceed with interruption of fire-alarm service without Owner's written permission.

C. Use of Devices during Construction: Protect devices during construction unless devices are placed in service to protect the facility during construction.

1.11 SEQUENCING AND SCHEDULING

A. Existing Fire-Alarm Equipment: Maintain existing equipment fully operational until new equipment has been tested and accepted. As new equipment is installed, label it "NOT IN SERVICE" until it is accepted. Remove labels from new equipment when put into service, and label existing fire-alarm equipment "NOT IN SERVICE" until removed from the building.

B. Equipment Removal: After acceptance of new fire-alarm system, remove existing disconnected fire-alarm equipment and wiring.

1.12 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace fire-alarm system equipment and components that fail in materials or workmanship within specified warranty period.

1. Warranty Extent: All equipment and components not covered in the Maintenance Service Agreement.

2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SYSTEM DESCRIPTION

A. Source Limitations for Fire-Alarm System and Components: Components shall be compatible with, and operate as an extension of, existing system. Provide system manufacturer's certification that all components provided have been tested as, and will operate as, a system.

B. Noncoded, UL-certified addressable system, with multiplexed signal transmission and horn /strobe evacuation.

C. Automatic sensitivity control of certain smoke detectors.

D. All components provided shall be listed for use with the selected system.

E. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.2 SYSTEMS OPERATIONAL DESCRIPTION

A. Fire-alarm signal initiation shall be by one or more of the following devices and systems:

1. Manual stations.
2. Heat detectors.
3. Flame detectors.
4. Smoke detectors.
5. Duct smoke detectors.
6. Air-sampling smoke-detection system (VESDA).
7. Carbon monoxide detectors.
8. Combustible gas detectors.
9. Automatic sprinkler system water flow.
10. Preaction system.
11. Fire-extinguishing system operation.
12. Fire standpipe system.
13. Dry system pressure flow switch.
14. Fire pump running.

B. Fire-alarm signal shall initiate the following actions:

1. Continuously operate alarm notification appliances, including voice evacuation notices.
2. Identify alarm and specific initiating device at fire-alarm control unit, connected network control panels, off-premises network control panels, and remote annunciators.
3. Transmit an alarm signal to the remote alarm receiving station.
4. Unlock electric door locks in designated egress paths.
5. Release fire and smoke doors held open by magnetic door holders.

6. Activate voice/alarm communication system.
7. Switch heating, ventilating, and air-conditioning equipment controls to fire-alarm mode.
8. Activate smoke-control system (smoke management) at firefighters' smoke-control system panel.
9. Activate stairwell and elevator-shaft pressurization systems.
10. Close smoke dampers in air ducts of designated air-conditioning duct systems.
11. Activate preaction system.
12. Recall elevators to primary or alternate recall floors.
13. Activate elevator power shunt trip.
14. Activate emergency lighting control.
15. Activate emergency shutoffs for gas and fuel supplies.
16. Record events in the system memory.
17. Record events by the system printer.
18. Indicate device in alarm on the graphic annunciator.

C. Supervisory signal initiation shall be by one or more of the following devices and actions:

1. Valve supervisory switch.
2. High- or low-air-pressure switch of a dry-pipe or preaction sprinkler system.
3. Alert and Action signals of air-sampling detector system.
4. Elevator shunt-trip supervision.
5. Fire pump running.
6. Fire-pump loss of power.
7. Fire-pump power phase reversal.
8. Independent fire-detection and -suppression systems.
9. User disabling of zones or individual devices.
10. Loss of communication with any panel on the network.

D. System trouble signal initiation shall be by one or more of the following devices and actions:

1. Open circuits, shorts, and grounds in designated circuits.
2. Opening, tampering with, or removing alarm-initiating and supervisory signal-initiating devices.
3. Loss of communication with any addressable sensor, input module, relay, control module, remote annunciator, printer interface, or Ethernet module.
4. Loss of primary power at fire-alarm control unit.
5. Ground or a single break in internal circuits of fire-alarm control unit.
6. Abnormal ac voltage at fire-alarm control unit.
7. Break in standby battery circuitry.
8. Failure of battery charging.
9. Abnormal position of any switch at fire-alarm control unit or annunciator.
10. Voice signal amplifier failure.
11. Hose cabinet door open.

E. System Supervisory Signal Actions:

1. Initiate notification appliances.
2. Identify specific device initiating the event at fire-alarm control unit, connected network control panels, off-premises network control panels, and remote annunciators.
3. Record the event on system printer.

4. After a time delay of 200 seconds, transmit a trouble or supervisory signal to the remote alarm receiving station.
5. Transmit system status to building management system.
6. Display system status on graphic annunciator.

2.3 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Raceways 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."

2.4 MANUAL FIRE-ALARM BOXES

A. Manufacturer: Due to interoperability with the existing installed system, manufacturer is limited to the following:

1. SimplexGrinnell LP.

B. General Requirements for Manual Fire-Alarm Boxes: Comply with UL 38. Boxes shall be finished in red with molded, raised-letter operating instructions in contrasting color; shall show visible indication of operation; and shall be mounted on recessed outlet box. If indicated as surface mounted, provide manufacturer's surface back box.

1. Single-action mechanism, breaking-glass or plastic-rod type; with integral addressable module arranged to communicate manual-station status (normal, alarm, or trouble) to fire-alarm control unit.
2. Double-action mechanism requiring two actions to initiate an alarm, breaking-glass or plastic-rod type; with integral addressable module arranged to communicate manual-station status (normal, alarm, or trouble) to fire-alarm control unit.
3. Station Reset: Key- or wrench-operated switch.
4. Indoor Protective Shield: Factory-fabricated, clear plastic enclosure hinged at the top to permit lifting for access to initiate an alarm. Lifting the cover actuates an integral battery-powered audible horn intended to discourage false-alarm operation.
5. Weatherproof Protective Shield: Factory-fabricated, clear plastic enclosure hinged at the top to permit lifting for access to initiate an alarm.

2.5 SYSTEM SMOKE DETECTORS

A. Manufacturer: Due to interoperability with the existing installed system, manufacturer is limited to the following:

1. SimplexGrinnell LP.

B. General Requirements for System Smoke Detectors:

1. Comply with UL 268; operating at 24-V dc, nominal.
2. Detectors shall be two -wire type.
3. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to fire-alarm control unit.
4. Base Mounting: Detector and associated electronic components shall be mounted in a twist-lock module that connects to a fixed base. Provide terminals in the fixed base for connection to building wiring.
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 digital-addressable type, individually monitored at fire-alarm control unit for calibration, sensitivity, and alarm condition and individually adjustable for sensitivity by fire-alarm control unit.

    a. Rate-of-rise temperature characteristic of combination smoke- and heat-detection units shall be selectable at fire-alarm control unit for 15 or 20 deg F per minute.
    b. Fixed-temperature sensing characteristic of combination smoke- and heat-detection units shall be independent of rate-of-rise sensing and shall be settable at fire-alarm control unit to operate at 135 or 155 deg F.
    c. Multiple levels of detection sensitivity for each sensor.
    d. Sensitivity levels based on time of day.

C. Photoelectric Smoke Detectors:

1. Detector address shall be accessible from fire-alarm control unit and shall be able to identify the detector's location within the system and its sensitivity setting.
2. An operator at fire-alarm control unit, having the designated access level, shall be able to manually access the following for each detector:

    a. Primary status.
    b. Device type.
    c. Present average value.
    d. Present sensitivity selected.
    e. Sensor range (normal, dirty, etc.).

D. Ionization Smoke Detector:

1. Detector address shall be accessible from fire-alarm control unit and shall be able to identify the detector's location within the system and its sensitivity setting.
2. An operator at fire-alarm control unit, having the designated access level, shall be able to manually access the following for each detector:

    a. Primary status.
    b. Device type.
    c. Present average value.

d. Present sensitivity selected.
e. Sensor range (normal, dirty, etc.).

E. Duct Smoke Detectors: Photoelectric type complying with UL 268A.

1. Detector address shall be accessible from fire-alarm control unit and shall be able to identify the detector's location within the system and its sensitivity setting.
2. An operator at fire-alarm control unit, having the designated access level, shall be able to manually access the following for each detector:

a. Primary status.
b. Device type.
c. Present average value.
d. Present sensitivity selected.
e. Sensor range (normal, dirty, etc.).

3. Weatherproof Duct Housing Enclosure: NEMA 250, Type 4X; NRTL listed for use with the supplied detector for smoke detection in HVAC system ducts.
4. Each sensor shall have multiple levels of detection sensitivity.
5. Sampling Tubes: Design and dimensions as recommended by manufacturer for specific duct size, air velocity, and installation conditions where applied.
6. Relay Fan Shutdown: Fully programmable relay rated to interrupt fan motor-control circuit.

2.6 PROJECTED BEAM SMOKE DETECTORS

A. Projected Beam Light Source and Receiver: Designed to accommodate small angular movements and continue to operate and not cause nuisance alarms.

B. Detector Address: Accessible from fire-alarm control unit and able to identify the detector's location within the system and its sensitivity setting.

C. An operator at fire-alarm control unit, having the designated access level, shall be able to manually access the following for each detector:

1. Primary status.
2. Device type.
3. Present average value.
4. Present sensitivity selected.
5. Sensor range (normal, dirty, etc.).

2.7 CARBON MONOXIDE DETECTORS

A. General: Carbon monoxide detector listed for connection to fire-alarm system.

1. Mounting: Adapter plate for outlet box mounting.
2. Testable by introducing test carbon monoxide into the sensing cell.
3. Detector shall provide alarm contacts and trouble contacts.

4. Detector shall send trouble alarm when nearing end-of-life, power supply problems, or internal faults.
5. Comply with UL 2075.
6. Locate, mount, and wire according to manufacturer's written instructions.
7. Provide means for addressable connection to fire-alarm system.
8. Test button simulates an alarm condition.

2.8 MULTICRITERIA DETECTORS

A. Mounting: Adaptor plate for outlet box mounting.

B. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to fire-alarm control unit.

C. Automatically adjusts its sensitivity by means of drift compensation and smoothing algorithms. The detector shall send trouble alarm if it is incapable of compensating for existing conditions.

D. Test button tests all sensors in the detector.

E. An operator at fire-alarm control unit, having the designated access level, shall be able to manually access the following for each detector:

1. Primary status.
2. Device type.
3. Present sensitivity selected.
4. Sensor range (normal, dirty, etc.).

F. Sensors: The detector shall be comprised of four sensing elements including a smoke sensor, a carbon monoxide sensor, an infrared sensor, and a heat sensor.

1. Smoke sensor shall be photoelectric type as described in "System Smoke Detectors" Article.
2. Carbon monoxide sensor shall be as described in "Carbon Monoxide Detectors" Article.
3. Heat sensor shall be as described in "Heat Detectors" Article.
4. Each sensor shall be separately listed according to requirements for its detector type.

2.9 HEAT DETECTORS

A. Manufacturer: Due to interoperability with the existing installed system, manufacturer is limited to the following:

1. SimplexGrinnell LP.

B. General Requirements for Heat Detectors: Comply with UL 521.

1. Temperature sensors shall test for and communicate the sensitivity range of the device.

C. Heat Detector, Combination Type: Actuated by either a fixed temperature of 135 deg F or a rate of rise that exceeds 15 deg F per minute unless otherwise indicated.

1. Mounting: Adapter plate for outlet box mounting.
2. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to fire-alarm control unit.

D. Heat Detector, Fixed-Temperature Type: Actuated by temperature that exceeds a fixed temperature of 190 deg F.

1. Mounting: Adapter plate for outlet box mounting.
2. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to fire-alarm control unit.

E. Continuous Linear Heat-Detector System:

1. Detector Cable: Rated detection temperature 155 deg F. Listed for "regular" service and a standard environment. Cable includes two steel actuator wires twisted together with spring pressure, wrapped with protective tape, and finished with PVC outer sheath. Each actuator wire is insulated with heat-sensitive material that reacts with heat to allow the cable twist pressure to short circuit wires at the location of elevated temperature.
2. Control Unit: Two-zone or multizone unit as indicated. Provide same system power supply, supervision, and alarm features as specified for fire-alarm control unit.
3. Signals to Fire-Alarm Control Unit: Any type of local system trouble shall be reported to fire-alarm control unit as a composite "trouble" signal. Alarms on each detection zone shall be individually reported to central fire-alarm control unit as separately identified zones.
4. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to fire-alarm control unit.

2.10 AIR-SAMPLING SMOKE DETECTOR

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. Ansul Incorporated; Tyco International Ltd.
2. Fenwal Protection Systems; A UTC Fire & Security Company.
3. Fike Corporation.
4. Notifier.
5. Xtralis Pty Ltd.

B. General Description:

1. Air-sampling smoke detector shall be laser based using a piping system and a fan to transport the particles of combustion to the detector.
2. Provide two levels of alarm from each zone covered by the detector and two supervisory levels of alarm from each detector.
3. The air being sampled shall pass through filters to remove dust particulates greater than 20 microns before entering the detection chamber.

4. Detectors shall have the capability via RS 485 to connect up to 100 detectors in a network.
5. Detectors shall communicate with the fire-alarm control unit via addressable, monitored dry contact closures, RS 485, and interface modules. Provide a minimum of six relays, individually programmable remotely for any function.
6. Pipe airflow balancing calculations shall be performed using approved calculation software.

C. Detector:

1. Detector, Filter, Aspirator, and Relays: Housed in a mounting box and arranged in such a way that air is drawn from the detection area and a sample passed through the dual-stage filter and detector by the aspirator.
2. Obscuration Sensitivity Range: 0.005 - 6 percent obs/ft.
3. Four independent, field-programmable, smoke-alarm thresholds per sensor pipe and a programmable scan time delay. The threshold set points shall be programmable.

    a. The four alarm thresholds may be used as follows:

        1) Alarm Level 1 (Alert): Activate a visual and an audible supervisory alarm.
        2) Alarm Level 2 (Action): Activate shutdown of electrical/HVAC equipment and activate a visual and an audible supervisory alarm.
        3) Alarm Level 3 (Fire 1): Activate building alarm systems and initiate call to fire response unit.
        4) Alarm Level 4 (Fire 2): Activate suppression system or other countermeasures.

    b. Final Detection System Settings: Approved by Owner.
    c. Initial Detection Alarm Settings:

        1) Alarm Level 1 (Alert): 0.08 percent obs/ft.
        2) Alarm Level 2 (Action): 1.0 percent obs/ft.
        3) Alarm Level 3 (Fire 1): 2.0 percent obs/ft.
        4) Alarm Level 4 (Fire 2): 4.0 percent obs/ft.

4. Power Supply:

    a. Regulated 24-V dc, monitored by the fire-alarm control unit, with battery backup.
    b. Battery backup shall provide 24 hours' standby, followed by 30 minutes at maximum connected load.

5. Detector shall also transmit the following faults:

    a. Detector.
    b. Airflow.
    c. Filter.
    d. System.
    e. Zone.
    f. Network.
    g. Power.

6. Provide four in-line sample pipe inlets that shall contain a flow sensor for each pipe inlet. The detector shall be capable of identifying the pipe from which smoke was detected.
7. Aspirator: Air pump capable of allowing for multiple sampling pipe runs up to 650 feet in total, (four pipe runs per detector) with a transport time of less than 120 seconds from the farthest sample port.
8. Air-Sampling Flow Rates Outside Manufacturer's Specified Range: Result in a trouble alarm.
9. Provide software-programmable relays rated at 2 A at 30-V dc for alarm and fault conditions.
10. Provide built-in event and smoke logging; store smoke levels, alarm conditions, operator actions, and faults with date and time of each event. Each detector (zone) shall be capable of storing up to 18,000 events.
11. Urgent and Minor Faults. Minor faults shall be designated as trouble alarms. Urgent faults, which indicate the unit may not be able to detect smoke, shall be designated as supervisory alarms.

D. Displays:

1. Include display module within each detector.
2. Each display shall provide the following features at a minimum:

    a. A bar-graph display.
    b. Four independent, high-intensity alarm indicators (Alert, Action, Fire 1, and Fire 2), corresponding to the four alarm thresholds of the indicated sector.
    c. Alarm threshold indicators for Alert, Action, and Fire 1.
    d. LED indication that the first alarm sector is established.
    e. Detector fault and airflow fault indicators.
    f. LED indicators shall be provided for faults originating in the particular zone (Zone Fault), faults produced by the overall smoke-detection system, and faults resulting from network wiring errors (Network Fault).
    g. Minor and urgent LED fault indicators.

E. Sampling Tubes:

1. Smooth bore with a nominal 1-inch OD and a 7/8-inch ID. Sampling pipe with between 5/8- and 1-inch ID can be used in specifically approved locations when recommended by manufacturer.
2. Pipe Material: CPVC and complying with UL 1887, "Safety Fire Test of Plastic Sprinkler Pipe for Visible Flame and Smoke Characteristics."
3. Joints in the sampling pipe shall be airtight. Use solvent cement approved by the pipe manufacturer on all joints except at entry to the detector.
4. Identify piping with labels reading: "Aspirating Smoke Detector Pipe - Do Not Paint or Disturb" along its entire length at regular intervals according to NFPA 72.
5. Support pipes at not more than 60-inch centers.
6. Fit end of each trunk or branch pipe with an end cap and drilled with a hole appropriately sized to achieve the performance as specified and as calculated by the system design.

F. Sampling Holes:

1. Sampling holes of 5/64 inch, or other sized holes per manufacturer's written instructions, shall be separated by not more than the maximum distance allowable for conventional smoke detectors. Intervals may vary according to calculations.
2. Follow manufacturer's written recommendations to determine the number and spacing of sampling points and the distance from sampling points to ceiling or roof structure and to forced ventilation systems.
3. Each sampling point shall be identified by an applied decal.

2.11 NOTIFICATION APPLIANCES

A. Manufacturer: Due to interoperability with the existing installed system, manufacturer is limited to the following:

1. SimplexGrinnell LP.

B. General Requirements for Notification Appliances: Individually addressed, connected to a signaling-line circuit, equipped for mounting as indicated, and with screw terminals for system connections.

C. General Requirements for Notification Appliances: Connected to notification-appliance signal circuits, zoned as indicated, equipped for mounting as indicated, and with screw terminals for system connections.

1. Combination Devices: Factory-integrated audible and visible devices in a single-mounting assembly, equipped for mounting as indicated, and with screw terminals for system connections.

D. Chimes, Low-Level Output: Vibrating type, 75-dBA minimum rated output.

E. Chimes, High-Level Output: Vibrating type, 81-dBA minimum rated output.

F. Horns: Electric-vibrating-polarized type, 24-V dc; 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.

G. Visible Notification Appliances: Xenon strobe lights complying with 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:

a. 75 cd.
b. 15/30/75/110 cd, selectable in the field.

2. Mounting: Wall mounted unless otherwise indicated.

3. For units with guards to prevent physical damage, light output ratings shall be determined with guards in place.
4. Flashing shall be in a temporal pattern, synchronized with other units.
5. Strobe Leads: Factory connected to screw terminals.
6. Mounting Faceplate: Factory finished, red.

H. Voice/Tone Notification Appliances:

1. Comply with UL 1480.
2. Speakers for Voice Notification: Locate speakers for voice notification to provide the intelligibility requirements of the "Notification Appliances" and "Emergency Communications Systems" chapters in NFPA 72.
3. High-Range Units: Rated 2 to 15 W.
4. Low-Range Units: Rated 1 to 2 W.
5. Mounting: semirecessed or surface mounted and bidirectional.
6. Matching Transformers: Tap range matched to acoustical environment of speaker location.

I. Exit Marking Audible Notification Appliance:

1. Exit marking audible notification appliances shall meet the audibility requirements in NFPA 72.
2. Provide exit marking audible notification appliances at the entrance to all building exits.
3. Provide exit marking audible notification appliances at the entrance to areas of refuge with audible signals distinct from those used for building exit marking.

2.12 MAGNETIC DOOR HOLDERS

A. Description: Units are equipped for wall or floor mounting as indicated and are complete with matching doorplate.

1. Electromagnets: Require no more than 3 W to develop 25-lbf holding force.
2. Wall-Mounted Units: Flush mounted unless otherwise indicated.
3. Rating: 24-V ac or dc.
4. Rating: 120-V ac.

B. Material and Finish: Match door hardware.

2.13 ADDRESSABLE INTERFACE DEVICE

A. General:

1. Include address-setting means on the module.
2. Store an internal identifying code for control panel use to identify the module type.
3. Listed for controlling HVAC fan motor controllers.

B. Monitor Module: Microelectronic module providing a system address for alarm-initiating devices for wired applications with normally open contacts.

