Project 19-048.2
Heating System Renovation at Port Administration Building

BIDDING DOCUMENTS
FOR
HEATING SYSTEM RENOVATION
AT
PORT ADMINISTRATION BUILDING

Key Dates:

**Mandatory Pre-Bid Meeting:** Thursday, June 6, 2019 at 10:00 a.m. at the Port Administration Building, 3460 North Delaware Avenue, Philadelphia PA, 19134. Attendees should check-in at the first-floor lobby area.

**Questions:** Questions must be in writing and should be sent to the attention of the Procurement Department at e-mail address procurement@philaport.com. Questions must be received by Thursday, June 13, 2019 at NOON.

**Bid Submission Deadline:** Bids will be received in the office of the Philadelphia Regional Port Authority Procurement Department, at 3460 N. Delaware Avenue, 2nd Fl., Philadelphia, PA 19134 until Thursday, June 27, 2019 at 2:00 PM.
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PART 1
INSTRUCTIONS TO BIDDERS

FOR

PHILADELPHIA REGIONAL PORT AUTHORITY

CONTRACTS

(Revised as of September 28, 2018)

FOR USE ONLY WITH INVITATIONS TO BID FOR CONSTRUCTION.
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FAILRE TO COMPLY WITH THESE INSTRUCTIONS MAY RESULT IN THE REJECTION OF THE BID AS NOT RESPONSIVE

Section 1 Work to be Performed:

The Work to be performed is described in the Contract Documents for the prime contractor contracts to be awarded on the Project. The Contract Documents may be inspected during regular business hours at the offices of PhilaPort, 3460 N. Delaware Avenue 2nd Floor Philadelphia, Pennsylvania 19134. During the bidding process, the Contract Documents are available on PhilaPort’s website www.philaport.com and can be accessed under the procurement tab. Presently there is no charge for obtaining a copy from the website. One or more copies of the Contract Documents may be obtained upon application to the Procurement Department by making a nonrefundable payment in the amount specified by PhilaPort for each set of Plans, Specifications, and Bidding Documents requested.

All contractors must be registered with the Vendor Data Management Unit (“VDMU”) of the Commonwealth of Pennsylvania if they wish to do business with PhilaPort. Registration may be done via the internet or via telephone and is required in order to be awarded a contract. VDMU will assign each contractor a vendor ID number which will be used to identify that contractor within the Commonwealth. Please use the following information to complete the vendor registration form, or to make changes to an existing vendor ID number:

Central Vendor Management Unit
Phone 717-346-2676
Toll Free 1-866-435-7363
Web Address: www.vendorregistration.state.pa.us

The Bidding Documents consist of the Notice to Bidders, these Instructions to Bidders, the Bid Form, the Certification Form, Bid Security, submissions related to PhilaPort’s Diversity Inclusion Policy and Plan, the Non-collusion Affidavit, and forms and submittals required by the Specifications or other Bidding or Contract Documents to be submitted with the Bid. The Contract Documents are identified in the General Conditions.

Section 2 Familiarity with Proposed Work:

A. The Bidder is responsible for examining the nature and location of the Work for the Project, including the Work of other prime contractors, the conformation of the ground, existing underground conditions and structures, the soil and rock conditions, all utilities, and the character, quality and quantity of the materials that will be required. The Bidder shall also examine the proposed Contract, including plans, specifications and all other documents and data pertaining to the Project, and has obtained all information on or before the submission of his Bid necessary for the submission of his Bid and the completion of the Work. After the award of the contract, the Contractor may not submit any claim alleging insufficient data, incorrectly assumed conditions, or misunderstanding of any kind related to the Project.
B. Bidders are required to comply with any and all access control requirements imposed at the site to gain entry. In addition, to gain access to PhilaPort facilities, Bidders are required to comply with the Maritime Security ("MARSEC") regulations requiring contractors entering PhilaPort facilities to have knowledge of, thorough training or equivalent job experience, in the following, as appropriate:

1. Relevant Provisions of the Facility Security Plan;

2. The meaning and consequential requirements of the different MARSEC levels as they apply to them, including emergency procedures & contingency plans;

3. Recognition and detection of dangerous substances and devices;

4. Recognition of characteristics and behavior patterns of persons who are likely to threaten security; and

5. Techniques used to circumvent security.

Each marine terminal maintains its own Facility Security Plan and Facility Security Officer. Due to the sensitive security information contained in such plans, they are not available for review. The Facility Security Officer for the terminal will brief you on relevant provisions of the Security Plan and application of the different MARSEC levels. Sections (3) (4) & (5) listed above apply to your operations and their interaction with the Port as a result of working on Port Facilities.