C. Integral Relay: Capable of providing a direct signal to elevator controller to initiate elevator recall and to circuit-breaker shunt trip for power shutdown.

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.

D. Control Module:

1. Operate notification devices.
2. Operate solenoids for use in sprinkler service.

2.14 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 receive an alarm, supervisory, or trouble signal from fire-alarm control unit and automatically capture two telephone line(s) and dial a preset number for a remote central station. When contact is made with central station(s), signals shall be transmitted. If service on either line is interrupted for longer than 45 seconds, transmitter shall initiate a local trouble signal and transmit the signal indicating loss of telephone line to the remote alarm receiving station over the remaining line. Transmitter shall automatically report telephone service restoration to the central station. If service is lost on both telephone lines, transmitter shall initiate the local trouble signal.

C. Local functions and display at the digital alarm communicator transmitter shall include the following:

1. Verification that both telephone lines 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.

2.15 NETWORK COMMUNICATIONS

A. Provide network communications for fire-alarm system according to fire-alarm manufacturer's written requirements.

B. Provide network communications pathway per manufacturer's written requirements and requirements in NFPA 72 and NFPA 70.

C. Provide integration gateway using BACnet for connection to building automation system.

2.16 DEVICE GUARDS

A. Description: Welded wire mesh of size and shape for the manual station, smoke detector, gong, or other device requiring protection.

1. Factory fabricated and furnished by device manufacturer.
2. Finish: Paint of color to match the protected device.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions for compliance with requirements for ventilation, temperature, humidity, and other conditions affecting performance of the Work.

1. Verify that manufacturer's written instructions for environmental conditions have been permanently established in spaces where equipment and wiring are installed, before installation begins.

B. Examine roughing-in for electrical connections to verify actual locations of connections before installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 EQUIPMENT INSTALLATION

A. Comply with NFPA 72, NFPA 101, and requirements of authorities having jurisdiction for installation and testing of fire-alarm equipment. Install all electrical wiring to comply with requirements in NFPA 70 including, but not limited to, Article 760, "Fire Alarm Systems."

1. Devices placed in service before all other trades have completed cleanup shall be replaced.
2. Devices installed but not yet placed in service shall be protected from construction dust, debris, dirt, moisture, and damage according to manufacturer's written storage instructions.

B. Connecting to Existing Equipment: Verify that existing fire-alarm system is operational before making changes or connections.

1. Connect new equipment to existing control panel in existing part of the building.
2. Connect new equipment to existing monitoring equipment at the supervising station.
3. Expand, modify, and supplement existing control monitoring equipment as necessary to extend existing control monitoring functions to the new points. New components shall be capable of merging with existing configuration without degrading the performance of either system.

C. Equipment Mounting: Install fire-alarm control unit on finished floor.

D. Install wall-mounted equipment, with tops of cabinets not more than 78 inches above the finished floor.

E. Manual Fire-Alarm Boxes:

1. Install manual fire-alarm box in the normal path of egress within 60 inches of the exit doorway.
2. Mount manual fire-alarm box on a background of a contrasting color.
3. The operable part of manual fire-alarm box shall be between 42 inches and 48 inches above floor level. All devices shall be mounted at the same height unless otherwise indicated.

F. Smoke- or Heat-Detector Spacing:

1. Comply with the "Smoke-Sensing Fire Detectors" section in the "Initiating Devices" chapter in NFPA 72, for smoke-detector spacing.
2. Comply with the "Heat-Sensing Fire Detectors" section in the "Initiating Devices" chapter in NFPA 72, for heat-detector spacing.
3. Smooth ceiling spacing shall not exceed 30 feet.
4. Spacing of detectors for irregular areas, for irregular ceiling construction, and for high ceiling areas shall be determined according to Annex A or Annex B in NFPA 72.
5. HVAC: Locate detectors not closer than 60 inches from air-supply diffuser or return-air opening.
6. Lighting Fixtures: Locate detectors not closer than 12 inches from any part of a lighting fixture and not directly above pendant mounted or indirect lighting.

G. 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.

H. Duct Smoke Detectors: Comply with NFPA 72 and NFPA 90A. Install sampling tubes so they extend the full width of duct. Tubes more than 36 inches long shall be supported at both ends.

1. Do not install smoke detector in duct smoke-detector housing during construction. Install detector only during system testing and prior to system turnover.

I. Air-Sampling Smoke Detectors: If using multiple pipe runs, the runs shall be pneumatically balanced.

J. Elevator Shafts: Coordinate temperature rating and location with sprinkler rating and location. Do not install smoke detectors in sprinklered elevator shafts.

K. Single-Station Smoke Detectors: Where more than one smoke alarm is installed within a dwelling or suite, they shall be connected so that the operation of any smoke alarm causes the alarm in all smoke alarms to sound.

L. Remote Status and Alarm Indicators: Install in a visible location near each smoke detector, sprinkler water-flow switch, and valve-tamper switch that is not readily visible from normal viewing position.

M. 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. Install all devices at the same height unless otherwise indicated.

N. Visible Alarm-Indicating Devices: Install adjacent to each alarm bell or alarm horn and at least 6 inches below the ceiling. Install all devices at the same height unless otherwise indicated.

O. Device Location-Indicating Lights: Locate in public space near the device they monitor.

P. Antenna for Radio Alarm Transmitter: Mount to building structure where indicated. Use mounting arrangement and substrate connection that resists 100-mph wind load with a gust factor of 1.3 without damage.

3.3 PATHWAYS

A. Pathways above recessed ceilings and in nonaccessible locations may be routed exposed.

1. Exposed pathways located less than 96 inches above the floor shall be installed in EMT.

B. Pathways shall be installed in EMT.

C. Exposed EMT shall be painted red enamel.

3.4 CONNECTIONS

A. For fire-protection systems related to doors in fire-rated walls and partitions and to doors in smoke partitions, 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. Alarm-initiating connection to smoke-control system (smoke management) at firefighters' smoke-control system panel.
2. Alarm-initiating connection to stairwell and elevator-shaft pressurization systems.
3. Smoke dampers in air ducts of designated HVAC duct systems.
4. Magnetically held-open doors.
5. Electronically locked doors and access gates.
6. Alarm-initiating connection to elevator recall system and components.
7. Alarm-initiating connection to activate emergency lighting control.
8. Alarm-initiating connection to activate emergency shutoffs for gas and fuel supplies.
9. Supervisory connections at valve supervisory switches.
10. Supervisory connections at low-air-pressure switch of each dry-pipe sprinkler system.
11. Supervisory connections at elevator shunt-trip breaker.
12. Data communication circuits for connection to building management system.
13. Data communication circuits for connection to mass notification system.
14. Supervisory connections at fire-extinguisher locations.
15. Supervisory connections at fire-pump power failure including a dead-phase or phase-reversal condition.

3.5 IDENTIFICATION

A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

B. Install framed instructions in a location visible from fire-alarm control unit.

3.6 GROUNDING

A. Ground fire-alarm control unit and associated circuits; comply with IEEE 1100. Install a ground wire from main service ground to fire-alarm control unit.

B. Ground shielded cables at the control panel location only. Insulate shield at device location.

3.7 FIELD QUALITY CONTROL

A. Field tests shall be witnessed by authorities having jurisdiction.

B. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.

C. Perform tests and inspections.

D. Perform the following tests and inspections with the assistance of a factory-authorized service representative:

1. Visual Inspection: Conduct visual inspection prior to testing.

a. Inspection shall be based on completed record Drawings and system documentation that is required by the "Completion Documents, Preparation" table in the "Documentation" section of the "Fundamentals" chapter in NFPA 72.
b. Comply with the "Visual Inspection Frequencies" table in the "Inspection" section of the "Inspection, Testing and Maintenance" chapter in NFPA 72; retain the "Initial/Reacceptance" column and list only the installed components.

2. System Testing: Comply with the "Test Methods" table in the "Testing" section of the "Inspection, Testing and Maintenance" chapter in NFPA 72.
3. Test audible appliances for the public operating mode according to manufacturer's written instructions. Perform the test using a portable sound-level meter complying with Type 2 requirements in ANSI S1.4.
4. Test audible appliances for the private operating mode according to manufacturer's written instructions.
5. Test visible appliances for the public operating mode according to manufacturer's written instructions.
6. Factory-authorized service representative shall prepare the "Fire Alarm System Record of Completion" in the "Documentation" section of the "Fundamentals" chapter in NFPA 72 and the "Inspection and Testing Form" in the "Records" section of the "Inspection, Testing and Maintenance" chapter in NFPA 72.

E. Reacceptance Testing: Perform reacceptance testing to verify the proper operation of added or replaced devices and appliances.

F. Fire-alarm system will be considered defective if it does not pass tests and inspections.

G. Prepare test and inspection reports.

H. Maintenance Test and Inspection: Perform tests and inspections listed for weekly, monthly, quarterly, and semiannual periods. Use forms developed for initial tests and inspections.

I. Annual Test and Inspection: One year after date of Substantial Completion, test fire-alarm system complying with visual and testing inspection requirements in NFPA 72. Use forms developed for initial tests and inspections.

3.8 MAINTENANCE SERVICE

A. Initial Maintenance Service: Beginning at Substantial Completion, maintenance service shall include 12 months' full maintenance by skilled employees of manufacturer's designated service organization. Include preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper operation. Parts and supplies shall be manufacturer's authorized replacement parts and supplies.

1. Include visual inspections according to the "Visual Inspection Frequencies" table in the "Testing" paragraph of the "Inspection, Testing and Maintenance" chapter in NFPA 72.
2. Perform tests in the "Test Methods" table in the "Testing" paragraph of the "Inspection, Testing and Maintenance" chapter in NFPA 72.
3. Perform tests per the "Testing Frequencies" table in the "Testing" paragraph of the "Inspection, Testing and Maintenance" chapter in NFPA 72.

3.9 SOFTWARE SERVICE AGREEMENT

A. Comply with UL 864.

B. Technical Support: Beginning at Substantial Completion, service agreement shall include software support for two years.

C. 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 access to system and to upgrade computer equipment if necessary.

3.10 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain fire-alarm system.

END OF SECTION 283111

SECTION 312300 - EXCAVATION AND FILL

PART 1: GENERAL

1.01 SUBMITTALS

A. All materials to be used for backfill, including common fill and bedding materials, shall be approved by Engineer prior to placing the materials in the pipe trench. All backfill and bedding materials whether obtained from the trench excavation or from an off-site source must be tested as directed by the Engineer.

B. Samples of the materials shall be submitted to an approved testing agency for analysis. The test results and report stating that the materials meet the requirements of these Specifications and the Specifications of Federal, State and local authorities (where applicable) shall be submitted to the Engineer for approval prior to placing the materials in the pipe trench.

PART 2: PRODUCTS

2.01 GENERAL

A. Refer to the trench restoration details on the Contract Drawings for the locations of trench backfill and bedding materials for each pipe material.

2.02 BACKFILL MATERIALS

A. Backfill material shall be either select excavated material, imported bank run sand and gravel, or quarry processed stone.

B. Select excavated material is defined as material free from stones over 4-inches, organic or vegetable material, asphalt, concrete, refuse, frozen soil, or any other material deemed unsuitable by the Engineer. Excavated material consisting primarily of clay or silt will not be approved as "select" excavated material and must be disposed of off-site. Excavated materials consisting primarily of decomposed shale fragments will generally be accepted as select material. The Engineer must approve the use of any excavated material as backfill.

C. Bank run sand and gravel (soil aggregate Type I-2) shall be bank run supply, free of clay and foreign material, as approved by the Engineer. Bank run sand and gravel shall only be used when an insufficient quantity of select excavated material is available to backfill the trench and when directed by the Engineer. Bank run sand and gravel (soil aggregate Type I-2) shall meet the following gradation:

U.S. Sieve Size	Percentage by Weight Passing Square Mesh Sieves
2"	100%
3/4"	65 - 100%
No. 4	40 - 75%
No. 5	5 - 30%
No. 200	0 - 7%

D. Quarry-processed stone shall be a broken stone material conforming to the requirements for dense graded aggregate material as outlined in Section 901.08 of the New Jersey State Department of Transportation "Standard Specifications for Road and Bridge Construction", latest edition. This material shall be hard, durable, broken stone so that it can be compacted into a hard dense mass. A 30-pound sample for each proposed source shall be submitted to the Engineer for approval before any material is trucked onto the site. The Engineer reserves the right to have a certified testing laboratory perform sieve analyses on the material. The material shall be leveled to the required grades and compacted by approved methods. Quarry process stone shall have the following gradation:

U.S. Sieve Size	Percentage by Weight Passing Square Mesh Sieves
1-1/2 Inch	100
3/4 Inch	55 - 90
No. 4	25 - 60
No. 50	5 - 25
No. 200	3 - 12

E. Dense graded aggregate materials other than quarry process stone shall not be used in lieu of quarry process stone. Recycled concrete will not be acceptable.

2.03 PIPE BEDDING AND HAUNCHING

A. As used hereinafter, bedding refers to material placed in the trench below the pipe invert. Haunching refers to material placed between the pipe and trench wall, from the invert to the bottom of the backfill material.

B. Bedding and Haunching Material

1. The trench excavation shall extend to a depth 6-inches below pipe invert. A 6-inch layer of quarry-processed stone shall then be placed, graded, and compacted. After providing joint clearance, pipe shall then be laid directly on the stone.

2. Quarry processed stone shall be clean, hard aggregate, shall be accurately leveled to required grades, and where required shall be compacted by tamping or other approved means. The material shall conform to the requirements of Part 2.02.

3. NJDOT #57 Stone

If directed by the Engineer, NJDOT #57 stone shall be used for pipe bedding. The material shall conform to the following gradation.

U.S. Standard Sieve Size	Percent Finer By Weight
1-1/2"	100
1"	95 - 100
1/2"	25 - 60
No. 4	0 - 10
No. 8	0 - 5

PART 3: EXECUTION

3.01 CONSTRUCTION EQUIPMENT

A. The Contractor shall select his equipment such that, to the maximum extent possible, damage to existing surfaces and structures is minimized. It is the Contractor's responsibility, to repair, at his expense, any damages due to the use of any equipment to complete the work.

3.02 NOISE, DUST AND ODOR CONTROL

A. The Contractor's construction activities shall be conducted so as to eliminate all unnecessary noise, dust and odors.

3.03 PROTECTION OF TREES

A. Special care shall be taken to avoid damage to trees and their root system. Machine excavation shall not be used when, in the opinion of the Engineer, it would endanger the tree. In general, where the line of trench falls within the limits of the limb spread, headers are required across the trench to protect the tree. The operation of all equipment, particularly when employing booms, the storage of materials, and the disposition of excavation shall be conducted in a manner which will not injure trees, trunks, branches or their roots unless such trees are designated for removal.

3.04 TRENCH SUPPORT

A. Where necessary, particularly to prevent disturbance, damage or settlement of adjacent structures, pipelines, utilities, improvements or paving, excavation shall be adequately sheeted and braced. Details of sheeting and bracing shall be submitted to the Engineer prior to installation.

B. Sheeting and bracing shall remain in place until the pipe has been laid, tested for defects and repaired, if necessary, and the earth around the pipe compacted to a depth of two feet over the top of the pipe. Sheeting and bracing of all excavation shall comply with the latest statutes of the State of New Jersey governing safety of Workers in the Construction Industry. Where sheeting and bracing systems are used,

they must be designed by a Professional Engineer licensed in the State of New Jersey. The Contractor shall submit a sheeting plan to the Engineer as proof that the design has been done; however, this submittal will not be considered as a shop drawing and the Engineer will not be responsible for the adequacy or safety of the sheeting design or installation. The sheeting design shall conform to all applicable requirements of the New Jersey Construction Safety Code and the Occupational Health and Safety Act.

C. Any damage to new or existing structures occurring through settlement, water or earth pressure, or other causes due to inadequate bracing or through negligence or fault of the Contractor in any other manner, shall be repaired by the Contractor at his own expense.

D. The Contractor shall specifically comply with OSHA Standards for Excavations (29 CFR Part 1926), "OSHA Standards." As such, the Contractor shall be responsible for providing a "competent person" as defined in the OSHA Standards and as required by the standards. The Contractor shall be solely responsible for the selection, design, installation, and implementation of all "protective systems" as defined in the OSHA Standards. The pipeline design by the Owner, the Engineer, or the Engineer's Consultant does not include the design of the "protective systems" since the design of the "protective systems" is the responsibility of the Contractor.

3.05 TRENCH EXCAVATION AND BOTTOM PREPARATION

A. General excavation shall consist of the satisfactory removal and disposal of all materials taken from within the limits of the Work contracted, meaning the material lying between the original ground line and the finished ground line as shown on the Drawings regardless of whether the original ground line is exposed to air or is covered by water. Excavation below existing ground line to enable any required construction or removals is included. It is distinctly understood that any reference to earth, rock, silt, debris or other materials on the Drawings or in the Specifications is solely for the Owner's information and shall not be taken as an indication of classified excavation or the quantity of earth, rock, silt, debris or other material encountered.

B. All excavation shall be made to the lines and grades indicated on the Drawings or established in the field by the Engineer.

C. Excess excavated materials and excavated materials unsuitable for backfilling shall be properly disposed of by the Contractor clear of the site. The Contractor shall furnish to Engineer satisfactory evidence that an appropriate disposal site will be used. No additional payment shall be made for disposal of excess excavated material.

D. Open trench shall never exceed 200 feet in advance of pipe laying and shall be reduced as required by conditions encountered.

E. Widths of trenches shall be held to a minimum to accommodate the pipe and appurtenances. The trench width shall be measured at the top of the pipe barrel and shall conform to the following limits:

Minimum: Outside diameter of the pipe barrel plus 8 inches, i.e., 4 inches each side.

Maximum: Outside pipe diameter plus 30 inches.

F. If, for any reason the trench width exceeds the maximum trench width defined in Paragraph 3.05.E, the Contractor shall provide additional bedding and backfill material to fill the additional width of trench, at no cost to the Owner.

G. All trenches shall provide for a minimum of 48 inches of cover over the top of the pipe barrel to the top of the finished grade of the roadway or ground surface unless otherwise authorized by the Engineer.

H. The trench shall be excavated to the depth required, so as to provide a uniform and continuous bearing and support for the pipe barrel above the bedding on solid and undisturbed ground at every point between joints, except that it will be permissible to disturb the finished trench bottom over a maximum length of 18 inches near the middle of each length of pipe by the withdrawal of pipe slings or other lifting tackle. When required, bell holes shall be provided. The finished trench bottom shall be accurately prepared by means of hand tools.

I. Where excavation is made in rock or boulders, the trench shall be excavated 8 inches below the pipe barrel for pipe 12 inches in diameter or less, and 12 inches below the pipe barrel for 16 inch diameter pipe and larger. All loose material shall be removed from the trench bottom. After preparation of the trench bottom, a pipe bed shall be prepared using bedding material as specified in Section 312300.2.03.

J. When unsuitable material is found below subgrade, as determined by the Engineer, Contractor shall remove the material to a depth determined by the Engineer, and provide compacted bedding material to backfill the trench in the area where unsuitable material has been excavated.

K. If any excavation is caused by the Contractor's error, or wherever the excavation is carried below the lines and grades given either by the Engineer or shown on the Contract Drawings, the Contractor shall, at his own expense, refill all such excavated space with such material and in such manner as may be directed, in order to insure the stability of the various structures. Beneath all structures, space excavated without authority shall be refilled with Class "D" (2500 lb.) concrete or other material approved by the Engineer. The expense for this work shall be borne by the Contractor.

3.06 TRENCH BACKFILLING

A. All trench excavation shall be backfilled immediately after pipe is laid. Compacted bedding material as described in Section 312300.2.03 shall be used to backfill the trench from the bottom of the pipe barrel to the level shown on the Contract Drawings. The material shall be placed in uniform 6-inch loose layers and each layer

mechanically compacted so as to eliminate the possibility of settlement, pipe misalignment or damage of joints.

B. Backfill around the pipe, and up to a cover of at least 12-inches over the top of the pipe shall be placed in 6-inch layers, each layer to be thoroughly compacted to 95% of maximum dry density by mechanical tampers of an approved type. Backfill material shall be as specified in Section 312300.2.02. In the case of the steel pipe, the stone shall extend to the top of the pipe. Care shall be taken to avoid damaging or moving the pipe.