C. Any information obtained as a result of the Geotechnical testing ("Geotechnical Information") concerning subsurface materials or conditions was obtained by PhilaPort for the Engineer's use in designing the Project. This Geotechnical Information is included in the Specifications for the Project or, in the alternative, available to the Bidders upon request written. Bidder acknowledges that he may request Geotechnical Information.

The technical data found in the Geotechnical Information is represented to be accurate by PhilaPort, but the conclusions and inferences that may be found in or inferred from the Geotechnical Information is not warranted and the accuracy or completeness of any such conclusions and inferences is not guaranteed by PhilaPort. The Contractors must assume all responsibility in excavating for this Project and may rely only upon the factual subsurface information obtained from PhilaPort or Engineer.

Bidders shall make their own investigation of existing subsurface conditions. If Bidder desires to obtain additional information or data to supplement that which exists in the form of Geotechnical Information, Bidder shall make a written request for documents or for access to the site. PhilaPort will, to the extent reasonably feasible, afford the Bidder the opportunity, at Bidder’s own expense, to conduct additional tests and examinations and to make measurements and studies of all kinds; where PhilaPort cannot grant such rights, it will cooperate with Contractor in
endeavoring to secure such rights. The ground and existing structures shall be returned to its original condition as prior to testing. PhilaPort may require a bond to secure the restoration of the original conditions.

Before making any such excavations, borings or soundings, driving test piles, digging test pits on the Site, or undertaking any other examination of the subsurface thereof, the Bidder shall provide to PhilaPort proof of insurance that is satisfactory to PhilaPort. Bidder is responsible for field verifying locations of all existing utilities. Prior to excavation or earth moving, the Bidder is to contact PA One-Call to mark out locations of existing utilities.

D. The Work herein contemplated being public work, the Bidder acknowledges that no mechanics liens may be filed.

E. The Bidder acknowledges that, should Work to be performed be specified or indicated in more than one prime contract and no clarifications received by Addenda prior to Bid date, each Bidder so affected who is submitting a Bid shall consider the Work to be part of his contract. A subsequent determination will be made and an amount commensurate to the labor, material and equipment to be provided will be deducted from the Bidder determined not to be responsible.

F. The Bidder acknowledges that he has ascertained all governmental and utility requirements with respect to wage scales, materials, labor, safety and sanitation and shall base his Bid prices on full compliance therewith.

G. The Bidder acknowledges that he has familiarized himself with labor conditions which might affect or influence the performance of the Work.

H. The Bidder acknowledges that he was afforded the opportunity to attend and participate in the pre-bid meeting.

I. The Bidder acknowledges that he is fully aware of the Owner's status as a governmental entity in relation to this Project and the requirements of Applicable Laws generally, and those specifically related to certain exemptions from the application of sales and use taxes.

J. The Bidder acknowledges that the awarded Contractor on the Project is responsible for coordination of his own construction activities and for resolving coordination issues with his Subcontractors and any other prime contractors.

K. The Bidder acknowledges that he is aware and has been advised that the Contractor is solely responsible for initiating, maintaining and supervising all safety precautions and programs required under his portion of the Work and the Work of the Bidder’s Subcontractors and Sub-Subcontractors and that the Bidder has reviewed, evaluated and taken into consideration these requirements when submitting the Bid.

L. The Bidder acknowledges that he is aware and has been advised that his Subcontractors must be given the complete Bidding and Construction Documents for bidding purposes so as to ensure consistency and adherence to the Contract Documents, that the Bidder as Contractor is
responsible fully to the Owner for the performance of his Subcontractors and that the Bidder will require each Subcontractor, through legally enforceable written agreements, to meet all of the responsibilities with respect to any portion of the Work performed by any Subcontractor.

M. The Bidder acknowledges that he assumes all risks resulting from any changes in the conditions which may occur during the progress of the Work, subject to the right of any Contractor to recover from another Prime Contractor damages for interference and delay.

N. The Bidder has reviewed the scheduling requirements issued by and on behalf of the Owner and appearing on the Plans and in the Specifications and has to the extent appropriate incorporated the information set forth therein in preparing his Bid.

Section 3 Pre-Bid Conferences:

A. In the event PhilaPort chooses to conduct a mandatory pre-bid conference, notice of the time and location of such conference will either be provided in the Notice to Bidders, or in the “Notice to Bidders” on the cover page of the Specifications, mailed to each Bidder at the address provided to PhilaPort by the Bidders or posted on PhilaPort’s website. The failure of a Bidder to attend a mandatory pre-bid conference shall result in the Bidder’s Bid being rejected. Minutes taken at such a mandatory pre-bid conference will be maintained by PhilaPort and a copy of the minutes will be provided upon written request to PhilaPort.

B. In the event PhilaPort chooses to conduct an optional pre-bid conference, attendance is not mandatory and notice of the time and location of such conference will either be provided in the Notice to Bidders, or in the “Notice to Bidders” on the cover page of the Specifications, mailed to each Bidder at the address provided to PhilaPort by the Bidders or posted on PhilaPort’s website. Minutes taken at such an optional pre-bid conference will be maintained by PhilaPort and a copy of the minutes will be provided upon written request to PhilaPort.

Section 4 Interpretation of Contract Documents:

A. During the Bidding Phase, every request for interpretation shall be made in writing to the Director of Procurement. All written requests (“Requests for Interpretation”) related to the proposed Work or proposed Contract Documents must be received by the Director of Procurement at the offices of PhilaPort, no later than close of business ten (10) calendar days prior to the Bid Opening Date. If a request is received within ten (10) calendar days of the bid opening date, PhilaPort may, in its sole discretion, answer the request. Requests must be submitted by hand-delivery, courier, regular or expedited mail, or facsimile transmission. Requests sent via email will not be considered “written” requests.

B. BIDDERS ARE PROHIBITED FROM SEEKING ANY ORAL INTERPRETATION REGARDING THE MEANING OF THE BIDDING OR CONTRACT DOCUMENTS. ANY CONVERSATION BETWEEN A BIDDER AND PHILAPORT OR THE ENGINEER MAY NOT BE RELIED UPON BY ANY BIDDER, IS NOT BINDING UPON PHILAPORT AND SHALL NOT BECOME PART OF THE
CONTRACT DOCUMENTS. ONLY INFORMATION APPEARING IN WRITTEN BULLETINS ISSUED BY PHILAPORT OR ITS ENGINEER MAY BE RELIED UPON BY THE BIDDERS.

C. PhilaPort’s response to any Request for Interpretation will be in the form of a written Addendum or Bulletin signed by PhilaPort. PhilaPort will post all Addenda and Bulletins to its website at www.philaport.com and it shall be the responsibility of the Bidder to check for updates. The Bidder is responsible for all Addenda and Bulletins issued, whether or not reviewed. All addenda and Bulletins become a part of the Contract Documents, and all Bidders are bound by their provisions.

D. Whenever an item is defined in the Bidding or Contract Documents by trade name and catalogue number of a manufacturer or vendor, the term “or approved equal,” if not inserted therewith shall be implied. Any reference to a particular manufacturer’s product either by trade name or by limited description is solely for the purpose of more clearly indicating the minimum standard of quality desired, except where a “no substitute” is requested. When a “no substitute” is requested, PhilaPort will consider bids for the referenced product only. The term “or approved equal” is defined as meaning any other make which, in the sole opinion of the Engineer, is of such character, quality, and performance equivalence as to meet the standard of quality of products specified for which it is to be used equally as well as that specified.

E. A Bidder who wishes to (i) offer an alternate to the requested item or (ii) include a request for the Engineer to approve an equal, must submit a Request for Interpretation pursuant to Section A. above. The Request for Interpretation must include a complete description of the alternate or equal and must identify the product’s deviations from the specifications. For consideration of approved equals, the Request for Interpretation must include the (a) complete identification of the product the Bidder proposes to offer by trade name, brand and/or model number; (b) furnish descriptive literature and data with respect to the substitute product it proposes to furnish; and (c) indicate any known specification deviations from the referenced product. Upon receipt of the Request for Interpretation, the Engineer will determine whether the alternate or equal is acceptable. If the Engineer, in his discretion, determines that the alternate or equal is acceptable, the Director of Procurement will issue an addendum to the Bidding or Contract Documents revising the specification. If the alternate or equal is not accepted, there will be no addendum issued.