C. All backfill above a plane 12" over the pipe is to be placed in lifts not exceeding 12-inches and compacted to at least 95% of its maximum dry density established by ASTM D-1557. The trenches and excavations shall be wet down, or the excavated material shall be dried as required to obtain optimum density while the backfilling is being carried out. The Contractor may use mechanical equipment to place the back-fill. This shall be done in such a manner that the material does not free fall, but shall be so placed that it will flow onto the previously placed material. No compacting of the backfill with mechanical equipment, such as wheeled vehicles, will be permitted unless sufficient cover is provided over the pipe to prevent damage to the pipe.

D. In all trenches, backfill between a plane 12" above the top of the pipe and the finished surface grade shall be placed in successive layers and thoroughly compacted using mechanical tampers, hydro-tampers, or high speed vibro tampers.

E. The trench surface shall be regularly attended to during the course of the Contract. The Contractor shall take prompt corrective measures to correct any settlement or washout. The trench surface shall be maintained in a safe condition and shall not interfere with natural drainage.

F. Any material required for backfilling the trenches or for filling depressions caused by settlement or wash-out shall be supplied and placed by the Contractor at his expense.

END OF SECTION

SECTION 312319 - DEWATERING

PART 1: GENERAL

1.01 WORK INCLUDED

The dewatering of all areas where work must be performed under this Contract is the responsibility of the Contractor and no additional sum will be allowed for any dewatering operation, overtime, equipment rental or any other expense incurred due to the occurrence of ground water, surface water or water from possible leakage of existing buildings, structures and piping in the vicinity of the Contractor's operations.

1.02 RELATED WORK

Section 2105 - Environmental Protection

Section 2200 - Earthwork

PART 2: PRODUCTS

2.01 MATERIALS AND EQUIPMENT

The Contractor shall furnish all materials and equipment necessary to carry out all dewatering required during construction.

PART 3: EXECUTION

At all times, the Contractor is to maintain and operate proper and adequate surface and subsurface dewatering in order to keep the construction site dry and in such condition that construction of structures and utilities and placement and compaction of fill and backfill may proceed unhindered by saturation of the area.

The Contractor is to prevent surface water and subsurface or groundwater from flooding or spilling into excavations, and from flooding the project site or surrounding area. He is to remove all water in order to prevent softening of structure or pipe foundation bottoms, undercutting footings, and soil consistency changes detrimental to the stability of subgrades and foundations. The Contractor is further to provide and maintain pumps, well points, sumps, suction and discharge lines, or other dewatering system components necessary to convey all water away from excavations.

The Contractor shall dewater the excavation as required to lower the ground water level to a minimum of 2'-0" below grade at all times.

The Contractor is to obtain, any local permits required for construction dewatering. Cost of local permits shall be paid by the Contractor.

When dewatering will occur in the vicinity of structures or potable wells, the Contractor shall monitor for adverse effects to structures or wells due to dewatering and shall be responsible to remedy same to the satisfaction of the State. Discharges from dewatering activities which contain silt or hydrogen sulfide are subject to the following controls:

1. All discharges from dewatering activities to surface waters, wetlands or storm sewers shall be free of sediments. Care shall be taken not to damage or kill vegetation by excessive watering or by damaging silt accumulation in the discharge area. If discharges are sediment laden, techniques shall be employed to remove sediment prior to discharge. A sedimentation basin shall be constructed and use as specified, where necessary, to protect vegetation and to achieve environmental objectives.

2. Storm and Sanitary Sewer inlets within construction areas shall be provided with perimeter hay bales or other appropriate siltation control measures.

* * * * *

SECTION 329219 - TOPSOIL AND SEEDING

PART 1 - GENERAL

1.01 WORK INCLUDED

A. The work included in this section shall cover the stripping, stockpiling and replacement of any existing topsoil throughout the site, the furnishing and placement of additional topsoil as required to provide a 6-inch covering throughout the area to be grassed, and restoration of disturbed areas to their original condition.

B. Also included shall be the furnishing and spreading of seed, lime, fertilizer, and other surface treatment required for the growth of grass, the cutting and watering of such grass as hereinafter specified.

PART 2 - PRODUCTS

2.01 TOPSOIL

A. Topsoil, if any, taken from original excavations shall be carefully and separately stored, and after completion of the rough grading, shall be spread, graded, and rolled to conform with the elevations shown on the Contract Drawings. Additional topsoil, as required, shall be furnished by the Contractor at no additional cost. A minimum thickness of topsoil of six (6) inches will be required in all areas to be seeded.

B. Topsoil shall be replaced with adequate amounts of topsoil material to restore the disturbed area to its original, pre-disturbance grade and depth of soil.

C. All stockpiled existing topsoil shall be thoroughly cleared of all sticks, roots, branches, coarse sods, and other deleterious matter, and all stones larger than one inch in diameter before it is re-spread.

D. New topsoil furnished from sources outside the site shall have a minimum organic content of not less than 2.75 percent by weight which shall be guaranteed by the supplier of the topsoil. New topsoil shall be of good quality and approved by the Engineer. All new topsoil shall be from the same source.

E. Topsoil shall not be handled or spread when it is in a frozen or muddy condition or otherwise unsuitable for handling.

F. No topsoil shall be spread before completion of all construction in the area or before all fills are fully stabilized.

G. Before spreading topsoil, the subgrade shall be cleared of all stones more than two inches in diameter, all coarse roots, sticks, and debris to a depth of 4 inches. Any portions of the subgrade which have been compacted to a hard surface shall be pulverized and cultivated to a depth of four inches by plowing, disk harrowing, or other satisfactory method. Immediately prior to topsoil distribution the surface shall be scarified to provide a good bond with the topsoil.

2.02 FERTILIZING AND SEEDING

A. After topsoil is in place, the Contractor shall take a minimum of five (5) soil samples at various points designated by the Engineer and shall submit them to the local Soil Conservation District Office or other designated agency for analysis and pH determination. After the pH value of the topsoil is thus determined, the Engineer shall recommend the rate of limestone application to bring the pH to 6.5. The cost of the limestone addition is to be included in the lump sum bid price.

B. Ground limestone shall be evenly applied by the Contractor to all areas to be seeded at the rate specified by the Engineer and shall be thoroughly and evenly mixed with the soil to a depth of 5 inches below finished grade.

C. All areas to be seeded shall then be fine graded to remove all ridges and depressions, and the surface shall be cleaned of all stones greater than one inch in diameter, and other debris.

D. After preparation of the seed bed, and at least nine days before seeding, an approved commercial complete fertilizer with a minimum content of 10% nitrogen, 20% phosphoric acid, and 10% potash shall be incorporated into the soil at a rate of 14 lbs/1,000 sq. ft. to a depth of 2 inches. The soil shall then be thoroughly watered.

E. Seed shall then be evenly spread and raked into the prepared soil at a rate of 6.0 lbs/1,000 sq.ft. Seed shall be rolled with a water ballast roller and shall be watered, protected by and tended by the Contractor until there is a hardy stand of grass. Areas not thus productive shall be refertilized and reseeded as above until grass is established. All seeded areas shall be immediately mulched with hay uniformly spread in a layer 1 to 1-1/2 inch thick, loose measurement. Hay shall be blown on in its natural length. Chopped hay shall not be used. No seeded areas shall remain unmulched longer than 5 days. Mulch nettings of jute or excelsior matting shall be used during colder months to protect slopes. After mulching, Contractor shall apply mulch binder consisting of one application of a biodegradable, non-phytotoxic tackifier at a rate as recommended by the manufacturer and approved by the Engineer. All mulch shall be left in place to disintegrate except that Contractor shall remove excessive amounts of hay when so directed by the Engineer.

F. Seeded areas which erode during the Contract period (including the year's maintenance and repair period) shall be repaired and restored by the Contractor in accordance with all provisions of this Section of the Specifications.

G. Dates and schedules for seeding operations shall be as approved by the Engineer. Seeding shall be done in favorable weather, in the fall where possible, and in early spring if necessary to complete unfinished areas.

H. Seed to be furnished under this section shall be composed of the following NJDOT Class A Mixture:

Kind of Seed	Min. Purity Percent	Min. Germination Percent	Percent of Total Weight of Mixture
Kentucky Bluegrass	85	75	15
Red Fescues (creepings or chewings)	95	80	40
Kentucky 31	95	80	20
Redtop	92	85	10
Perennial Ryegrass	98	85	10
White Clover	97	90	5

I. The seed shall contain practically no seeds of noxious weeds and shall be delivered mixed in uniform sealed bags showing weights, analysis, and vendor's name.

J. Less application rates of fertilizer or seed or variations from fertilizer composition or seed type will be permitted only with the recommendations from the local Soil Conservation District Office after completion of a soils analysis.

2.03 WATERING AND CUTTING LAWNS

A. The Contractor shall take all necessary steps to produce a satisfactory lawn covering. Such steps shall include the thorough watering of the new lawn until it has received its second cutting.

B. The cost of such watering shall be borne by the Contractor, and the equipment and manpower required shall be furnished by the Contractor.

C. The Contractor shall also be held responsible for a minimum of two (2) cuttings of all lawns. Any lawn areas which have not developed after two (2) cuttings shall be cut until a full lawn is produced.

D. The cuttings of lawn shall not occur closer than 5 to 7 days, or a directed by the Engineer.

E. If a full lawn is produced prior to the project completion date, the Contractor is responsible to maintain (cutting, watering, etc.) the lawn until the project completion date.

2.04 SODDING

A. The Contractor may furnish and place sod in lieu of providing seed at no additional charge to the Owner.

B. Sodding operations shall not be undertaken until all other construction work and clean-up operations have been completed. Sodding shall be done during time of favorable growing periods such that at least two (2) cutting operations can be undertaken by the Contractor.

C. Sod shall be placed within 24 hours after stripping and be protected against drying and breaking of the rolled strips.

D. Sod shall be obtained from a competent nursery man with at least five (5) years' experience. The Contractor shall provide the Engineer with the name of the sod supplier for approval prior to order and placement of such material.

E. Sod shall be comprised of approximately 25% Kentucky Blue Grass. The balance of the sod shall be comprised of approximately 15% Red Top grass, 45% domestic-grown chewings Fescue, and 15% Astoria Bent. Sod shall be strongly rooted, be not less than two (2) years old, and be free of weeds and undesirable native grasses. All sod shall be capable of growth and development when planted. Sod shall be of uniform thickness, approximately 5/8 inch (excluding top growth) at time of cutting.

F. No sod shall be placed on frozen ground. All sod shall be supplied in rows of 12" width by 48' in length. Sod shall be placed on the contour such that alternate rows will have staggered joints with all edges butted tight to adjacent sod pieces. Sod shall be lightly tamped or rolled to ensure contact with the subgrade. Broken or torn pads will not be acceptable.

G. Immediately after placing the sod, the Contractor shall fertilize the sod with 5-10-5 applied at a rate of 600 lbs/acre. Fertilizer shall be combined with a thin layer of topsoil spread evenly over the sodded area to a smooth uniform surface. Along the crown of the slope a capping strip of jute or plastic netting properly secured shall be used to prevent undercutting of the sod. The Contractor is responsible to maintain (cutting, watering, etc.) the lawn until the project completion date and acceptance by the Owner and provide no less than two cuttings.

- END OF SECTION -

SECTION 400513 – PROCESS PIPING

PART 1 - GENERAL

1.01 WORK INCLUDED

A. The work under this Division of the Specifications shall include all materials, equipment and labor for furnishing, installing and testing the piping work described. The work also includes making all connections to pipelines and appurtenances; furnishing and installing all valves, piping, flexible joints, pipe expansion joints and accessories; installation of concrete thrust blocks; furnishing and installation of pipe insulation where required; furnishing and installation of all hangers and hanger supports; and relocation of existing pipelines and appurtenances, all as specified herein and as shown on the Drawings.

B. Although certain construction operations described above are a necessary part of the pipe, valve and accessory installation; the materials and installation specifications may not be included in this division or section. The Contractor shall refer to the appropriate sections or divisions of Specifications for work other than piping and valves which may be related to the work defined in this section.

C. The Contractor is advised that making connections to existing pipelines or relocating existing pipelines or appurtenances requires careful consideration as to the construction techniques employed. The Contractor shall be solely responsible for maintaining existing pipelines in such a manner as to prevent disruption of services or prevent bypassing of untreated or partially treated wastewaters directly or indirectly to any watercourse or underground aquifer.

D. The piping work shall include, but not necessarily be limited to the following services and categories both inside, outside, underground or above ground, on or off-site:

   i. Non Potable Water
   ii. Ejector Pump Discharge
   iii. Sump Pump Discharge
   iv. Floor Drains
   v. Sanitary Sewers - Gravity
   vi. Miscellaneous Equipment Connections

PART 2 - PRODUCTS

2.01 HANGERS AND SUPPORTS

A. Hangers and supports for piping, valves and pipeline appurtenances are shown on the drawings only in isolated instances. As a part of the piping work, the Contractor shall securely support all piping, valves and pipelines and shall include the cost of all hangers and supports. Included in this classification are saddle stands, steel and cast iron stanchions, hangers, pipe rolls, bearing plates, fastenings, concrete inserts, or other anchors and appurtenances. Where new supports are to be attached to existing concrete, the Contractor shall modify existing concrete, and furnish and install epoxy type expansion anchors as required and as specified in another division of these specifications.

B. Hangers and supports shall be adequate to maintain the piping, valves and equipment in proper position and alignment, and to prevent sway or movement under all operating conditions. Particular attention is called to discharge lines of pumps, connections to wall pieces, and to restraining of mechanical type joints.

C. The Contractor shall employ the services of a qualified and approved pipe hanger designer/manufacturer to fabricate and furnish all hangers, supports and anchor and guide devices for all piping, valves and accessories in structures and buildings. All design information, calculations and layout drawings; including details of inserts, hangers, supports, anchors, braces, saddles, stanchions, specials, accessories and the like shall be submitted to the Engineer for his review in advance of installation. Special consideration shall be given in the design of pipe supports to the effects of thermal expansion or contraction and to lateral forces from pipe junctions. All hanger and support systems shall be designed, detailed, dimensioned and certified by a professional engineer licensed in the State of New Jersey, at no additional cost to the Owner.

D. The design of hangers and support systems shall employ the various attachments to structures and piping as specified herein. The components, as manufactured by Grinnel, Fee & Mason, or equal, may be utilized in various combinations subject to the approval of the Engineer.

E. All rolled formed metal sections shall not be less than 12 gauge (.105 inches thick) material. All structural steel sections shall be not less than 3/16 inches thick.

F. Design and installation shall be in accordance with best industry practice and shall be governed by the Petroleum Refinery Piping Code ANSI B31.3, latest revision, MSS Sp-58 and MSS Sp-69 and other requirements as specified herein. Anchors and restraints shall be designed for the test pressures specified; operating thermal forces to be encountered; and the type of expansion devices and pipe joints utilized for the installation. All structural steel members shall be designed for a maximum tensile capacity of 9,000 psi and shall provide for a minimum factor of

safety of five (5) based upon ultimate strength. Maximum deflections shall be limited to 1/360 of the span. The system shall be designed to accommodate the dynamic forces in affect when pumping systems are either started or stopped and shall be such as to insure that no sway, permanent system deformation or chattering shall occur at any time. Pipe supports shall be designed to resist lateral forces in accordance with Section 1113.10 of the BOCA code.

G. Structural steel framework for supporting pipes shall be furnished and installed where shown or required, and shall be anchored to walls, floors and ceiling with stainless steel expansion bolts having a maximum working strength load of 25 percent of ultimate load capacity of the entire unit in its application. Framework design, materials, fabrication and installation shall be as indicated in Division 5 of these Specifications.

H. Material for hangers and supports shall conform to the requirements of the latest revisions to the following standards:

Cold Work Strip Steel (for metal framing)	- ASTM Designation A569-85
Structural Steel	- ASTM Designation A36/A36M-84a
Threaded Steel Rods	- ASTM Designation A575-81
Steel Castings	- ASTM Designation A27-84a Grade 65-35, Full Annealed
All Other Auxiliary Steel for Pipe Supports	- ASTM Designation A36/A36M-84a
Wrought Steel Pipe	- ASTM Designation A53-84a (Schedule 40)
Iron Castings	- ASTM Designation A48-83 (Class 35)
Cast Iron Pipe Stanchions	- ANSI Standard B31.1, Class 125
Malleable Iron Castings	- ANSI Designation A47
Bolting Materials	- Bolts, Stud Bolts, Nuts and Washers - ASTM Designation A307-84
Chains	- ASTM Designation A413-80
Bolt Materials - Stainless Steel - Type 304	- ASTM Designation A167-84a
Hot Dipped Galvanizing After Fabrication	- ASTM Designation A123-84
Fittings Material	- ASTM Designation A575-81

I. Pipe Supports: In general pipe supports from the various structures shall be as follows:

1. From Walls or Columns:
   i. Welded Steel brackets.
   ii. Adjustable stands of the roll type.
2. From Floors or Piers:
   i. Pipe rolls or chairs with bases.
   ii. Saddle stands or stanchions.
   iii. Metal framing system with pipe rolls.
3. From Overhead Slabs or Sides of Beams:
   i. Pipe rolls or rings suspended from threaded rod hangers.
   ii. Metal framing system with pipe rolls.

J. Bracket shall be made of welded wrought steel and shall be designed for three maximum loads classified as follows:

Light	750 lbs.
Medium	1,500 lbs.
Heavy	3,000 lbs.

K. When medium or heavy brackets are bolted to walls, backing plates of adequate size and thickness shall be furnished and installed to distribute the load against the wall. Where the use of backing plates is not practical, the brackets shall be fastened to the wall in an approved manner.

L. Saddle stands shall be of the adjustable type. Each stand shall consist of a length of wrought steel pipe fitted at the base with a standard screw threaded cast iron flange and at the top with an adjustable saddle or roll. The base flange shall be bolted to the floor or foundation, and grouted.

M. Stanchions shall be of similar construction to the saddle stand. They shall be fitted at the top with a cast iron pipe saddle support or with a pipe stanchion saddle consisting of a yoke and nuts.

N. Column supports of cast iron or steel pipe type or of an approved design, built-up structural steel type, shall be installed, where required.

O. Non-shrink grout shall be used under all floor type supports or bedding plates. Grout shall be as specified in Division 3 of the specifications.

P. Pipe covering protection saddles shall be used on pipes 3" and larger which are to be covered with insulation. Hangers and supports shall include proper pipe covering protection saddles. Saddles shall be not less than 12" long and shall be made of covered steel plates with the side edges turned up. For pipe 8" and larger, the saddle shall have a welded center plate to provide a three-point

support. The saddles shall be filled with either plastic cement or with sectional covering cut to suit, before being placed.

Q. Anchors shall be furnished and installed when specified, shown or required for holding the pipe and equipment in position or alignment. All anchors shall be designed for rigid fastening to the structures either directly or through brackets. The design of all anchors shall be subject to the Engineer's approval.

R. Anchors for piping shall be of the cast iron chair type with wrought steel straps, except where anchors form an integral part of pipe fittings, or where an anchor of special design is required.

S. All individual concrete inserts shall be of malleable iron and shall be installed in the concrete structures where required for fastening the supporting devices. To facilitate installation, nail slots shall be provided in the exposed flanges of the insert. Working loads as recommended by manufacturer shall not be exceeded, regardless of allowable rod load. Concrete inserts shall be "Rocket Type" concrete insert anchor as manufactured by Richmond Screw Anchor Co.; Grinnell Corp.; or equal.

T. The use of adhesive stud anchors will be permitted only to existing concrete or at locations specifically approved by the Engineer.

2.02 SCHEDULE OF PIPE AND JOINTING

A. Pipe and fitting materials, jointing and pipe lining shall be in accordance with the following schedule. This schedule is set forth as a guide to illustrate requirements. The lack of the specific mention of any particular pipelines does not relieve the Contractor from the responsibility for furnishing, installing, painting and testing such a pipeline in accordance with the requirements of these Specifications and the following schedule. The term "cast iron" may mean ductile cast iron or grey cast iron, depending on the size of the piping and whether it is buried or not. The Contractor shall refer to the notes following the schedule:

Service	**Pipe Material**	**Jointing**
Non-Potable Water Ejector Pump Discharge	(a) Ductile iron, cement lined, bituminous seal coated	(a) Flanged/Split coupled (inside) Mechanical/push-on/Restrained (outside)
Floor Drains Sump Pump Discharge	(a) Schedule 80 PVC	(a) Solvent welded

B. GENERAL NOTES (APPLY TO ALL PIPING SCHEDULES)

1. All interior (non-buried) ductile iron pipe shall be painted and shall, therefore, be supplied without outside bituminous coating. All buried ductile iron piping shall receive outside bituminous coating in accordance with the latest revision of AWWA C106.

2. All cement linings of ductile iron pipe shall be bituminous seal coated in accordance with the latest revision of AWWA C104-85. Ductile iron pipe without cement lining shall receive inside bituminous seal coat conforming to the latest revision of AWWA C104-85.

3. Jointing of buried piping shown as mechanical may be replaced with approved rubber gasketed push-on joint at the Contractor's option, unless otherwise directed by the Engineer.

4. All buried fittings on all piping shall be secured for thrust conditions utilizing concrete thrust blocks, or tie rods and socket clamps as permitted by the Engineer.

5. Joint restraining lengths required at bends and fittings will be based on calculations utilizing the line test pressures or water hammer pressures whichever are larger.

6. Copper piping to be located inside the Raw Sewage Pump Station and Grit Building shall be painted.

PART 3 - EXECUTION

3.01 EXCAVATION AND BACKFILL WORK IN CONNECTION WITH PIPE LAYING

A. The laying of underground pipe will require trimming and grading of trench bottoms for the pipe, and will require backfilling and tamping around all pipes to an elevation one foot above crown of pipe. Such procedures are to be followed as the pipe laying progresses following the approval of all inspection and testing procedures, to provide protection and stabilization of the pipes, irrespective of the size, type, or number of pipes.

B. The width of each pipe trench is to be not less than two (2') feet plus the outside pipe diameter, at the level of twelve (12") inches above the top of the pipe. Pipe laying work is to be conducted so that trenching operations are not advanced too far ahead of the pipe laying operations, resulting in excessive lengths of open trench. In general, open trench ahead of pipe laying should not exceed 50 feet.

C. Special precautions shall be taken in placing, filling, and compacting multiple pipe systems played in a common trench or on common fill at the same centerline elevation to ensure that pipe alignments and grades are maintained and that no unbalanced soil loads are imposed. Adequate harnessing or thrust-blocking or both if the situation dictates will be required where pressure pipe systems are involved.

D. Pipes are to be bedded as shown on the drawings. Bedding shall consist of a minimum of eight (6") inches of broken stone or screened gravel (NJDOT 57).

E. Trenches are to be backfilled with broken stone or screened gravel (NJDOT 57) to a point twelve (12") inches above the crown of the pipe. In areas below existing or future pavements, select fill (DGA) is to be used up to the point of final subgrade. Backfill is to be carefully deposited in layers not to exceed 6 inches in thickness, on both sides of pipe, and thoroughly and carefully rammed until enough fill has been placed to provide a cover of not less than one foot above top of pipe. If permitted by the Engineer, Type "G" may be used above a plane twelve (12") inches above the pipe crown in areas outside existing or future paved areas.

F. When pipe crossings occur, the lower pipe is to be laid first and all backfill thoroughly compacted to the level of the higher pipe before the higher pipe is laid. At the discretion of the Engineer, backfill material under such conditions may be existing material Type "G" Fill, broken stone or 4000 psi concrete conforming to the details shown for concrete encasements.

G. In all excavations for pipelines, unsuitable soil, boulders, rocks, masonry or other similar materials are to be excavated to a level of at least eight (6") inches below the invert of the pipe, and carefully refilled with approved material mechanically compacted to provide a stable sub base. Rocks or boulders are to be removed from sides of trenches to a plane twelve (12") inches outside the outside wall of the pipe, unless permission to do otherwise is expressly given. Broken stone or screened gravel (NJDOT 57) bedding is to be provided, placed and compacted to the minimum depths indicated in the Contract Documents.

H. Prior to backfill, the Contractor shall make "Record Drawings", accurately indicating the line and grade of pipeline, as described in General Requirements of the Specifications.

3.02 INSTALLATION – GENERAL REQUIREMENTS

Installation to be in accordance with the detailed piping Specifications.

3.03 TESTING

Testing to be in accordance with the detailed piping Specifications.

3.03 CLEANING AND FLUSHING

A. On completion, the interior of all piping shall be carefully cleaned and flushed. The Contractor shall carefully clean all air and gas piping, headers and accessories through which air or gas is delivered, so that all dust, dirt, oil, grease, or other foreign material will be effectively removed.

3.04 STERILIZATION

A. After pressure testing the Contractor shall flush and disinfect all site potable water (city water) lines. Disinfection shall be in accordance with the latest revisions to AWWA C601, American Water Works Association Standard for Disinfecting Water Mains. Contractor shall be responsible for doing all work required to successfully disinfect these water lines to the satisfaction of the Engineer, Owner, and local authorities.

3.05 SHEETING AND BRACING

A. Where necessary, particularly for safety or to prevent disturbance, damage or settlement of adjacent structures, pipelines, utilities, improvements or paving, excavations are to be sheeted and braced. Any damage to new or existing structures or pipelines occurring through settlement, water or earth pressure, or other causes due to inadequate bracing, through negligence or fault of the Contractor in any other manner, is to be repaired by the Contractor at his own expense.

B. The sides of all excavations are to be cut with stable side slopes which shall also comply with local codes and ordinances having jurisdictions. The Contractor is to shore and brace where stable sloping is not possible because of space restrictions or stability of material excavated. The Contractor is to maintain all sides and slopes of excavations in a safe condition until completion of backfilling.

C. Where excavations exceed five (5') feet in depth, the Contractor is, in advance of the start of the work, to submit installation and excavation procedures to the Engineer for review. The information is to include complete details and descriptive data of materials and installation procedures for sheeting and bracing and excavation of side slopes as proposed to be used.

D. Where sheeting or trench boxes are used, they must be designed by a Professional Engineer licensed to practice in the State of New Jersey.

E. Said Engineer is to provide the Contractor with a certification signed and sealed by him stating that the design of the sheeting and bracing conforms to all applicable requirements of the Occupational Health and Safety Act. Copies of this certification are to be submitted to the Engineer.

F. The Contractor must follow the proposed sheeting plans submitted. No deviations may be made from the filed procedure without first submitting a

revised sheeting and bracing plan, signed and certified as required for the original submission, by the same licensed Professional Engineer who prepared the original submission.

G. All payment for furnishing, placing and removing sheeting and bracing or other excavation protection, such as sloped excavation sides outside the normal excavation limits, are included under the lump sum bid for this project, with the exception that if sheeting and bracing is used and is ordered left in place by written order of the Engineer, payment will be made in accordance with the Contract Section covering Changes.

H. Any damage to new or existing structures, piping and site electrical work occurring through settlement, water pressure, earth pressure, or other causes, due to inadequate bracing or through the negligence or fault of the Contractor by any means, is to be repaired by the Contractor at his own expense.

3.06 FLUSH, SAMPLE AND DRAIN CONNECTIONS

A. The Contractor shall furnish and install, where shown on the Contract Drawings and as required by the Engineer, all flush, sample and drain connections (piping and valving). During the shop drawing and coordination drawing review phase of the project, the Contractor shall carefully review the piping layout and provide all pipeline flush, sample and drain connections required, whether or not shown on the Contract Drawings. Location of all connections shall be as approved by the Engineer. The cost of the connections shall be included in the lump sum price bid.

- END OF SECTION -

SECTION 400513 – METAL PIPE AND FITTINGS

PART 1 - GENERAL

1.01 WORK INCLUDED

A. The Contractor shall furnish, lay and joint, paint and test metal pipes, fittings and wall pieces as shown on the Contract Drawings and as required to fulfill the intent of the Specifications. A general materials and jointing schedule is set forth in the Schedule of Pipe and Jointing included in the Specifications.

B. Joints for ductile iron piping shall be flanged, mechanically coupled, rubber ring, bell and spigot, or split couplings of the flexible gasketed mechanical type as called for on the Schedule of Pipe and Jointing or as shown on the Contract Drawings.

C. Pipe hangers and supports shall be provided and installed in accordance with the best acceptable practice, in numbers and types described in these Specifications, as shown on the Drawings or be as directed by the Engineer.

PART 2 - PRODUCTS

2.01 DUCTILE IRON PIPE

A. Ductile iron pipe shall be centrifugally cast for working pressure of 150 psi. Ductile iron pipe shall conform to the following standards: ANSI/AWWA C151/A21.51-81.

B. Ductile iron pipe of the following classes and thicknesses for 150 psi service (laying condition "1") shall be as follows unless otherwise specified or indicated on the Drawings:

1. For pipelines with less than 5-foot cover, pipe class shall be in accordance with AWWA C151 latest revision.

Pipe Dia. in	Up To 5' Cover Class (Min. Thickness)	8' Cover Class (Min. Thickness)	12' Cover Class (Min. Thickness)	16' Cover Class (Min. Thickness)	20' Cover Class (Min. Thickness
4	51 (0.26)	51 (0.26)	51 (0.26)	51 (0.26)	51 (0.26)
6	50 (0.25)	50 (0.25)	50 (0.25)	50 (0.25)	50 (0.25)
8	50 (0.27)	50 (0.27)	50 (0.27)	50 (0.27)	50 (0.27)
10	50 (0.29)	50 (0.29)	50 (0.29)	50 (0.29)	51 (0.32)
12	50 (0.31)	50 (0.31)	50 (0.31)	50 (0.31)	51 (0.34)
14	50 (0.33)	50 (0.33)	50 (0.33)	51 (0.36)	51 (0.36)
16	50 (0.34)	50 (0.34)	50 (0.34)	51 (0.37)	52 (0.40)
18	50 (0.35)	50 (0.35)	51 (0.38)	52 (0.41)	53 (0.44)
20	50 (0.36)	50 (0.36)	51 (0.39)	52 (0.42)	54 (0.48)

Pipe Dia. in	Up To 5' Cover Class (Min. Thickness)	8' Cover Class (Min. Thickness)	12' Cover Class (Min. Thickness)	16' Cover Class (Min. Thickness)	20' Cover Class (Min. Thickness
24	50 (0.38)	50 (0.38)	52 (0.44)	54 (0.50)	55 (0.53)
30	50 (0.39)	51 (0.43)	53 (0.51)	55 (0.59)	56 (0.63)
36	51 (0.48)	51 (0.48)	53 (0.58)	55 (0.68)	56 (0.73)
42	51 (0.53)	51 (0.53)	53 (0.65)	55 (0.71)	56 (0.83)
48	52 (0.65)	52 (0.65)	53 (0.72)	55 (0.86)	56 (0.93)

2. For pipelines with less than 5-foot cover, pipe class shall be in accordance with AWWA C151 latest revision.

C. Wherever cast iron pipe is specified or noted in Schedules or on the Drawings, it shall be construed to mean ductile iron.

D. Push-on joints and mechanical joints shall conform to ANSI/AWWA C111/A21 11, latest revision. Bell and spigot joints shall be restrained where indicated on the Drawings or specified. Only buried and non-exposed ductile iron pipe shall receive an outside bituminous coating.

E. All fittings for ductile iron pipe shall be Class 250 ductile iron conforming to ANSI standards A21.10 and A21.11 for mechanical joint or push-on joint. The restraint of fittings shall be with thrust rods, concrete blocking or locktight gaskets as appropriate for the pressures anticipated, and as further direct in the field, considering particular conditions of installation.

F. Cement lining shall be provided where called for in the schedule. Lining shall conform to AWWA C104, latest revision (ANSI A21.4-1985) with bituminous seal coat. Cement lining shall be 1/8" thick for all pipes 12" diameter and smaller and 3/16" thick for all pipes 14" diameter and larger. The pipes shall be bituminous seal coated on the interior wall. Process aeration piping shall not be cement lined.

G. Flanged ductile iron pipe shall have ductile iron flanges conforming to ANSI B16.1 Class 125 specifications designed for use with ANSI/AWWA C110/A21.10-82 flanged fittings, with pipe barrel conforming to ANSI/AWWA C151/A21.51-81, or latest revisions with the previously mentioned exception. Ductile iron pipe shall be threaded and flanged in the foundry. The flanges shall be of the long hub type; screwed on the pipe barrel; power tightened by machine; and faced and drilled after tightening. No ductile iron pipe of class thickness less than Class 53, shall be threaded and flanged.

H. Split couplings shall be of the flexible, gasketed mechanical type. They shall be designed to mechanically engage and lock grooved or shouldered pipe ends, to form a positive couple allowing for some degree of angular deflection, contraction or expansion. Coupling shall have pressure ratings at least equal to the test pressures applied to the pipes being joined. Gaskets shall be of an elastomeric, synthetic rubber material and shall be of the type and composition recommended by the coupling manufacturer for the service and temperature intended.

I. Pipes designed to be jointed by split-type couplings shall have grooved or shouldered ends in accordance with the requirements of the coupling manufacturer. All pipe which is to be grooved shall have the minimum wall thickness recommended by the coupling

manufacturer to insure that the removal of the metal does not lessen the strength or pressure rating of the pipe. The Contractor shall note that if this wall thickness exceeds that which is otherwise specified in this section, the thicker wall pipe shall be furnished at no additional cost to the Owner.

J. Minimum pipe wall thickness for grooved end pipe with split couplings shall be as follows:

Ductile Iron Pipe
up to 16" - Class 53
18" - Class 54
20" - Class 55
24" - Class 56
30" - Class 55
36" - Class 55

2.02 BLACK OR GALVANIZED STEEL PIPE

A. Black or galvanized steel pipe shall conform to the requirements of ASTM Designation A-120 for standard and extra-strength weight pipe, and shall have threaded ends. Fittings shall be malleable iron and galvanized malleable iron, except as otherwise specified, conforming to the requirements of ASTM Standard A338 for a working pressure of 150 psi. Fittings for extra-strength pipe shall be 250 psi.

B. Banded fittings shall be used. Threaded joints shall be made up with an approved thread lubricant. Lamp wick and similar materials shall not be used to make up joints. Unions shall be provided for disconnection where required.

2.03 COPPER AND BRASS PIPE

A. Copper piping for buried underground service shall be Type K, soft annealed seamless copper water tube, ASTM B88, latest revision with approved brass compression joint fittings. Wrought copper solder-joint fittings may also be used, however, the Type K tubing must be properly rounded and sized as required for each solder joint.

B. Copper piping for interior and above ground service shall be Type L, drawn temper seamless copper water tube, ASTM B88, latest revision with wrought copper solder-joint fittings, ANSI B16.22, latest revision. Certain types of compression fittings may be used, but only when they are manufactured specifically for use with drawn temper copper tubing and approved by the Engineer.

C. Soldering shall be performed with type 95-5 solder.

D. Brass piping shall be annealed seamless red brass (Copper Alloy No. 230) pipe, ASTM B43-85 (ANSI H26-1), with approved 150 lb. threaded brass fittings.

2.04 EXTRA HEAVY CAST IRON SOIL PIPE

A. Cast iron soil pipe and fitting shall be extra heavy cast iron soil pipe and shall conform to the Standard Specification for Cast Iron Soil Pipe and Fittings, ASTM Designation A74, latest revision.

B. All cast iron soil pipe shall be furnished with hub and spigot ends. The castings shall be sound and free from cracks and holes and cold shuts. Joints shall be made with positive double seal compression type neoprene gaskets conforming to ASTM 564-85, or latest revision, such as Tyler Ty-Seal, Fernco Joint Sealer Co., or equal. Joints shall be installed strictly in accordance with joint manufacturer's recommendations as approved by the Engineer.

C. Where required, cleanouts shall be provided.

2.05 STAINLESS STEEL PIPE AND FITTINGS MATERIAL

A. All pipe fittings shall be manufactured to ASTM A778-80 or A774-80 standards from sheet and plate conforming to ASTM A-240 and A-304L. Sheet finish to be 2B plate finish No. 1.

B. Pipe and fittings up to 150 psi. operating pressure and maximum 200 Deg. F. will be supplied in the following nominal wall thicknesses:

2-1/2? to 8" I.P.S. Schedule 5

Elbows 2-1/2? to 16? inclusive will be smooth flow (pressed type).

Slip-on rolled angle face rings of stainless steel for flanges 2-1/2? to 14? inclusive will be of 1/8? wall thickness.

Backing flanges will be stainless steel of proper thickness. Contractor shall submit manufacturer's data for review.

The rolled angle faces shall be true and perpendicular to the axis of the pipe or fitting. Plain ends of pipe or fittings shall be true and perpendicular to the axis with edges deburred.

When specified, pipe ends may also be prepared either for Victaulic or Dresser couplings.

C. Welding

Welding in fabricator's shop and in the field shall be performed by qualified welders to approved procedures.

Welding rod or wire to be of same composition or superior to the pipe and fittings material.

Weld deposit at the seams shall have a slight crown on both sides of the weld and no cracks or crevices shall be allowed.

Excessive weld deposits, slag, weld spatter and projections into interior of pipe shall be removed by grinding.

D. Finish

Pipe and fittings to be immersed in pickling solution in manufacturer's plant and scrubbed and washed until discoloration and possible iron, picked up from manufacturing process, is removed.

All field welds to be treated with pickling paste, scrubbed and washed with stainless wire brushes until clean. Completed pipelines are to be washed with steam or hot water to remove any dirt picked up during transport on construction site.

Particular care must be exercised during fabrication and installation to avoid contact of stainless steel pipe with structural steel, chain, wire-ropes, steel tools, etc., as the contamination of stainless steel by steel may lead to marks due to rusting of imbedded steel. Stainless steel pipe and fittings shall be manufactured by Douglas Bros., Portland Maine or equal.

PART 3 - EXECUTION

3.01 LAYING AND JOINTING

A. All pieces shall be carefully examined for defects, and no piece known to be defective shall be laid. Any defective piece discovered after laying shall be removed and replaced in a satisfactory manner, regardless of any prior approvals.

B. All pipe and castings shall be thoroughly cleaned before being lowered into the trench, or before jointing. The exposed ends of all incomplete lines shall be closed with tight plugs adequately secured at all times when pipe laying is not actually in progress.

C. All pipe castings shall accurately conform to the lines and grades shown on the plans or ordered by the Engineer. All wall pipes and other castings to be imbedded in concrete shall be accurately set and thoroughly secured. Pipe shall be laid in a manner to assure that valve stems and boxes will be set plumb.

D. Special care shall be exercised at the outside face of structures and manholes to support pipes bridging the excavation for such structures or manholes. The pipe shall be supported by compacted gravel bedding or 1500 psi concrete as directed by the Engineer. The cost for these supports shall be deemed included in the lump sum price bid for the work.

E. Where required for proper location of laterals, valves, fittings, or other castings; or for any other purposes; or where ordered, pipe or fitting shall be cut with an approved pipecutter. Cutting shall be carefully done by experienced men, in such a manner as to leave a smooth end normal to the axis of the pipe.

F. Where shown on the Drawings, or required in the finished work, all pipe and special castings shall be adequately supported, anchored and secured by approved encasements, hangers or ties.

G. Sleeves and mechanical couplings shall be provided when necessary to provide adequate flexibility, not only for convenience in the original installation of the line, but to afford convenience in the event of future removal, alterations or repairs.

H. Location of joints shall be such as to provide maximum convenience in assembly of piping and appurtenant equipment, with provisions by sleeves or couplings to minimize strain on structures, equipment or flanges.

I. Any cracked or broken pipe or valves shall be promptly removed and replaced with sound pieces regardless of any prior approval.

J. All flanges, unless otherwise required, shall have standard drillings. Flanges shall be firmly bolted with machine, stud or tap bolts of the proper size and thread. The bolts and nuts shall be of the best quality refined bar steel, with good, true threads, and shall be so

tightened as to evenly distribute the stress in the bolts and bring the pipe into uniform alignment.

K. In general, no flanges shall be permitted underground except where directed by the Engineer.

L. Bolts shall have standard hexagonal heads and nuts made to American Standard rough dimensions, and shall be conferred and trimmed.

M. Where required, flanges shall be tapped for stud bolts.

N. All gaskets shall be Rainbow, Durable, Garlock, or equal, unless lead or other material is specifically called for.

O. Gaskets 8" in diameter and smaller shall be 1/16" thick and gaskets larger than 8" in diameter shall be 3/32" thick.

P. GASKET MATERIAL FOR ALL DIGESTER GAS PIPING SYSTEMS SHALL BE NITRILE.

Q. Mechanical joints shall be made in strict accordance with the manufacturer's recommendations, using proper bolt torques and gaskets lubricants. All parts shall be thoroughly cleaned before assembly.

R. Where shown on the Contract Drawings, or where in the opinion of the Engineer, convenience of installation or removal, or particular flexibility to avoid breakage in service, is required, flexible couplings of the Dresser or Victaulic type shall be furnished and installed.

S. Jointing with mechanical couplings shall conform with instructions of the manufacturer. All bolts shall be tightened to preserve true alignment and uniformly distribute the stress in the bolts. Bolt tightening shall be accomplished with torque wrenches.

T. Bell and spigot rubber ring joints shall be assembled in strict accordance with the manufacturer's recommendations. Bell and spigot shall be thoroughly cleaned before making up the joints.