F. Unless otherwise specified in these Instructions to Bidder, all products offered by Bidders must be new or re-manufactured. A “new” product is one that will be used first by PhilaPort after it is manufactured or produced. A “re-manufactured” product is one which: 1) has been rebuilt, using new or used parts, to a condition which meets the original manufacturer’s most recent specifications for the item; 2) does not, in the opinion of the Engineer, differ in appearance from a new item; and 3) has the same warranty as a new item. Unless otherwise specified in this invitation for bids, used or reconditioned products are not acceptable. This clause shall not be construed to prohibit Bidders from offering products with recycled content, provided the product is new or remanufactured.

G. The Contractor awarded the Contract on the Project is required to pay Pennsylvania Sales
and Use Taxes and may claim an exemption only for some construction materials. To obtain exemptions for some of the construction materials, the Contractor must submit an application to the Pennsylvania Department of Revenue.

H. Should the Work require the use of Steel or Steel Products, Bidders shall note that only steel products produced in the United States of America shall be used. Bidders are required to familiarize themselves with the Commonwealth of Pennsylvania’s Act No. 1978-P.L.6 - No. 3, the Steel Procurement Act, as it pertains to this requirement.

I. The Director of Procurement is the single point of contact for the bidding on the Project. PhilaPort reserves the right to reject the Bid of a Bidder who violates this provision.

Section 5 Submission of Bids:

A. All Bids shall be submitted on forms prepared by PhilaPort. All entries on the Bid Form and Certification must be in ink or typewritten, preferably in blue ink to indicate an original writing.

B. All Base Bids will be considered as separate and distinct bids. If a base bid is left blank, PhilaPort will interpret this to mean the Bidder did not submit a bid on that base bid, but this will not invalidate any remaining Base Bids. The Bidder may not, however, withdraw a single base Bid when more than one Base Bid has been submitted. In this circumstance, if the Bidder wishes to withdraw any Base Bid, the Bidder must withdraw every Base Bid he submitted.

Section 6 Bid Requirements:

A. The Bid Form and Signature Page shall be filled out and completed and signed by each Bidder. The signature must be an ORIGINAL and HAND-SCRIPTED signature.

B. Every Bidder must complete and execute (including verification) with the Bid a Non-Collusion Affidavit.

C. All Bids must be sealed, marked, and delivered in accordance with the Notice and these Instructions to Bidders. Bids will be opened and read publicly promptly after the deadline for the submittal of Bids.

D. The failure to execute or complete a blank on the Bid Form shall cause the Bid to be rejected only if the amount of the base Bid or Bid for an Alternate or Unit Price cannot be determined. The failure of the Bidder to sign the Bid Form shall be conclusively treated as a nonresponsive Bid, and the Bid shall be rejected. The failure to attest to the signature made on behalf of a corporate Bidder or a Bidder which is Limited Liability Company shall not make the Bid nonresponsive.

E. The blanks provided for the entry of sums on the Bid Form shall permit the Bidder to enter his Bid in words, or in numerical figures, or in both words and numerical figures. In case
of discrepancy where both words and numerical figures are entered, the numerical figures shall control. No Bid shall be rejected solely by reason of the failure to enter sums in both words and numerical figures provided that a sum is ascertainable. If a sum is ascertainable, the Bid will conclusively be determined to be responsive.

G. All Bids should be regular in every respect. Interlineations, additions, excisions or conditions made or included in the completed Bid Form by the Bidder shall be disregarded and the Bid, if otherwise sufficient, shall be accepted. Only in the event that, notwithstanding the disregard of the interlineation, addition, excision or condition, the amount of the Base Bid or Bid for a Unit Price or an Alternate cannot be determined shall the Bid be rejected.

H. All requested Alternates shall be Bid. If an alternate price called for does not involve a change in price, the Bidder shall so indicate by writing "No Change", "None", "Zero", "0", "No cost", "N/A" or the equivalent of any of these entries, in the space provided. Bidders shall not be permitted to refuse to Bid on an Alternate, and the failure to enter a sum with the intention of refusing to Bid the Alternate shall be disregarded. The use of any of the above-identified entries, or the failure to enter an amount in the blank for an Alternate, shall be treated conclusively as a Bid of zero dollars for the Work described in the Alternate. The failure to indicate whether a sum inserted for an Alternate is an "add" or a "deduct" shall be treated conclusively as a deduction to the base Bid. The failure to make an entry for an Alternate shall not cause the Bid thereby to be made nonresponsive.