U. When ductile iron pipe is cut in the field, cut ends shall be tapered about 1/8" at a 45° angle and all sharp edges or rough spots removed by use of a coarse file or portable grinder.

V. Threaded joint piping shall be made up with lubricants applied on the male threads only. No undue strains shall be placed on threaded joints due to misalignment of pipe. Lampwick, cord, fibre, lead wool or other unapproved material is prohibited for making up threaded joints.

W. Welded joints shall be made using pipe and fittings bevelled for V welds with all workmanship in accordance with the ANSI "Code of Pressure Piping".

X. All welds shall be made by certified welders and shall conform to procedures for which each welder has been certified. The Contractor shall submit certification statements for the welders and the methods employed.

Y. All pipe of Schedule 10 and heavier wall thickness shall be properly prepared before butt welding. Grind ends to a 37 1/2° bevel, leaving a flat lip of approximately 1/16" on inside edges. Clean ends with acetone or denatured alcohol and a stainless steel wire brush. Weld preparation procedures other than as specified herein shall be as approved by the Engineer.

Z. All welds shall have full penetration and be smooth without protrusions on the interior of the pipe. Any cracks or blow holes appearing on the surface of a welding bead shall be ground away before depositing the next bead.

AA. Solder joints shall be made using recessed fittings and 95-5 solder alloy. Joints shall be completely filled.

- END OF SECTION -

SECTION 400513.20 - COUPLINGS, CONNECTIONS AND SEALS

PART 1 - GENERAL

1.01 WORK INCLUDED

A. Under this section of the Specifications, the Contractor shall furnish and install flexible couplings, connections and seals as shown on the Contract Drawings and as described herein.

PART 2 - PRODUCTS

2.01 FLEXIBLE COUPLINGS

A. Flexible couplings shall be installed in accordance with the recommendations of the particular manufacturer whose material is being supplied and all flexible couplings shall be adequately harnessed and tied to withstand the test pressures of the pipelines.

B. Where auxiliary harnesses are used which are not a part of the packaged flexible coupling, but are used to prevent the coupling from coming apart, they shall consist of stainless steel threaded rods with nuts and washers and be installed hand-tight.

C. Flexible couplings as defined under this section of the Specifications shall be considered to be Style 38 Couplings as manufactured by Dresser Industries, Inc., Style 31, 41, 44 and 77 Couplings (as required by pipe size and material) as manufactured by Victaulic Company of America, Depend-O-Lok band couplings as manufactured by Victaulic/Depend-O-Lok, or equal.

2.02 FLEXIBLE CONNECTIONS

A. Ample provisions shall be made in all pipe lines to compensate for linear expansion and transverse movement whether caused by thermal stresses or by the dynamic conditions of pump operation. Unless other forms of expansion joints are specified, all runs of pipe subject to changes in length shall be fabricated shorter than their theoretical length to the extent of one-half of the expansion and shall be so erected that the pipe is free to expand without increasing the stresses imposed when cold. When the foregoing method of compensation for expansion is not adequate, the Contractor shall furnish and install, in the pipe lines, expansion devices that will be adequate to allow the lines to expand and contract freely without injury to any part of the piping system or its support. The devices may be in the form of connections such as expansion joints, swivel or swing joints, or pipe beds, and shall include such anchors and alignment guides as may be shown, specified, recommended by the joint manufacturer, or required to make the device effective.

B. Metal expansion joints shall be of the internally guided, packless type, suitable for 125 psi pressure, unless otherwise specified. The traverse shall be adequate for maximum estimated expansion movement. Unless otherwise specified, expansion joints on all pipe lines 2-inches and smaller shall have stainless steel bellows and threaded ends. Metal expansion joints for pipe lines 2-1/2 inches in diameter or larger shall be of the iron body pattern with stainless steel bellows and flanged ends faced and drilled to 125 pound ANSI Standards.

Metal expansion joints shall be as manufactured by Adsco Division, Yuba Industries, Inc., Flexicraft Industries, Inc., Metra-Flex Company or equal.

C. Rubber expansion joints shall be of the arch type; constructed of multiple plies of woven fabric; impregnated with elastomer; reinforced with welded steel rings embedded in the body and completely encased in a corrosion-resistant and durable synthetic rubber cover. Flanges shall be integral with the joint body. The fabric shall be rayon or cotton duck with rubber elastomer for normal temperature service (up to 180°F) and polyester fabric with butyl elastomer for high temperature service (up to 250°F). Joints shall be of pipe line size to meet the test pressure conditions and face-to-face measurements as designated. All joints located at 1" or 1-1/2" concrete structural expansion joints shall be of the (3) three-arch type. Arches shall be unfilled, except where joints are used on sludge lines. In this case, arches shall be filled with soft rubber. Rubber expansion joints shall be of the design required to withstand the test pressures without deformation, damage or leakage. Galvanized steel retaining rings shall be furnished and installed with each joint. Rubber expansion joint flanges shall be drilled to ANSI 125 lb. pattern. Unless otherwise specified, rubber expansion joints shall be Mercer, Style 500R as manufactured by the Mercer Rubber Company; General Rubber Corp., or equal.

D. Rubber expansion joints for concrete encased piping shall be single-arch, soft sleeve type neoprene and duck, with slip-on ends. They shall be fastened to the piping with banded stainless steel clamps.

E. Rubber expansion joints on the suction side of all pumps, blower and compressors shall be provided with a temporary wire mesh strainer. This mesh shall be for the protection of the equipment during start up, and prevent extraneous material that might have been left within the adjacent piping from damaging the joints or equipment. This wire mesh shall be of 17 gauge stainless steel, with 1/4" openings, having a minimum net open area of 70%. The location of this mesh shall be between the flanges of the rubber expansion joints on the suction side of the equipment. Suitable gasketing shall be provided to prevent leakage. After preliminary equipment start-up, the Contractor shall remove all wire mesh and entrapped material from within the piping, in preparation for testing as defined in other sections of the Specifications.

F. The Contractor shall have the option of purchasing expansion joints through the equipment manufacturers, for special service conditions. Such an option shall be first approved by the Engineer.

2.03 SEALS

A. Seals shall be as manufactured by Link-Seal of the Thunderline Corp. or equal and consist of modular mechanically connected and tightened, synthetic rubber links placed in the annular space between the wall or floor sleeve and the principal pipe and be on both faces of the wall sleeve. Seals shall continuously fill the annular space between the penetrating pipe and the inside of the opening in the wall or floor and designed to provide a completely watertight seal against a hydrostatic head of 20 psig. All seals shall be installed, wherever possible, so that they can be adjusted and tightened from the interior of structures, from the dry sides of walls and from the top of slabs. All seals are to be provided with stainless steel hardware.

- END OF SECTION -

SECTION 400513.53 - DUCTILE IRON PIPING SYSTEMS

1.01 WORK INCLUDED

The work under this Section of the specifications shall include all materials, equipment & labor for furnishing, laying, installing, and testing the piping work and appurtenances herein described and as shown on the Contract Drawings.

The piping work shall include all piping in areas such as building interior, building exterior, and underground on the site.

1.02 RELATED WORK

Section 2200 - Earthwork
Division 15000 – General Requirements

1.03 QUALITY ASSURANCE

Dimensions shown on Contract Drawings are approximate only. Contractor shall verify all piping geometry in the field and shall be responsible for insuring proper alignment and fit of all piping consistent with the intent of the Contract Drawings.

1.04 SUBMITTALS

Shop drawings and manufacturer's literature for all Contractor supplied materials shall be promptly submitted to the Engineer for approval in accordance with the General Requirements of the specifications.

The following items shall be submitted before delivery of pipe or fittings:

1. Certification by the manufacturer or supplier that the pipe furnished for this project meets all pertinent AWWA Standards.

2. Catalog cuts and installation instructions for all restrained joints including boltless restrained joint pipe and grooved end joint pipe for ductile iron pipe.

1.05 DELIVERY, STORAGE, AND HANDLING

The Contractor shall carefully examine all material for defects. Material which is known, or thought, to be defective shall not be installed.

PART 2: PRODUCTS (MATERIAL)

2.01 DUCTILE IRON PIPE

Ductile iron pipe and fittings shall be as manufactured by U.S. Pipe and Foundry, American Cast Iron Pipe Company, or Atlantic States Cast Iron Pipe Company, or equal.

A. General

Ductile iron pipe shall conform to the latest specifications as adopted by the American National Standards Institute, Inc., (ANSI) and the American Water Works Association (AWWA). Specifically, ductile iron pipe shall conform to ANSI/AWWA C151/A21.51.

The pipe shall be coated outside with a bituminous coating in accordance with ANSI/AWWA C151/A21.51. The pipe interior shall be cement mortar lined and seal coated in compliance with the latest revision of ANSI/AWWA C104/A21.4. **Ductile Iron Pipe furnished for air service not contain cement mortar lining and shall be bituminous seal coated on the interior wall.**

B. Pipe Class

The class of pipe shall be as a minimum pressure Class 250. Where indicated on the Drawings, thicker classes shall be furnished.

All flanged pipe shall be a minimum of thickness Class 53, unless otherwise indicated on the Contract Drawings.

C. Testing

Each length of pipe shall be subjected to a hydrostatic proof test by the manufacturer as required by ANSI/AWWA C151/A21.51.

D. Joints

1. Mechanical and Push-on

Mechanical and Push-on joints shall conform to ANSI/AWWA C111/A21.11.

2. Flanged

Flanged joints shall conform to ANSI/AWWA C110/A21.10 for fittings and ANSI/AWWA C115/A21.15 for pipe.

Flanged joints shall not be used in underground installations except within structures or where shown on the Drawings.

3. Boltless Restrained Joint Pipe 4,6 and 8 Inch Diameter

Pipe joints shall conform to AWWA C-111, except that the gasket shall be specifically designed to include stainless steel locking segments which are vulcanized into the gasket to grip the spigot-end pipe and prevent joint separation. Restraining gaskets shall be Field-Lok gaskets as manufactured by U.S. Pipe for use with Tyton-Joint pipe as manufactured by U.S. Pipe.

2.02 DUCTILE IRON FITTINGS

A. Ductile Iron Fittings

Fittings shall be ductile iron conforming to ANSI/AWWA C110/A21.10.

1. Working Pressures

Fittings shall be suitable for the following working pressures unless otherwise noted:

Size	Pressure Pounds per Square Inch Standard Ductile Iron
4" - 24"	150

2. Coating and Lining

The fittings shall be coated with a bituminous coating in accordance with ANSI/AWWA C110/A21.10 and lined inside with cement mortar and seal coated in accordance with ANSI/AWWA C104/A21.4.

B. Joints

1. Mechanical and Push-on

Mechanical and Push-on joints including accessories shall conform to ANSI/AWWA C111/A21.11.

2. Flanged

Flanged joints shall meet the requirements of ANSI/AWWA C110/A21.10.

Flanged joints shall not be used in underground installations except within structures or where shown on the Contract Drawings.

2.03 DUCTILE IRON PIPE MARKING

Each pipe, fitting or special section shall have plainly marked thereon:

1. Pipe Class
2. Date of Manufacture
3. Manufacturer's name or trademark
4. On bends, the angle turned thereby
5. Manufacturer's identification number

2.04 RESTRAINING GLANDS

Mechanical joint valves and fittings shall be provided with ductile iron retainer glands, rated for 150 psi minimum working pressure, and shall be as manufactured by Megalug, Inc., or U.S. Pipe M.J. Gripper Glands.

2.05 NUTS, BOLTS AND GASKETS

A Gaskets For Pipe

Unless otherwise specified, gaskets for all flanged joints in process piping systems shall be 1/8" compressed thickness, homogeneous red rubber composition, compressed into sheets resistant to plastic flow. Gaskets shall be Garlock Packing Company No. 22, as supplied by Garlock Packing Company, or similar products by alternate manufacturers such as Rainbow or Durable.

B Bolts, Nuts and Washers For Piping and Valves

Unless otherwise specified or shown on the Drawings, bolts and nuts for flanged steel and iron pipe, fittings, and valves shall conform to the following ASTM standards:

Type of Flange	Location	Bolts	Nuts
Cast iron Ductile iron Steel: AWWA C207 Classes B and D ANSI B16.5 Class 150	Above ground, in buildings, and in chambers not subject to flooding	A307 Grade B	A563 Grade A Heavy Hex
	Buried or in chambers subject to flooding	A193 Grade B8A	A193 Grade B8A
Steel: AWWA C-207 Classes E and F ANSI B16.5 Class 300	All locations (underground or in chambers subject to flooding, coat bolts and nuts with bitumastic paint)	A193 Grade B7	A193 Grade B7

All bolts shall have markings on the head in accordance with the applicable ASTM standard, include manufacturer's identification symbol and grade symbol. Except for ASTM A563 nuts, all nuts shall also have these markings.

PART 3: EXECUTION

3.01 INSTALLATION - GENERAL REQUIREMENTS

All pipe shall be laid and maintained to the required lines and depths. Fittings and valves shall be at the required locations with joints centered, spigots home and all valve and hydrant stems plumb and otherwise in strict accordance with the Specifications.

All buried steel lugs, rods, brackets and flanged joint bolts and nuts shall be given one (1) coat of Koppers #50 coal tar coating prior to backfilling.

No deviation shall be made from the required alignment, depth or grade except with the written consent of the Engineer.

All pipe shall be laid to the depth specified. The depth shall be measured from the final surface grade to the top of the pipe barrel. The minimum pipe cover shall be as shown on the Drawings or as specified in the Specifications.

Do not lay pipe in a wet trench, on subgrade containing frost, and when trench conditions are unsuitable for such work. If all efforts fail to obtain a stable dry trench bottom and the Engineer

determines that the trench bottom is unsuitable for trench foundation, he will order in writing the kind of stabilization to be constructed.

Thoroughly clean the pipes and fittings before they are installed and this material shall be kept clean until the acceptance of the completed work. Lay pipe with the bell ends facing in the direction of laying, unless otherwise shown on the Drawings, or directed by the Engineer.

Exercise care to insure that each length abuts against the next in such manner that no shoulder or unevenness of any kind occurs in the pipe line.

No wedging or blocking is permitted in laying pipe unless by written order of Engineer.

Before joints are made, bed each section of pipe the full length of the barrel with recesses excavated so pipe invert forms continuous grade with invert of pipe previously laid. Do not bring succeeding pipe into position until the preceding length is embedded and securely in place.

Dig bell holes sufficiently large to permit proper joint making and to insure pipe is firmly bedded full length of its barrel.

During "pushing home" of any style piping, timber shall be placed between the jacking device (backhoe, bucket, pipe jacket, etc.) and the pipe being driven home.

Walking or working on completed pipeline, except as necessary in tamping and backfilling, is not permitted until trench is backfilled one-foot deep over top of pipes.

Take up and relay pipe that is out of alignment or grade, or pipe having disturbed joints after laying.

Take up and replace with new, such in-place pipe sections found to be defective. Replacement work at Contractor's expense.

Take necessary precautions to prevent the floating of the pipeline by the accumulation of water in the trench, or the collapse of the pipeline from any cause. Should floating or collapse occur, restoration will be at the Contractor's expense.

Bedding and backfilling materials for buried pipe shall be as specified previously in Section 2200 - Earthwork, as specified in subsequent paragraphs, and in accordance with the Contract Drawings.

Take every precaution to prevent foreign material from entering the pipe while it is being placed. During laying operations, do not place debris, tools, clothing, or other materials in the pipe.

Close all openings in the pipeline with watertight plugs when pipe laying is stopped at the close of the day's work or for other reasons, such as rest breaks or meal periods.

Place enough backfill over the center sections of the pipe to prevent floating.

Carry out the cutting of pipe only with equipment specifically designed for that purpose such as an abrasive wheel, rotary wheel cutter, a guillotine pipe saw or a milling wheel saw. The use of chisels or hand saws will not be permitted. Cut ends and rough edges should be ground smooth and for push-on connections, the cut end should be beveled slightly.

In distributing material at the project site, each piece shall be unloaded opposite or near the place where it is to be laid in the trench. Each length of pipe shall be adequately blocked to prevent movement. Stockpiled pipe shall be adequately blocked to prevent movement. No pipe, material, or any other object shall be placed on private property, obstruct walkways or driveways, or in any manner interfere with the normal flow of traffic.

In the case of ductile iron pipe, special care shall be exercised, during handling temporary storage or construction to avoid damage to the bells, spigots or flanged ends. If damaged pipe cannot be repaired to the Engineer's satisfaction, it shall be replaced at the Contractor's expense.

The Contractor shall be responsible for maintaining the minimum required distance between the water line and other utility lines in strict accordance with all Federal, State and local requirements and all right-of-way limitations.

Maximum allowable deflection at the joints for push-on joint pipe, regardless of pipe material, shall be as follows providing manufacturer's recommendations are not more stringent:

Size of Pipe	Deflection Angle	Maximum Deflection (18-ft. Length)	Maximum Deflection (20-ft. Length)
thru 12"	2-1/2°	9-1/2"	10-1/2"
14"-36"	1-1/2°	5-1/2"	6"
42"-48"	1°	3-1/4"	4"

In case the curve is too sharp for the allowable deflection, short lengths of pipe may be used upon approval of the ENGINEER and at no additional cost to the OWNER.

Particular care shall be exercised to that no high points are established where air can accumulate in the pipelines.

3.02 DUCTILE IRON PIPE INSTALLATION

A) Installation of Buried Pipe and Fittings

The installation of buried iron piping, except as otherwise shown or specified, shall conform to AWWA C-600, "Standard for Installation of Ductile Iron Water Mains and Appurtenances". Boltless restrained joint pipe shall also be installed in accordance with manufacturer's recommended instructions.

B) Installation of Mechanical Joints

Assembly of Push-on pipe mechanical joint valves shall be in accordance with the manufacturer's printed instructions and AWWA C-600. Installation of retainer glands shall be in accordance with the manufacturer's printed instructions. Torque wrenches shall be used for installation of mechanical and retainer glands.

The bell, plain end, and gasket shall be thoroughly cleaned and lubricated immediately before assembling the joint. The gasket shall the be inserted into the groove in the bell. Before starting joint assembly, a liberal coating of special lubricant shall be applied to the gasket and spigot end. With the spigot end centered in the bell, the spigot end is pushed home. Bolts for mechanical joints shall be tightened in an alternating top-to-bottom and side-to-side sequence in order to

bring the gland up to the bell face evenly. If effective sealing is not achieved at the maximum torques listed AWWA C-600, the joint shall be disassembled, thoroughly cleaned, and reassembled. Over stressing of bolts to compensate for poor joint assembly will not be permitted.

C) Installation of Flanged Joints

All flanges, unless otherwise required, shall have standard drillings. Flanges shall be firmly bolted with machine, stud or bolts of the proper size bar steel, with good, true threads, and shall be so tightened as to evenly distribute the stress in the bolts and bring the pipe into uniform alignment.

In general, no flanges shall be permitted underground except as directed by the Engineer, or as indicated on the Drawings.

Where required, flanges shall be tapped for stud bolts.

3.03 PIPE SUPPORTS

Supports shall be as specified in Section 15124 – Pipe and Equipment Supports

3.03 PRESSURE TESTS

The Contractor shall provide all labor, materials, equipment, gauges, air, water and all else necessary to pressure test all ductile iron piping systems installed under this Contract. Except as otherwise shown or specified, testing shall be in accordance with AWWA C-600, Section 4.

The general method of testing pipelines designed to convey liquids shall be as follows:

1. A hydrostatic test pressure shall be maintained in the pipeline for a minimum period of two (2) hours. At the end of the test period, if the test pressure has remained constant, the pipeline shall have passed the test. If the pressure has dropped, it shall be brought back to the test pressure by pumping a known volume of water (by pumping from a graduated container or by metering) back into the pipeline. The volume of water thus used, representing leakage from the pipeline, shall be recorded. If the leakage is less than the allowable leakage specified below, the pipeline shall have passed the test. If the leakage exceeds the allowable specified, the Contractor shall locate the leak, permanently repair the section of piping where the leak is occurring to the satisfaction of the Engineer, and retest the pipeline as specified above. This process shall be repeated until the pipeline has successfully passed the pressure test.

2. Contractor shall make certain that all air is expelled from a pipeline before it is tested. All caps, plugs and fittings shall be adequately braced and anchored to withstand the test pressures. The test pressure specified by the Engineer shall be obtained and measured at the highest elevation in the pipeline under test.

3. Contractor shall take special note of piping configurations as shown on the Drawings, especially where piping begins or terminates with fittings which will be difficult to seal, plug and anchor. In these cases, it may be necessary to perform the testing after special anchorage systems have been installed.

SECTION 400513.73 – PLASTIC PROCESS PIPING

1.01 WORK INCLUDED

The work under this Section of the specifications shall include all materials, equipment & labor for furnishing, laying, installing, and testing the piping work and appurtenances herein described and as shown on the Contract Drawings.

The piping work shall include all piping in areas such as building interior, building exterior, and underground on the site.

1.02 RELATED WORK

Section 15000 –General Requirements
Section 15124 – Pipe and Equipment Supports

1.03 QUALITY ASSURANCE

Dimensions shown on Contract Drawings are approximate only. Contractor shall verify all piping geometry in the field and shall be responsible for insuring proper alignment and fit of all piping consistent with the intent of the Contract Drawings.

1.04 SUBMITTALS

Shop drawings and manufacturer's literature for all Contractor supplied materials shall be promptly submitted to the Engineer for approval in accordance with the General Requirements and Section 15050 of the specifications.

1.05 DELIVERY, STORAGE, AND HANDLING

The Contractor shall carefully examine all material for defects. Material that is known, or thought, to be defective shall not be installed.

PART 2: PRODUCTS (MATERIAL)

2.01 PIPE AND NIPPLES

Pipe shall be PVC, SCH 80, Type 1, Grade 1 or Class 12454-b conforming to ASTM D1784 and ASTM D1785.

2.02 FITTINGS

A. Schedule 80, as specified under 2.01 Pipe above. Fittings shall conform to ASTM D2467
B. Fittings for sanitary waste and vent piping and roof drains shall be socket type ends, ASTM D2665

2.03 FLANGES

One piece, molded hub type flat faced flanges, 125 pound standard, as specified under 2.02 Fittings.

2.04 JOINTS

Joints shall be socket weld, except where connecting to unions, valves, and equipment with threaded connections that may require future removal.

2.05 GASKETS

Gaskets shall be full faced, 1/8" thick, fabricated from ethylene propylene rubber. When mating flange has a raised face, use flat ring gasket and provide filler gasket between OD of raised face and flange OD to protect PVC flange.

2.06 BOLTING

Type 316 stainless steel, ASTM A193, Grade B8M hex head bolts and ASTM A194, Grade 8M hex head nuts. Bolts shall be fabricated in accordance with ANSI B18.2 and provided with washers of the same material as the bolts.

2.07 SOLVENT CLEANER AND CEMENT

Solvent cleaner shall be as recommended by the manufacturer. All socked connections shall be joined with PVC solvent cement conforming to ASTM D2564. Manufacturer and viscosity shall be as recommended by the pipe and fitting manufacturer to assure compatibility.

2.08 THREAD LUBRICANT

Teflon tape.

2.09 BELOW GROUND PIPE

Pipe and fittings shall be ASTM D3034, standard dimension ratio not to exceed 35. Joints shall be rubber gasketed complying with ASTM D3212. Gaskets shall be ASTM F477. Lubricant for joining pipe shall be as approved by the pipe manufacturer.

2.10 RESTRAINING GLANDS

Mechanical joint valves and fittings shall be provided with ductile iron retainer glands, rated for 150 psi minimum working pressure, and shall be Series 2000 as manufactured by EBBA Iron of Eastland, Texas or equal.

PART 3: EXECUTION

3.01 INSTALLATION - GENERAL REQUIREMENTS

All pipe shall be laid and maintained to the required lines and depths. Fittings and valves shall be at the required locations with joints centered, spigots home and all valve and hydrant stems plumb and otherwise in strict accordance with the Specifications. Use adequate ventilation when working with pipe joint solvent cement.

All buried steel lugs, rods, brackets and flanged joint bolts and nuts shall be given one (1) coat of Koppers #50 coal tar coating prior to backfilling.

No deviation shall be made from the required alignment, depth or grade except with the written consent of the Engineer.

All pipe shall be laid to the depth specified. The depth shall be measured from the final surface grade to the top of the pipe barrel. The minimum pipe cover shall be as shown on the Drawings or as specified in the Specifications.

Do not lay pipe in a wet trench, on subgrade containing frost, and when trench conditions are unsuitable for such work. If all efforts fail to obtain a stable dry trench bottom and the Engineer determines that the trench bottom is unsuitable for trench foundation, he will order in writing the kind of stabilization to be constructed.

Thoroughly clean the pipes and fittings before they are installed and this material shall be kept clean until the acceptance of the completed work. Lay pipe with the bell ends facing in the direction of laying, unless otherwise shown on the Drawings, or directed by the Engineer. Exercise care to insure that each length abuts against the next in such manner that no shoulder or unevenness of any kind occurs in the pipe line.

No wedging or blocking is permitted in laying pipe unless by written order of Engineer.

Before joints are made, bed each section of pipe the full length of the barrel with recesses excavated so pipe invert forms continuous grade with invert of pipe previously laid. Do not bring succeeding pipe into position until the preceding length is embedded and securely in place.

Dig bell holes sufficiently large to permit proper joint making and to insure pipe is firmly bedded full length of its barrel.
During "pushing home" of any style piping, timber shall be placed between the jacking device (backhoe, bucket, pipe jacket, etc.) and the pipe being driven home.

Walking or working on completed pipeline, except as necessary in tamping and backfilling, is not permitted until trench is backfilled one-foot deep over top of pipes.

Take up and relay pipe that is out of alignment or grade, or pipe having disturbed joints after laying.

Take up and replace with new, such in-place pipe sections found to be defective. Replacement work at Contractor's expense.

Take necessary precautions to prevent the floating of the pipeline by the accumulation of water in the trench, or the collapse of the pipeline from any cause. Should floating or collapse occur, restoration will be at the Contractor's expense.

Bedding and backfilling materials for buried pipe shall be as specified previously in Section 2200 - Earthwork, Section 15000 – General Requirements, as specified in subsequent paragraphs, and in accordance with the Contract Drawings.

Take every precaution to prevent foreign material from entering the pipe while it is being placed. During laying operations, do not place debris, tools, clothing, or other materials in the pipe.

Close all openings in the pipeline with watertight plugs when pipe laying is stopped at the close of the day's work or for other reasons, such as rest breaks or meal periods.

Place enough backfill over the center sections of the pipe to prevent floating.

Carry out the cutting, make-up and installation in strict accordance with the pipe manufacturer's written recommendations. Plastic pipe shall be laid by snaking the pipe from one side of the trench to the other. Offset shall be as recommended by the manufacturer for the maximum temperature variation between time of solvent welding and during operation.

In distributing material at the project site, each piece shall be unloaded opposite or near the place where it is to be laid in the trench. Each length of pipe shall be adequately blocked to prevent movement. Stockpiled pipe shall be adequately blocked to prevent movement. No pipe, material, or any other object shall be placed on private property, obstruct walkways or driveways, or in any manner interfere with the normal flow of traffic.

Special care shall be exercised, during handling temporary storage or construction to avoid damage to the bells, spigots or flanged ends. If damaged pipe cannot be repaired to the Engineer's satisfaction, it shall be replaced at the Contractor's expense.
The Contractor shall be responsible for maintaining the minimum required distance between the water line and other utility lines in strict accordance with all Federal, State and local requirements and all right-of-way limitations.

Maximum allowable deflection at the joints for push-on joint pipe, regardless of pipe material, shall be as follows providing manufacturer's recommendations are not more stringent:

Size of Pipe	Deflection Angle	Maximum Deflection (18-ft. Length)	Maximum Deflection (20-ft. Length)
thru 12"	2-1/2°	9-1/2"	10-1/2"
14"-36"	1-1/2°	5-1/2"	6"
42"-48"	1°	3-1/4"	4"

In case the curve is too sharp for the allowable deflection, short lengths of pipe may be used upon approval of the ENGINEER and at no additional cost to the OWNER.

Particular care shall be exercised to that no high points are established where air can accumulate in the pipelines.

3.02 INTERIOR PLASTIC (PVC) PIPE INSTALLATION

Solvent cement jointing shall conform to ASTM D2855, "Standard Recommended Practice for Making Solvent Cemented Joints with Polyvinyl Chloride (PVC) Pipe and Fittings", and the manufacturer's recommendations. Provide piping and supports spaced no further apart than manufacturer's recommended spacing for 100 F service

The Contractor shall provide slip type PVC expansions with joint material as recommended by the manufacturer for the type of service temperature range anticipated. Joints shall be installed near all fittings and not more than 100 feet apart on all runs of pipe.

3.03 BURIED PIPE

The specifications in this part are applicable to the installation of gravity sewer , drain pipe, and the force main, the type and class of which are indicated on the drawings and/or specified in subsequent sections.

A) Lines and Grades

The grade and alignment of the pipe shall be maintained by the use of laser instruments.

The Contractor shall furnish all labor, material, surveying instruments and tools to establish and maintain all lines and grades. The responsibilities of the Engineer to provide and of the Contractor to maintain basic control points are outlined in the General Requirements.

All pipe, fittings and specials shall be carefully inspected in the field before lowering into the trench. Cracked, broken, warped, out-of-round or otherwise defective pipe, fittings or specials as determined by the Contractor or the Engineer, shall be pulled and not installed. Such rejected pipe shall then be removed from the job site by the Contractor at his own expense.

After the trench has been brought to the proper grade, as hereinbefore specified, the pipe and specials shall be laid. Pipe jointing shall be in accordance with Manufacturer's recommendations.

All pipe fittings and specials shall be carefully lowered into the trench with ropes, slings and proper equipment. Pipe becoming cracked or otherwise damaged during or following installation shall be marked by the Contractor or Engineer and removed from the site as required in the preceding paragraph.

Blocking will not be permitted except where the pipe is to be encased in concrete. Any pipe that has its grades or joints disturbed after laying shall be taken up and relaid. The interior and ends of all pipes shall be thoroughly cleaned during laying operations by means of plugs or other approved methods. Under no circum stances shall pipe be laid in water and no pipe shall be laid when trench conditions or the weather is unsuitable for such work except by permission of the Engineer. Every precaution necessary shall be taken to obtain watertight construction. If deemed necessary, sewer lines will be tested for leakage.

If an inspection of the completed sewer on any part thereof shows any pipes or joints which allow the infiltration of water in a noticeable stream or jet, the defective work or material shall be replaced or repaired as directed.

Before final acceptance of the sewers, the Contractor shall furnish all equipment and personnel to conduct an acceptance test using low pressure air.

Contractor shall first clean and flush all lines, and all debris flushed out shall be removed.

All test plugs, gauges, an air compressor, and personnel for conducting the acceptance test shall be furnished by the Contractor. The test shall be conducted under the supervision of the Engineer.

For the acceptance test, air shall be slowly supplied to the plugged section of pipe to be tested until the internal air pressure reaches 4.0 psi greater than the average back pressure of any groundwater that may submerge the pipe. At least two minutes shall be allowed for temperature

stabilization before proceeding further. The back pressure of any groundwater caused by the water head above the invert of the pipe must be determined by a method approved by the Engineer. This back pressure must be added to the standard test pressures to compensate for the groundwater effect on the air test.

The rate of air loss shall then be determined by measuring the time interval required for the internal pressure to decrease from 3.5 psi to 2.5 psi greater than the average back pressure of any groundwater that may submerge the pipe.

The pipeline shall be considered acceptable, when the 1.0 psi pressure drop is not less than the holding time listed in the air table located at the end of this section.

If the pipe installation fails to meet these requirements, the Contractor shall determine at his own expense the source of exfiltration, and he shall repair or replace all defective materials or workmanship. The complete pipe installation shall meet the requirement of this test.

3.04 PIPE SUPPORTS

Supports shall be as specified in Section 15124 – Pipe and Equipment Supports

3.05 PRESSURE TESTS

The Contractor shall provide all labor, materials, equipment, gauges, air, water and all else necessary to pressure test all piping systems installed under this Contract. Low pressure air tests for buried gravity sewer pipe with push-on joints shall be conducted as specified under 3.03 above.

The general method of testing pipelines designed to convey liquids shall be as follows:

1. A hydrostatic test pressure shall be maintained in the pipeline for a minimum period of two (2) hours. At the end of the test period, if the test pressure has remained constant, the pipeline shall have passed the test. If the pressure has dropped, it shall be brought back to the test pressure by pumping a known volume of water (by pumping from a graduated container or by metering) back into the pipeline. The volume of water thus used, representing leakage from the pipeline, shall be recorded. If the leakage is less than the allowable leakage specified below, the pipeline shall have passed the test. If the leakage exceeds the allowable specified, the Contractor shall locate the leak, permanently repair the section of piping where the leak is occurring to the satisfaction of the Engineer, and retest the pipeline as specified above. This process shall be repeated until the pipeline has successfully passed the pressure test.

2. Contractor shall make certain that all air is expelled from a pipeline before it is tested. All caps, plugs and fittings shall be adequately braced and anchored to withstand the test pressures. The test pressure specified by the Engineer shall be obtained and measured at the highest elevation in the pipeline under test.

3. Contractor shall take special note of piping configurations as shown on the Drawings, especially where piping begins or terminates with fittings which will be difficult to seal, plug and anchor. In these cases, it may be necessary to perform the testing after special anchorage systems have been installed.

Allowable Leakage for Sewer Pipe: Allowable leakage shall be computed by the following formula:

$$L = \frac{SDP^2}{133,200}$$

L = allowable leakage, gallons per hour
S = length of pipe tested in feet
D = nominal pipe diameter, in inches
P = average test pressure, psi

The test pressures for pipe shall be 150 psi.

Allowable Leakage for Solvent Welded PVC Piping: The solvent welded PVC piping shall have no leakage. The solvent welded PVC lines shall be fully drained and blown with compressed air after testing.

* * * * *

MINIMUM HOLDING TIME REQUIRED FOR

PRESSURE TO DROP FROM 3-1/2 TO 2-1/2 PSIG

1 Pipe Diameter (in.)	2 Minimum Time (min:sec)	3 Length for Minimum Time (ft)	4 Time for Longer Length (sec)	Minimum Time for Length (L) Shown (min:sec)							
				100 ft	150 ft	200 ft	250 ft	300 ft	350 ft	400 ft	450 ft
4	3:46	597	.380 L 3:46	3:46	3:46	3:46	3:46	3:46	3:46	3:46	
6	5:40	398	.854 L 5:40	5:40	5:40	5:40	5:40	5.40	5:42	6:24	
8	7:34	298	1.520 L 7:34	7:34	7:34	7:34	7:36	8:52	10:08	11:24	
10	9:26	239	2.374 L 9:26	9:26	9:26	9:53	11:52	13:51	15:49	17:48	
12	11:20	199	3.418 L 11:20	11:20	11:24	14:15	17:05	19:56	22:47	25:38	
15	14:10	159	5.342 L 14:10	14:10	17:48	22:15	26:42	31:09	35:36	40:04	
18	17:00	133	7.692 L 17:00	19:13	25:38	32:03	38:27	44:52	51:16	57:41	
21	19:50	114	10.470 L	19:50	26:10	34:54	43:37	52:21	61:00	69:48	78:31
24	22:40	99	13.674 L	22:47	34:11	45:34	56:58	68:22	79:46	91:10	102:33
27	25:30	88	17.306 L	28:51	43:16	57:41	72:07	86:32	100:57	115:22	129:48
30	28:20	80	21.366 L	35:37	53:25	71:13	89:02	106:50	124:38	142:26	160:15
33	31:10	72	25.852 L	43:05	64:38	86:10	107:43	129:16	150:43	172:21	193:53
36	34:00	66	30.768 L	51:17	76:55	102:34	128:12	153:50	179:29	205:07	230:46

REF: UNI-BELL PLASTIC PIPE ASSOCIATION, PUB. UNI-B-6-79 "RECOMMENDED PRACTICE FOR LOW-PRESSURE AIR TESTING OF INSTALLED SEWER PIPE"

SECTION 400523 – PROCESS VALVES

PART 1 - GENERAL

1.01 WORK INCLUDED

A. The Contractor shall furnish, install, paint, adjust, and test all valves shown on the Drawings or required to provide a complete installation which is ready to operate. Valves shall be installed complete with all necessary appurtenances including hangers and supports, extension stems, floorstands, hand and chain wheels, operating wrenches, indicators or special automatic operators.

1.02 MATERIALS AND WORKMANSHIP

A. Valves and appurtenances for chemical feed systems shall be as specified elsewhere in these Specifications.

B. Gate valves shall conform with all applicable provisions of A.W.W.A. Standard Specification C500, or C-509, latest edition. Butterfly valves shall conform with all applicable provisions of A.W.W.A. Standard Specification C504, latest edition. Plug valves and knife valves shall be the best of their respective types and shall conform to the criteria listed in these Specifications.

C. Gate valves and check valves shall be of the same manufacturer, as far as practical.

D. All valves of a particular type shall be of the same manufacturer.

E. Valve flanges shall be ANSI 125 lb. Bells for underground valves shall match adjoining piping. No knife valve may be used for underground installation.

F. Unless otherwise required, all valves three (3") inches and larger and located in structures shall have flanged ends. Valves smaller than three (3") inches shall have threaded ends. Buried valves shall have standard two (2") inch operating nuts and shall have mechanical joint ends to conform to connecting piping.

G. Extension stems shall be provided for all buried valves where the operating nut is greater than three (3') feet below finished grade. Operating nuts or extension stems shall be brought to within 6" of the finished grade. Centering collars are to be provided on all extension stems. Extension stems shall be mechanically secured to the valve stem/nut using stainless steel hardware.

H. All flanged valves shall have laying lengths conforming to American National Standard dimensions for cast iron flanged valves, ANSI B16.10.

I. Valves shall open by turning hand wheels or operating nuts to the left, counterclockwise.

J. Non-rising stem gate valves shall be provided with "O" ring type packing.

K. Rising stem gate valves shall be provided with packed boxes.

L. Operations of valves shall be designed so that the effort required to operate the handwheel, lever, tee wrench, or chain shall not exceed 40 pounds applied at the extremity of the wheel, tee wrench, or lever.

PART 2 - PRODUCTS

2.01 GATE VALVES

A. Gate valves 3 inches and larger shall be iron body, fully bronze-mounted, solid wedge or double disc type with renewable seat rings, suitable for a working pressure of 150 psi and shop tested at 300 psi. All valves for sewage lanes shall be solid wedge.

B. Unless otherwise specified, hand wheel operated gate valves shall be of the outside screw and yoke type with rising stems. Buried valves shall be inside screw type with 2" square operating nuts. Valves for extension stem operation and for floorstand operation shall be inside screw type, unless valve position indication is required or is indicated on the Drawings.

C. Where buried gate valves are to be installed in the horizontal position, the gate valves shall be provided with bevel gear operators enclosed in gear cases of the totally enclosed type and shall be provided with rollers, horizontal tracks and scrappers.

D. Threaded gate valves shall be of all bronze construction; union bonnet type; with rising stems and handwheels; solid wedge pattern; designed for 125 psi steam pressure; and arranged to permit repacking under pressure.

E. Where specified or shown on the Drawings, valves shall be furnished with standard weight, 3 piece, cast iron valve boxes. Boxes shall be of the screw type, with deep covers to prevent tipping, and shall be suitably marked. Sections shall not be less than 5-1/4 inches in diameter. Lengths shall be suitable for use in the location indicated. On some buried valves, the depth of cover may not be deep enough to take the standard type of valve box. In such a case, a cast iron box of a design suitable for the particular conditions shall be furnished and installed. Such design shall provide for the elimination of direct loads through the box to the valve.

F. Floorstands shall be of the non-rising stem type with bronze indicators or a rising stem type as shown on the Drawings or directed by the Engineer.

G. Handwheels shall have a cast arrow, showing the direction of rotation for opening the valve.

H. The Contractor shall furnish six (6) tee wrenches under this Contract suitable for operation of buried valves. The lengths to be determined by the Engineer after valves have been set underground.

I. Gate valves for liquid services shall be as manufactured by Flowserve Anchor-Darling; Clow Corporation; Mueller or equal.

2.02 CHECK VALVES

A. Iron Check Valves for Liquid Service

1. The Contractor shall furnish and install cushioned swing check valves as shown on the drawings.

2. The function of the cushioned swing check valves shall be to permit flow in only one direction and close tightly when its discharge side pressure exceeds its inlet pressure. Closing of these valves shall take place without a slam or a bang.

3. The cushioned swing check valves shall be constructed of heavy cast iron body with a stainless steel trim and resilient seat, a noncorrosive shockless chamber.

4. It shall absolutely prevent the return of liquid back through the valve when the inlet pressure decreases below the delivery pressure. The valve must be tight seating, and must be shockless in operation. The seat ring must be renewable.