I. All requested Unit Prices for which estimated quantities have been provided in the Bid Form shall be bid. If the Unit Price Work will be performed at no cost to PhilaPort, the Bidder shall so indicate by writing "No Change", "None", "Zero", "0", "No cost", "N/A" or the equivalent of any of these entries, in the space provided. Bidders shall not be permitted to refuse to Bid on a Unit Price, and the failure to enter a sum with the intention of refusing to provide with his Bid the cost of the Unit Price Work shall be disregarded. The use of any of these entries, or the failure to enter an amount in the blank for Unit Price Work, shall be treated conclusively as a Bid of zero dollars for that Work. The failure to make an entry for a Unit Price with an estimated quantity shall not cause the Bid thereby to be made nonresponsive. Where an error is made in computing the extension of the per Unit Price to total price, the per Unit Price quoted shall govern.

J. All requested Unit Prices for which no estimated quantities are provided in the Bid Form shall also be bid. If the Unit Price Work will be performed at no cost to PhilaPort, the Bidder shall so indicate by writing "No Change", "None", "Zero", "0", "No cost", "N/A" or the equivalent of any of these entries, in the space provided. The use of any of these entries, or the failure to enter any of these entries or an amount in the blank for Unit Price Work shall be treated conclusively as a Bid of zero dollars for that Work.

K. In the event of a discrepancy between a Unit Price and an extended price, the lesser of (i) recalculation of the extended line based upon the Unit Price; and (ii) value of the extended line as written in the bid, shall govern. In such event, the extended price shall be divided by the estimated quantity for the Work or line item to arrive at a recomputed Unit Price which shall thereafter govern for purposes of payment. In the event the total bid price does not equal the
value of the sum of all the extended line prices, the total of the sum of the extended line prices shall govern (including any recomputed prices as set forth above).

L. The Bidder shall insert the Addenda by numbers in any spaces provided on the Bid Form. The Bidder shall ascertain, prior to submitting a Bid, that the Bidder has received all Bulletins and other Addenda issued. Bidder by the submission of the Bid, acknowledges conclusively that all Addenda properly issued are applicable and operative as a part of the Contract Documents. Failure of any Bidder to receive any Bulletin or Addenda as provided for herein shall not release such Bidder from the obligation of his Bid and the obligation to comply with the provisions of the Addenda. The failure to list one or more of the Addenda numbers on the Bid Form will not make the Bid nonresponsive.

M. The Bidder shall not condition, qualify or otherwise assert a stipulation of any kind in the Bid. Any condition, qualification or stipulation added to the Bid Form shall be disregarded and the Bid accepted as if the condition, qualification or stipulation did not appear. Only in the event that, notwithstanding the disregarding of the condition, qualification or stipulation, the amount of the base Bid or Bid for a Unit Price or an Alternate cannot be determined, shall the Bid be rejected.

N. Bids may be submitted by sole proprietors, partnerships, corporations, limited liability companies and forms of business organizations that are for the purposes of the contract a functional equivalent. Each Bidder must complete the Bid Form by entering the information requested, including for example the name of the Bidder, the name of the person signing the Bid, the Bidder’s business address with ZIP code.

O. Bids by sole proprietors must be signed by the individual proprietor and witnessed. Any fictitious name or name under which the sole proprietor trades must be stated.

P. Bids by partnerships must furnish the full name of one or more general partners, and must be signed in the partnership name by one or more general partners, followed by a listing of the names of all partners.

Q. Bids by corporations must be signed by the president of the corporation, a vice president of the corporation, or another corporate representative whose authority is established by an attached resolution. The signature of the representative must be witnessed and attested to by a secretary, assistant secretary, treasurer, assistant treasurer, or another corporate representative whose authority is established by an attached resolution. The Bid of a corporation does not require the affixing of the corporate seal. Any corporate resolutions attached to the Bid in order to establish the authority of a corporate representative may be dated as of the date of the Bid, or for a period of no more than one year prior thereto.

R. Bids by a Limited Liability Company or LLC, or equivalent form of business organization, must submit the Operating Agreement or similar documentation, establishing the authority of the representative who executes the Bid and the authority of the representative who attests to the validity of the signature.
S. When requested by PhilaPort, satisfactory evidence of the authority of the individual signing on behalf of the Bidder or attesting to the signature shall be furnished. The failure to furnish satisfactory evidence of the authority of the individual with three (3) business days of PhilaPort’s request, shall be conclusively treated as a deficiency requiring the rejection of the Bid.