5. The cushion chamber shall be attached to the side of the valve body externally and so constructed with a piston operating in a chamber that will effectively permit the valve to be operated without any hammering action. The shock absorption shall be by air, and the cushion chamber shall be so arranged that the closing speed will be adjustable to meet the service requirements.

6. The valve disc shall be of cast iron and shall be suspended from a noncorrosive shaft which will pass through a stuffing box and be connected to the cushion chamber on the outside of the valve.

7. The cushioned swing check valves shall be the GA Industries, Inc. Fig. No. 250-DS for 125# ASA Std. or equal.

B. P.V.C. Check Valves

1. PVC check valves shall be of the "Y" Type. Valves and internal parts shall be of PVC Type 1, Grade 1, Cell classification conforming to ASTM D-1784-81. "O" Ring shall be Viton. Temperature and pressure ratings will be the same as those for PVC Schedule 80 pipe.

2. The valves shall be as manufactured by Hayward Industrial Products, Inc., N.J. or equal.

3. Valves shall require less that 1 psi to open. Valves shall have threaded ends and the adjacent piping shall be equipped with unions to allow the removal of the valve without damaging the valve or piping.

2.03 KNIFE GATE VALVES

A. The knife gate valves shall be bonnetless knife type with wafer face-to-face flanged connections. Flanges shall be drilled to ANSI 125 pound standard.

B. Valves shall be resilient seated round port valves. Valve bodies shall have 304 stainless steel wetted parts. Valve packing shall be multiple layers of square, braided flax and shall be impregnated with marine or petroleum base lubricants. The packing gland shall be plastic coated.

C. The gate shall have a knife-edge. Both sides of the gate shall be finish ground.

D. The stem shall be stainless steel and shall have double pitch threads. Valve super-structure shall be fabricated of hot rolled angular steel. The yoke sleeve shall be acid resisting bronze.

E. Valves shall have a raised face seat with a relieved area around the seat to prevent jamming. The resilient seated valves shall have a stainless steal seat ring with a molded resilient insert bonded to the seat and gate side for installations where drip tight shutoff is required.

F. Resilient seat material shall be neoprene or hycar suitable for use with raw sewage. Valve shall have a handwheel operator.

G. All valves shall have a minimum design pressure rating of 150 psi and capable of a testing pressure of 300 psi.

H. Valves shall be DeZurik Series L., or equal.

2.04 BUTTERFLY VALVES

A. Iron Butterfly Valves

1. All butterfly valves shall conform with AWWA C-504-80.

2. Valve bodies shall be constructed of cast iron ASTM A126, Class B. Valve shafts shall be of wrought stainless steel with low friction journals. Valve discs shall be constructed of cast or ductile iron ASTM A-126, A-48, A-536. Valve seats shall be of synthetic rubber, suitable for sewage and air service and rated for the expected temperature range of 60-170°F. The seats shall be secured to the valve body or the valve disc as is standard for the manufacturers specified. Seat bond shall withstand 75 pounds pull under test procedure ASTM D-429, Method B. Bearings shall be sleeve-type, corrosion resistant and self-lubricating. Packing shall be self-adjusting Chevron type. Painting shall be standard.

3. All valves up to 20-inch size shall be of Class 150B. Pressure rating of larger valves shall be rated for 25 psi pressure.

4. Exposed valves shall have end flanges conforming in dimensions and drilling to ANSI B16.1, Class 125. Buried valves shall have mechanical joints conforming to the requirements of ANSI A21.11

5. Lever operated valves shall have heavy steel hand levers, provided with a comfortable non-metallic hand grip. It shall be possible to lock the lever to any desired position along its travel. Lever lengths shall be 12-inch for valves through 6-inch size. Lever operators shall not be used for any valve larger than 6-inch size.

6. Where specified, called for on the Contract Drawings, shown in a location subject to submergence or buried, valves and operators shall be suitable for submerged service.

7. Buried valves shall be provided with valve disc position indicator units. Each unit shall consist of cast iron adaptor for the valve box, guide bushing, position indicator, flexible washer, and a two-inch square AWWA nut with set screw. Exterior buried valves shall be adequately restrained by the same restraining method employed for the piping system. The units shall be Pratt Groundhog, as manufactured by Henry Pratt Co., or equal.

8. Where specified or shown on the Drawings, valves shall be furnished with standard weight, 3 piece, cast iron valve boxes. Boxes shall be of the screw type, with deep covers to prevent tipping, and shall be suitably marked. Sections shall not be less than 5-1/4 inches in diameter. Lengths shall be suitable for use in the location indicated. On some buried valves, the depth of cover may not be deep enough to take the standard type of valve box. In such a case, a cast iron box of a design suitable for the particular conditions shall be furnished and installed. Such design shall provide for the elimination of direct loads through the box to the valve.

B. PVC Butterfly Valves

1. The PVC butterfly valves shall have steel reinforced PVC discs, replaceable Viton liners, and stainless steel shafts. The PVC compound shall be Type 1, Grade 1, as outlined in ASTM D-1784.

2. Pressure rating of the valves shall be 150 psi at 73°F temperature of water.

3. The valves shall be as manufactured by Hayward Industrial Products, Inc., N.J. or equal.

2.05 PLUG VALVES

A. Plug valves shall be furnished and installed where shown on the Contract Drawings. In general, plug valves shall be used in all sludge and scum lines. Plug valves shall be rotated ninety (90) degrees for full open to full closed. Plug valves shall be of the non-lubricated, eccentric plug type with resilient faced plugs as manufactured by DeZurik Corp; Milliken Valve Company or equal.

B. The maximum rated working pressure for all plug valves shall be 175 psi through 12" and 150 psi for 14" and above and test pressures shall be 225 psi unless otherwise noted.

C. Valves shall provide drop tight shut off with pressure against the plug in either direction.

D. Port areas for valves through 20" shall be minimum 80% of full pipe area and port areas of 24" and larger valves shall be minimum 70% of full pipe area.

E. Valve bodies shall be of ASTM A126 Class B cast iron in compliance with AWWA C504 Section 2.2. Bodies in 3" and larger valves shall be furnished with a 1/8 inch thick welded overlay seat of not less than 90% pure nickel in accordance with AWWA C507 Section 7.2. Valves utilizing resilient seats attached to the body shall not be acceptable.

F. Plugs shall be of ASTM A126 Class B cast iron in compliance with AWWA C504, Section 2.2. The plug shall be of one piece construction and shall be capable of withstanding the full pressure rating of the valve without use of additional structural reinforcing ribs that extend beyond the profile of the plug itself. Plugs shall be resilient faced with neoprene or hycar, suitable for use with sewage.

G. Valves shall be furnished with replaceable, sleeve type metal bearings conforming to AWWA C504-80, Section 3.6 AWWA C507-73, Section 8. Bearings shall be of sintered, oil impregnated and permanently lubricated type 316 ASTM A743 Grade CF-8M or AISI Type 317L stainless steel. Non-metallic bearings shall not be acceptable.

H. Valve shaft seals shall be of the multiple V-ring type and shall be externally adjustable, repackable without removing the bonnet or actuator from the valve, and repackable under pressure. Shaft seals shall conform with AWWA C504, Section 3.7 and AWWA C507, Section 10.2. Valves utilizing 0-ring seals or non-adjustable packing shall not be acceptable. All exposed nuts, bolts, springs, washers, etc., shall be stainless steel for buried or submerged service valves and zinc plated for all others.

I. Plug valves shall be provided with stops. Where indicated, extension stems and cast iron floor stands with operating handwheels and position indicators shall be furnished and installed. Where indicated on the Drawings, plug valves shall be double ended chain wrench operated. Where extension stems and double ended wrenches are called for, the extension stems shall be securely braced in a vertical position and they shall not be less than two (2") inches in diameter. Buried plug valves shall be provided with extension stem operators where indicated on the Drawings. Extension stems shall be mechanically secured to the valve stem/nut with stainless steel hardware. Operating nuts shall terminate approximately 6" below the valve boxes. Suitable tee handle wrenches shall be provided.

J. Manual valves shall have lever or gear actuators, tee wrenches, extension stems, floor stands, and other appurtenances as indicated on the Drawings and as required. Valves 4" and less shall have non-removable levers unless otherwise specified or indicated. All valves 6" and larger shall be equipped with enclosed gear actuators conforming to AWWA C504 Section 3.8. All gearing shall be enclosed in a semi-steel, ASTM A126, Class "B" housing. Gears shall be suitable for running in a lubricant, with seals provided on all valve shafts and actuators to prevent entry of dirt and water. Each actuator shaft and quadrant shall be supported on permanently lubricated bronze bearings. Actuators shall clearly indicate the valve position; indicator shall be visible from the operating location; and an adjustable stop shall be provided to set the closing torque. In general, chain wheel operation shall be provided for valves located more than 6' above the operating floor level. Sufficient chain shall be provided to extend to within 3' of the operating level.

K. All valves shown in a location subject to submergence or buried valves and operators shall be suitable for submerged service. All exposed nuts, washers, bolts and springs shall be stainless steel.

L. Generally valves shall be installed in a position which will allow the plug to rotate into the top of the valve housing when the valve is open with the seat on the upstream end. The Contractor shall coordinate the position of operators and accessories to allow installation in this manner and have the handwheel horizontal or vertical or operating stem or chain wheel vertical.

2.06 PVC BALL VALVES

A. PVC valves shall be type I PVC double end entry, self-lubricated, corrosion resistant, ball valves with flanged or union type end connections as required. Valves shall be complete with replaceable Viton seal rings, Teflon seat rings and removable handles. Valves shall be designed for 150 psi, 75°F water service or for the chemical service intended.

2.07 SEWAGE SURGE RELIEF VALVE

A. Provide flanged Sewage Surge Relief Valves as shown on the drawings. The Sewage Surge Relief Valves shall be of a 90-degree elbow body configuration, with cast iron body containing a securely fastened stainless steel ring.

B. The valve disc shall have a resilient replaceable seat firmly held in place by a stainless steel ring fastened to the disc with screws. In the closed position with pipe pressures below the spring setting, the valve shall provide droptight closure. The disc movement shall be guided for proper alignment throughout its stroke and provide for full opening of the pipe line area when required.

C. The valve - normally closed - shall open when the system pressure exceeds the spring adjustment setting. Its opening stroke shall be limited to that which is necessary to provide protection against surge exceeding the spring setting. The valve shall close at slow speed consistent with adjustment of a self-contained oil cushion chamber that is provided with the valve. The cushioning device shall permit a range of adjustment for closing speeds to prevent hammer or bang.

D. External springs shall be enclosed in protective casings, and the disc stem bushing shall be bronze capped with a lantern-type gland vented to atmosphere for revealing seal leakage.

E. All materials and workmanship shall be first-class quality throughout. The valves shall be GA Industries, Inc. Figure number 625-D for 6" valves or equal.

2.08 SEWAGE COMBINATION AIR VALVE

A. The Contractor shall furnish and install single body sewage combination air valves as shown on the Contract Drawings. The Sewage Combination Air Valve shall be designed to exhaust large amounts of air during filling, release small amounts of accumulated air

during operation and open impending vacuum to admit large amounts of air while draining.

B. The Sewage Combination Air Valve shall be float operated and both the Air & Vacuum and Air Release functions shall be housed in a single conical shaped body and shall have a cam lock back flush attachment. Body and cover shall be stainless steel. The valve body shall be rated for 230 psi WOG and tested to 300 psi. All leverage mechanism parts and the spherical float shall be stainless steel. The large and small orifices seats shall be Buna-N and shall be renewable.

C. The Combination Air Valve shall be supplied with "Flushing Attachments" to allow periodic flushing of sediment, grease and solids. Attachments consist of: bronze blow-off and flushing valves, with a minimum of 5 feet of rubber hose, and quick disconnects to allow connection to a clean water source.

D. The single body Sewage Combination Air Valve shall be as manufactured by A.R.I Flow Control Accessories, their Model No. D-020, or equal.

2.09 TAPPING SLEEVES AND VALVES

A. Tapping sleeves and valves shall be as manufactured by the U.S. Pipe and Foundry, Valve and Hydrant division, or equal and shall employ an 0-ring, rubber gland type saddle.

B. Valves and valve boxes shall comply with the pertinent provisions listed in these Specifications, with the exception that tapping valves shall be provided with flanged inlet; mechanical joint outlet ends.

C. Work shall be carried out by personnel thoroughly experienced in the construction of wet taps, using approved methods and equipment. Certain construction methods are to be approved by the Engineer prior to any work being performed. The tapping sleeves and valves shall be securely supported and blocked by poured Class 1500 psi concrete against undisturbed ground.

2.10 AIR RELEASE VALVES

A. The Contractor shall furnish and install sewage Air Release Valves as shown on the Contract Drawings and at all high points on pressure lines. Each air release valve shall have a cast iron body and cover; stainless steel float; bronze linkage and other internal parts. Valves shall have a 2" NPT inlet; shall be provided with an appropriate shut-off valve and shall have a venting capacity of 58.7 SCFM. Valves shall be Figure 925F, Sewage Air Release Valves as manufactured by GA Industries or equal.

2.11 PRESSURE REDUCING VALVES

A. The Contractor shall furnish and install pressure reducing valves where shown on the Drawings, suitable for operating pressures and pressure reductions as listed on the Contract Drawings. Actual pressure reductions shall be computed for each application

prior to installation. Units shall be as manufactured by Golden-Anderson; Ross Valve or equal.

2.12 SOLENOID VALVES

A. Solenoid valves shall be bronze body, packless, full port area, globe type, with renewable composition disc seats. Valves shall be suitable for operation on 120V, 1 Ph, 60 Hz current and shall conform to the requirements of the Instrumentation Specification and shall be as manufactured by Automatic Switch Company, Gould "Vevetrol," or equal.

2.13 BACKFLOW PREVENTERS

A. Backflow preventer units of the reduced pressure type shall be furnished and installed on water lines where shown on the Contract Drawings. Each backflow preventer unit shall be a complete assembly consisting of two spring loaded check valves with a protection zone in between the check valves. This zone shall be controlled by diaphragm operated differential pressure relief valve. Low zone pressure shall open the differential valve to dissipate any water which might flow in a reverse direction through the downstream check. Test cocks shall be installed at each end of each check valve. Each unit shall be furnished complete with non-rising stem AWWA type gate valves at each end of the unit. Unit shall have 125 pound ANSI flanged ends and shall have a pressure rating of 150 psi. Body and working parts shall be bronze, brass and bronze trim. Provide drain line to floor drain.

B. Springs shall be stainless steel or plastic coated carbon steel. Backflow preventers shall be Wilkins Model 975XL (sizes ¾" to 2") and Wilkins Model 375ADA (for sizes 2 ½" to 10") as manufactured by Zurn Industries, Watts Model #909QT-S (sizes ¾" to 2"), Hersey/Beer Model 6C, or equal. The units shall meet all codes, New Jersey Department of Environmental Protection (NJDEP) requirements, and the local Water Company's approval.

2.14 MISCELLANEOUS SMALL VALVES, HYDRANTS, AND SPECIALTY ITEMS

A. The Contractor shall furnish and install miscellaneous small valves and hydrants where shown on the Drawings or mentioned in the Specifications.

B. The Contractor is advised that the general schedule appearing below may not contain each and every valve or specialty item required for all the various services and conditions encountered on this project. The schedule is intended to guide the Contractor as to the most probable types of small valves or specialties which would be needed to complete his work. The Contractor shall work with the Engineer in order to evaluate the requirements on a case by case basis.

C. All valves 2-1/2 inches and smaller shall have bronze bodies and threaded ends unless otherwise noted. They shall be designed for 150 psi service pressure.

D. All valves, hydrants and specialty valves shall be as manufactured by Walworth, DeZurik, Crane, Flowserve Anchor-Darling, Asco, Apco, Mueller, Clow **or equal**. They shall be furnished and installed as required to fulfill the intent of the Drawing and Specifications.

E. Insofar as practicable, valves and specialty items shall be furnished and installed for usage according to the following Schedule:

Type	Manufacturer and/or Model Number, or Equal	General Usage
Plug Valves	DeZurik	Individual air supplies
Gate Valves	Crane Model 429	Shut-off (non-throttling)
Globe Valves	Crane Model 7TF	Shut-off (throttling)
Needle Valves	Crane Figure 88	Fine Adjustment
Check Valves	Crane Model 27TF	Back Flow Prevention
Knife Gate Valves	De Zurik	Scum and grease
Solenoid Valves	ASCO as req'd	Automatic Control
Pressure Reducing Valves		
Pressure Regulating Pressure Reduction Valves	Watts 25AUB	Regulation W/Strainer
Safety Relief Valves	McDonnell & Miller	Over Pressure Safety
Air Release Valves	APCO Series 143C	Release of Air
Fire Hydrants	5-1/4" Mueller A-423	Fire Protection
Yard Hydrants	Eclipse - Model #2	Nonpotable or potable water
	Murdock – Model M-150	Local Usage
Interior Hose Bibbs	NIBCO Bronze Gate Valves	Air and Water Service, Furnish Each Valve with an Adapter to a Fit Universal Quick Hose Coupling
1-1/2" Flushing	DeZurik	Connections
Universal Quick Acting Couplings	Camlock Type 633	Flushing Connections
Float Valves	Watts Model	Seal Water Tank Level
Flow Indicators	Malema M-10000-32034-02.	Flow Indication
Curb Valve/Stop	Mueller	
PVC Pressure Relief	Plast-O-Matic	Valve Series RVT
Shear Gates Shut-off	M&H Fig. No. 44-02	
Pump Flap Valves Shut-off (gravity)	M&H Fig. No. 47-02	
Mud Valves Shut-off	M&H Fig. No. 140-02	

F. Heavy steel extension stems with adjustable cast iron couplings and bronze-bushed adjustable supports shall be provided and installed by the Contractor where required for convenient operation of valves. Extension stems shall be stainless steel where stems are subject to submergence or on buried valve applications. Extension stems shall be

mechanically attached to the valve stem/nut using stainless steel hardware. Floor boxes, cast in the concrete, shall be furnished where required and shall be of the bushing type.

G. Chain wheels shall be provided where shown on the Drawings or as specified, and shall be provided with deep flanges and teeth; chain guides; and the proper length of rustproof chain.

H. Floor stands, bench stands shall be provided with suitable structural supports or be mounted on concrete structures. They shall not be supported from gratings.

PART 3 - EXECUTION

3.01 INSTALLATION PROCEDURES

A. Valves shall be set plumb, and where required, shall be securely supported or hung. Valves shall be packed and adjusted prior to field tests and shall be left in good operating condition. Valves shall be painted to conform to adjoining piping. Valve boxes shall be positioned directly over the valves. After being correctly positioned for line and grade, the earth fill shall be carefully tamped around the valve box. The top of the box shall be set flush with pavement surfaces in paved areas and shall be one (1") inch above ground in grassed or earth areas. Valve boxes on buried valves shall be cleaned out; boxes shall be centered on operating nuts to permit free movement of valve keys.

B. Valve boxes shall be color-code painted in accordance with another division of these Specifications.

3.02 DATA TO BE SUBMITTED

A. The Contractor shall submit for approval, full data on all valves to be furnished, including dimension drawings showing details of construction and complete materials specifications.

3.03 GUARANTEE

A. All valves, specialties and appurtenances shall be guaranteed as to design, materials, and workmanship for a period of one (1) year from date of final acceptance.

3.04 VALVE TAGS

A. The Contractor shall furnish and install on every exposed valve a 1-1/2" square red plastic identification tag 3/32" thick with white incised numbers, accompanied by a heavy brass "S" hook, as manufactured by Seton Plate Company, Style 2960, or equivalent. Numbers shall correspond to those listed in the Valve Schedule. Where valve operators are not located at the valve itself, two tags shall be provided; one at the valve and the other at the point of operation. Tags shall not be attached to the valve operators or other moving parts.

- END OF SECTION -

SECTION 404113 - PROCESS PIPING HEAT TRACING

PART 1: GENERAL

1.01 WORK INCLUDED

This specification covers the requirements for materials and support services for electric heat-tracing systems supplied by the vendor. Neither the supply of the materials related to the connection of the power supply nor the installation of the entire system is part of this specification.

1.02 RELATED WORK

Section 40 42 23 – Pipe Insulation

1.03 SUMITTALS

A. Drawings and data of each pipe to be traced showing the following

1. Location of line and material.
2. All valves, flanges, equipment, pipe supports, instruments and other appurtenances.
3. Calculations showing design parameters and heat loss of line.
4. Electric loading.
5. Heat trace termination point.
6. Insulation thickness and type.
7. Catalog numbers for all components.
8. Required length of tracing for valves, flanges, equipment, pipe supports, instruments and other appurtenances based on manufacturers recommendations

B. Provide drawings for all required components as specified and as required to provide a complete system.

C. After installation provide a summary of the megger test values for each circuit

1.04 QUALITY ASSURANCE

The electric heat-tracing system shall conform to this specification. It shall be designed, manufactured, and tested in accordance with the applicable requirements of the latest edition of the following codes and standards.

FM Factory Mutual Research Corporation
IEEE 515 Institute of Electrical and Electronics Engineers
NEC U.S. National Electrical Code (NFPA 70)
NEMA National Electrical Manufacturers Association
NESC National Electrical Safety Code
UL 746B Underwriters Laboratories, Inc.
ANSI American National Standards Institute

1.04 DESIGN REQUIREMENTS

A. The Contractor shall be responsible for the complete design, fabrication, and installation of the electric heat trace system to include the following:

1. Sizing and selecting the heat tracing cable.
2. Heat output required for the fluid, pipe material and design conditions specified.
3. Preparing heat tracing drawings and submittals showing the location of each heat trace circuit, junction boxes.

PART 2: PRODUCTS

2.01 Self-Regulating Heating Cables

A. Self-regulating heating cable shall vary its power output relative to the temperature of the surface of the pipe or the vessel. The cable shall be designed such that it can be crossed over itself and cut to length in the field.

B. Self-regulating heating cable shall be designed for a useful life of 20 years or more with "power on" continuously, based on the following useful life criteria:

1. Retention of at least 75 percent of rated power after 10 years of operation at the maximum published continuous exposure (maintain) temperature.

2. Retention of at least 90 percent of rated power after 1000 hours of operation at the maximum published intermittent exposure temperature. The testing shall conform to UL 7468, IEC 216-1 Part 1.

C. All cables shall be warranted against manufacturing defects for a period of 10 years.

D. All cables shall be capable of passing a 2.5 kV dielectric test for one minute (ASTM 2633).

E. Pipe shall be heat traced with six (6) watts per foot of heat tracing. Fittings shall be traced with equivalent power heat tracing.

F. Heat tracing shall be compatible with schedule 80 PVC piping.

G. Freeze-Protection Systems.

1. The heating cable shall consist of two 16 AWG or larger nickel-plated copper bus wires, embedded in a self-regulating polymeric core that controls power output so that the cable can be used directly on plastic or metallic pipes. Cables shall have an unconditional temperature identification number (T-rating) of T6 (185°F or 85°C) without use of thermostats.

2. A ground-fault protection device set at 30 mA, with a nominal 100-ms response time, shall be used to protect each circuit. Each heat trace circuit shall be fed power from a 120 volt, 20-amp single pole circuit breaker.

3. Limit the lengths of the heat tracing circuits to limit the maximum single circuit capacity to 20 amps when starting the circuit at 40 degrees F.

4. The heating cable shall have a tinned-copper braid with a resistance less than the heating cable bus wire resistance as determined in type test (ASTM, B193, Sec. 5). The braid shall be protected from chemical attack and mechanical abuse by a modified polyolefin or fluoropolymer outer jacket.

5. The heating cable shall be BTV-CR or -CT self-regulating heating cable, with continuous exposure (maintain) capability up to 150°F (65°C) and intermittent exposure capability up to 185°F (85°C), as manufactured by Tyco Thermal Controls or equal Tyco Thermal Controls, 300 Constitution Drive, Menlo Park, CA 94025-1164,Tel (800) 545-6258, Fax (650) 474-7517, info@tycothermal.com, www.tycothermal.com.

H. Process-Temperature Maintenance With No Steam Exposure

1. The heating cable shall consist of two 16 AWG or larger nickel-plated copper bus wires, embedded in a self-regulating polymeric core that controls power output so that the cable has an unconditional temperature identification number (T-rating) of T4 (275°F or 135°C) without use of thermostats.

2. A ground-fault protection device set at 30 mA, with a nominal 100-ms response time, shall be used to protect each circuit.

3. The heating cable shall have a tinned-copper braid with a resistance less than the heating cable bus wire resistance as determined in a type test (ASTM, B193, Sec. 5). The braid shall be protected from chemical attack and mechanical abuse by a fluoropolymer outer jacket.

4. In order to confirm 2.01B, the self-regulating heating cable shall retain at least 90 percent of its original power output after having been cycled 300 times between 50°F (10°C) and 300°F (150°C), allowing at least six minutes of dwell time at each temperature.

5. The heating cable shall be QTVR-CT self-regulating heating cable, for continuous and intermittent exposure capability up to 225°F (110°C), as manufactured by Tyco Thermal Controls or equal.

2.02 Termination for Heating Cables

A. All connection components used to terminate heating cables, including power connectors, splices, tees, and connectors, shall be approved for the respective area classification and approved as a system with the particular type of heating cable in use. Under no circumstances shall terminations be used which are manufactured by a vendor other than the manufacturer of the heating cable.

B. In order to keep connections dry, components shall be rated NEMA 4X.

2.03 Thermostats and Contactors

A. Freeze-protection systems shall operate using self-regulating control or with the AMC-1A or AMC-F5 thermostat and the E104-100A or E304-40A contactor in ordinary areas, and AMC-1H thermostat with E307-40A contactor in hazardous locations, as supplied by Tyco Thermal Controls or equal.

2.04 Design Criteria

A. The following equipment shall require heat tracing and insulation.

1. All outdoor above grade pressurized process wastewater lines. Provide heat tracing down to 3 feet below grade.

B. Below are the design criteria for the heat tracing systems.

1. Minimum ambient temperature of –30 degrees F.

2. Maintain temperature of 40 degrees F.

3. Wind speed of 20 mph.

4. Safety factor of 10%.

C. The Contractor shall provide heat-tracing drawings using either hard copy or machine-readable CAD inputs.

D. Ambient air thermostats shall control all heat tracing circuits.

E. All splices and any other electrical connections shall be contained in junction boxes mounted external to the insulation.

2.05 Heat Traced Circuits

A. Each heat trace circuit shall be fed from a 20-amp single pole circuit breaker. An approximate list of the required circuits is shown below. Limit the length of the individual circuits to limit the single circuit capacity to 20 amps when starting the circuit at 40 degrees F. Add additional circuits to limit amp capacity to 20 as needed.

1. NPW Supply Pipe –above grade portion next to Administration Buildding – 6-inch

PART 3: EXECUTION

3.01 General

A. Install electric heat-trace system in strict accordance with manufacturer's instructions, local codes and recommended practices.

B. Ground metallic structures or materials used for support of heating cable or on which it is installed in accordance with local codes.

3.02 Heating Cable

A. Test with 500-volt insulation tester between each circuit and ground with neutral isolated from ground.

B. Insulation resistance: Minimum 1,000 megohms per 1,000 feet.

C. Install to maintain 40 degrees F pipe temperature when surrounding temperature is –30 degrees F for freeze protection.

D. Wrap and overlap heat trace on valves and other inline devices without burnout and to maintain freeze protection.

3.03 Components

A. Install in accordance with manufacturer's instructions and as shown on the contract drawings.

B. Install one thermostat for each individual circuit to sense ambient air temperature.

3.04 Field Support and Training

A. Furnish the services of a qualified field service engineer at the jobsite to assist with installation, inspection and certification of installation, system testing and startup, and training of Owner's personnel for equipment installed.

* * * * *

404213 - PROCESS PIPING INSULATION

PART 1: GENERAL

1.1 SCOPE OF WORK:

Extent of pipe insulation work shall be as shown on the plans. This specification shall apply to piping as indicated on the plans.

1.2 SUBMITTALS:

Submittals shall include product data for each type of pipe insulation identifying k-value, thickness, and accessories.

1.3 DELIVERY, STORAGE, AND HANDLING:

General Protection: Protect pipe insulation from physical damage and from becoming wet, soiled, or covered with ice or snow. Comply with manufacturer's recommendations for handling, storage, and protection during installation.

PART 2 : PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS:

Subject to compliance with requirements, provide products by one of the following, or equal:

A. Glass Fiber:

1. CertainTeed Corporation.
2. Knauf Fiberglass GmbH.
3. Manville.
4. Owens-Corning Fiberglass Corporation.
5. USG Interiors, Inc. - Thermafiber Division.

B. Fexible Elastomeric Cellular:

1. Armstrong World Industries, Inc.
2. Halstead Industrial Products.
3. IMCOA.
4. Rubatex Corporation.

C. Cellular Glass:

1. Pittsburgh Corning Corporation FOAMGLAS Insulation.

2.2 INSULATING MATERIALS:

A. Glass Fiber:

1. Material: Inorganic glass fibers, bonded with a thermosetting resin.

2. Jacket: All-purpose, factory-applied, laminated glass-fiber-reinforced, flame-retardant kraft paper and aluminum foil having self-sealing lap.

3. Preformed Pipe Insulation: ASTM C 547, Class 1, rigid pipe insulation, jacketed.

   a. Thermal Conductivity: 0.26 average maximum at 75 degrees F mean temperature.

   b. Density: 10 average maximum.

4. Vapor Barrier Coating: Waterproof coating to be as recommended by insulation manufacturer for outside service.

B. Flexible Elastomeric Cellular:

1. Material: Flexible expanded closed-cell structure with smooth skin on both sides.

2. Form: Tubular materials conforming to ASTM C 534, Type I.

3. Thermal Conductivity: 0.30 average maximum at 75 degrees F.

4. Coating: Water-based latex enamel coating as recommended by insulation manufacturer.

C. Cellular Glass:

1. Insulation: Cellular glass block insulation conforming to ASTM C552, "Specification for Cellular Glass Block and Pipe Thermal Insulation."

2. Jacketing: Flexible, resilient membrane waterproof against most soil and water conditions. PITTWRAP Jacketing by Pittsburgh Corning Corporation or equal.

3. Asphalt Coating: PITTCOTE 300 Finish, by Pittsburgh Corning Corp. (or equal).

4. Reinforcing Fabric: PC Fabric 79, by Pittsburgh Corning Corp. (or equal).

5. Strapping Tape: Glass fiber reinforced, 1" width, Scotch Brand #880 by 3M, or equal.

6. Bore Coating: Hydrocal B-11, by U.S. Gypsum, or equal.

7. High Temperature Sealant: Maximum temperature limit, 500 degree F. RTV 736 by Dow Corning Corporation, or equal.

D. Thickness: Thickness of insulation shall be at least as shown in the table below, as recommended by the manufacturer.

Nominal Pipe Diameter	Insulation Thickness
less than 6"	as recommended by manufacturer
6" - 8"	2.5"
10" - 12"	3.5"
greater than 12"	as recommended by manufacturer

2.3 ADHESIVES:

A. Adhesive for Glass Fiber Insulation:

1. Lagging Adhesive: MIL-A-3316C, nonflammable adhesive in the following Classes and Grades:

   a. Class 1, Grade A for bonding glass cloth and tape to unfaced glass fiber insulation, sealing edges of glass fiber insulation, and bonding lagging cloth to unfaced glass fiber insulation.

   b. Class 2, Grade A for bonding glass fiber insulation to metal surfaces.

2. Adhesive: Produced under the UL Classification and Follow-up service.

   a. Type: Nonflammable, solvent-based.

   b. Service Temperature Range: Minus 20 to 180 degrees F.

   B. Adhesive for Flexible Elastomeric Cellular Insulation: Solvent-based, contact adhesive recommended by insulation manufacturer.

2.4 JACKETS (as applicable to insulation type):

A. General: ASTM C 921, Type 1, except as otherwise indicated.

B. PVC: Proto Corporation 25/50 or Indoor/Outdoor, High-impact, UV-resistant fittings, 20-mils thick, jacketing and accessories, white or colored. Fitting cover system consists of pre-molded, high-impact PVC materials with fiber glass inserts. Fiber glass insert has a thermal conductivity ('K') of 0.26 at 75°F (ksi - 0.037 at 24°C).

   1. Closures: stainless steel tacks, matching PVC tape, or PVC adhesive per manufacturer's recommendations.

C. PVC Fitting Covers: Factory-fabricated fitting covers manufactured from 20-mil-thick, high-impact, ultra-violet-resistant PVC as specified in 2.4, B above.

   1. Adhesive: As recommended by insulation manufacturer.

D. Aluminum Jacket: ASTM B 209, 3003 Alloy, H-14 temper, roll stock ready for shop or field cutting and forming to indicated sizes.

1. Finish and Thickness: Smooth finish, 0.010 inch thick.

2. Moisture Barrier: 1-mil, heat-bonded polyethylene and kraft paper.

3. Elbows: Preformed 45-degree and 90-degree, short- and long-radius elbows, same material, finish, and thickness as jacket.

2.5 ACCESSORIES AND ATTACHMENTS (as applicable to insulation type):

A. Glass Cloth and Tape: Woven glass fiber fabrics, plain weave, presized a minimum of 8 ounces per sq. yd.

1. Tape Width: 4 inches.

2. Cloth Standard: MIL-C-20079H, Type I.

3. Tape Standard: MIL-C-20079H, Type II.

B. Bands: 3/4-inch wide, in one of the following materials compatible with jacket:

1. Galvanized Steel: 0.005 inch thick.

2. Aluminum: 0.007 inch thick.

3. Brass: 0.01 inch thick.

4. Nickel-Copper Alloy: 0.005 inch thick.

C. Wire: 14-gage nickel copper alloy, 16-gage, soft-annealed stainless steel, or 16-gage, soft-annealed galvanized steel.

2.6 SEALING COMPOUNDS (as applicable to insulation type):

A. Vapor Barrier Compound: Water-based, fire-resistive composition.

1. Water Vapor Permeance: 0.08 perm maximum.

2. Temperature Range: Minus 20 to 180 degrees F.

B. Weatherproof Sealant: Flexible-elastomer-based, vapor-barrier sealant designed to seal metal joints.

1. Water Vapor Permeance: 0.02 perm maximum.

2. Temperature Range: Minus 50 to 250 degrees F.

3. Color: Aluminum.

PART 3: EXECUTION

3.1 PREPARATION

A. Surface Preparation: Clean, dry, and remove foreign materials such as rust, scale, and dirt.

3.2 INSTALLATION, GENERAL (as applicable to insulation type):

A. Select accessories compatible with materials suitable for the service. Select accessories that do not corrode, soften, or otherwise attack the insulation or jacket in either wet or dry conditions.

B. Install vapor barriers on insulated pipes having surface operating temperatures below 60 degrees F.

C. Apply insulation material, accessories, and finishes according to the manufacturer's printed instructions.

D. Install insulation with smooth, straight, and even surfaces.

E. Seal joints and seams to maintain vapor barrier on insulation requiring a vapor barrier.

F. Seal penetrations for hangers, supports, anchors, and other projections in insulation requiring a vapor barrier.

G. Seal Ends: Except for flexible elastomeric insulation, taper ends at 45 degree angle and seal with lagging adhesive. Cut ends of flexible elastomeric cellular insulation square and seal with adhesive.

H. Apply adhesives and coatings at the manufacturer's recommended coverage-per-gallon rate.

I. Keep insulation materials dry during application and finishing.

J. Tightly butt longitudinal seams and end joints. Bond with adhesive.

K. Apply insulation continuously over fittings, valves, and specialties, except as otherwise indicated.

L. Apply insulation with a minimum number of joints.

M. Apply insulation with integral jackets as follows:

1. Pull jacket tight and smooth.

2. Cover circumferential joints with butt strips, at least 3-inches wide, and of same material as insulation jacket. Secure with adhesive and outward clinching staples along both edges of butt strip and space 4 inches on center.

3. Longitudinal Seams: Overlap seams at least 1-1/2 inches. Apply 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 4 inches on center.

a. Exception: Do not staple longitudinal laps on insulation applied to piping systems with surface temperatures at or below 35 degrees F.

4. Vapor Barrier Coatings: Where vapor barriers are indicated, apply on seams and joints, over staples, and at ends butt to flanges, unions, valves, and fittings.

5. At penetrations in jackets for thermometers and pressure gages, fill and seal voids with vapor barrier coating.

6. Repair damaged insulation jackets, except metal jackets, by applying jacket material around the damaged jacket. Adhere, staple, and seal. Extend the patch at least 2 inches in both directions beyond the damaged insulation jacket and around the entire circumference of the pipe.

N. Exterior Wall Penetrations: For penetrations of below grade exterior walls, terminate insulation flush with mechanical sleeve seal. Seal terminations with vapor barrier coating.

O. Interior Walls and Partitions Penetrations: Apply insulation continuously through walls and partitions, except fire-rated walls and partitions. Apply an aluminum jacket with a factory-applied moisture barrier over insulation. Extend 2 inches from both surfaces of wall or partition. Secure the aluminum jacket with metal bands at both ends. Seal the ends of the jacket with vapor barrier coating. Seal around penetration with joint sealer.

P. Fire-Rated Walls and Partitions Penetrations: Terminate insulation at penetrations through fire-rated walls and partitions. Seal insulation ends with vapor barrier coating. Seal around penetration with fire-stopping or fire-resistant joint sealer.

Q. Floor Penetrations: Terminate insulation at underside of floor assembly and at floor support at top of floor.

3.3 BELOW GROUND PIPE INSULATION INSTALLATION (as applicable to insulation type):

A. General: The following are additional requirements for insulation applied to piping installed below ground.

B. Terminate insulation at anchor blocks.

C. Apply insulation continuously through sleeves and manholes, except as specified above for exterior wall penetrations.

D. Finishing: Apply 3 coats of asphaltic mastic to a finish thickness of 3/16 inch over insulation jacket materials. Apply 10 x 10 mesh glass cloth between coats. Overlap edges of glass cloth by 2 inches.

3.4 GLASS FIBER INSULATION INSTALLATION:

A. Piping Insulation-Fiber Glass

1. Locate all seams in the least visible location.
2. Insulation installed on piping operating below ambient temperatures must have a continuous vapor retarder. All joints, seams and fittings must be sealed.
3. All ends must be firmly butted and secured with appropriate butt-strip material. On high-temperature piping, double layering with staggered joints may be appropriate. When double layering, the inner layer should not be jacketed.
4. Metal shields shall be installed between hangers or supports and the piping insulation. Rigid insulation inserts shall be installed as required between the pipe and the insulation shields. Inserts shall be of equal thickness to the adjacent insulation and shall be vapor sealed as required. Insulation inserts shall be no less than the following lengths:

1½" to 2½"	IPS	10"	long
3" to 6" IPS	12"	long	
8" to 10"	IPS	16"	long
12" and over	IPS	22"	long

5. For piping exposed in mechanical rooms or high traffic areas, insulation shall be protected from abuse by the use of appropriate thickness of PVC jacketing or metal jacketing.

3.5 FLEXIBLE ELASTOMERIC CELLULAR INSULATION INSTALLATION

A. Slip insulation on the pipe before making connections wherever possible. Seal joints with adhesive. Where the slip-on technique is not possible, cut one side longitudinally and apply to the pipe. Seal seams and joints with adhesive.

B. Valves, Fittings, and Flanges: Cut insulation segments from pipe or sheet insulation. Bond to valve, fitting, and flange and seal joints with adhesive.

1. Miter cut materials to cover soldered elbows and tees.

2. Fabricate sleeve fitting covers from flexible elastomeric cellular insulation for screwed valves, fittings, and specialties. Miter cut materials. Overlap adjoining pipe insulation.

3.6 JACKETS (as applicable to insulation type):

A. For piping exposed to the elements, jacketing shall be Outdoor Weatherable PVC with a minimum thickness of 0.020 inches, or 0.016 inches thick aluminum or stainless steel with a factory applied moisture barrier. Fitting covers shall be of similar materials. The insulation and jacketing shall be held firmly in place with a friction type Z lock or a minimum 2" overlap joint. All joints shall be sealed completely along the longitudinal seam and installed so as to shed water. All circumferential joints shall be sealed by use of preformed butt strips; minimum 2" wide or a minimum 2" overlap. Butt strips shall overlap the adjacent jacketing a minimum ½-inch and be completely weather sealed. PVC Jacketing shall be limited to a maximum 20-inch OD of the insulation when exposed to direct sunlight. A 6" to 10" unsealed slide joint shall be installed every 25 to 30 lineal feet for the thermal expansion of the pipe and jacketing. In addition, a thin bead of silicone grease may be applied in the overlap to prevent water migration while allowing the joint to slide. Where distance between fittings exceeds 8 lineal feet, an unsealed slide joint shall be installed. Insulation thickness for piping covered by PVC Jacketing shall be such that the surface temperature of the PVC does not exceed 125°F.

1. Seal openings, punctures, and breaks in vapor barrier jackets and exposed insulation with vapor barrier compound.

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