Section 7 State of Incorporation:

As a precondition to the acceptance of any Bid tendered by any corporation not incorporated in the Commonwealth of Pennsylvania, or the Bid of any other form of business organization including, but not limited to, a sole proprietorship, a limited partnership or a limited liability company not domiciled in the Commonwealth, the corporation, limited liability company, limited partnership or sole proprietorship shall comply with any applicable Commonwealth requirements related to registration. If the Bidder is incorporated in a state other than Pennsylvania, the Bidder must state whether the corporation is registered to do business in Pennsylvania. If the Bidder operates under an assumed or fictitious name, the Bidder must state whether such name has been registered in Pennsylvania. The administration of these requirements is through the Pennsylvania Department of State, Corporation Bureau, 206 North Office Building, Harrisburg, PA 17120, telephone (717) 787-1057, facsimile (717) 783-2244.

Section 8 Award to a Foreign Corporation:

No contract will be awarded to a Bidder which is a foreign (out-of-state or non-US) corporation or which is operating under a fictitious or assumed name unless the Bidder has complied with, or agreed to comply with, the registration requirements under the laws of Pennsylvania.

Section 9 Bid Guaranty:

A. All bids shall be accompanied by a certified bank treasurer’s or cashier’s check drawn in favor of the “Philadelphia Regional Port Authority” or “PhilaPort” in an amount equal to ten percent (10%) of the gross amount of the Base Bid, excluding Alternates and including Unit Price Work for which estimated quantities have been provided unless a different specific amount has been established by PhilaPort and set forth in the Bidding Documents. A bid bond from a surety company authorized to business in the Commonwealth is also acceptable.

B. For purposes of estimating the amount of the security, the amount of labor and the quantities of materials or supplies to be furnished, must be consistent and in accordance with the estimated quantities required to perform the Work of the Base Bid in the Contract Documents. PhilaPort shall not be bound by such estimates of the quantities of labor, materials or supplies required to be furnished under the Contract.

C. When bids are opened and the lowest responsible and responsive Bidder has been determined, PhilaPort within thirty (30) calendar days shall return the security provided by the Bidders except for the security submitted by the two apparent lowest responsive and responsible
Bidders. The security of these two Bidders, except where forfeiture of security is required, will be returned upon the execution of all Contract Documents by the lowest responsible Bidder. In the event the contract is not awarded by PhilaPort, the bid guaranty of these two Bidders will be returned on or about the sixty (60) days after the date of bid opening, unless the time for awarding the Bid has been extended by the Bidders or by operation of law.

Section 10 Timely Delivery of Bids:

The Bidder must submit his Bid to PhilaPort prior to the time scheduled for bid opening, regardless of the method of delivery used. Any Bid received after the time set for the bid opening will be rejected and, to the extent practicable, returned to the Bidder without being considered by PhilaPort.

Section 11 Delivery of Bid in Clearly Marked Envelope:

Each Bid shall be sealed in an envelope. The envelope shall be addressed to the address for receiving Bids noted in the “Notice to Bidders,” whether hand-delivered, delivered by regular or registered mail, delivered by a commercial or express-type courier, or delivered by other means. Facsimile or internet email transmission of Bids is not acceptable and all such Bids shall be disregarded. All Bids shall be enclosed in a sealed envelope and marked plainly on the outside with the bid number, bid description, and bid opening date. If the bid envelope is to be enclosed in another envelope for the purpose of express-type delivery, the exterior envelope shall be clearly marked as a bid and the bid number, bid description, and bid opening date shall be shown on the envelope.

Section 12 Withdrawal or Modification of a Bid Prior to Bid Opening:

A. Complete Withdrawal Before Date and Time. Subject to the provisions of Section 5.B, a Bid may be withdrawn by written notice or in person by a Bidder or his authorized representative (if their identity is established by photographic identification and proof of authorization, preferably on Bidder letterhead) and a receipt for the Bid is signed prior to the exact hour and date set for the opening of bids.

B. Modification Before Bid Date or Time of a Bid Already Submitted But Not Opened. If, before the time of the bid opening, a Bidder wishes to modify a Bid already delivered to PhilaPort, the Bidder’s authorized representative (if their identity is made known through photographic identification and proof of authorization) may request that PhilaPort return the Bid, but only if the Bidder’s representative signs a receipt for the Bid before the exact hour and date set for the opening of bids. The Bidder may then modify the Bid and resubmit the Bid so long as the modified Bid complies with the requirements set forth in these instructions to Bidders. PhilaPort will not, under any circumstances, open a Bid before the bid opening date and time.
Section 13  Bid Opening Procedure:

Bids will be opened and read aloud publicly at the time and place designated in the Notice to Bidders.

No inspection or photocopies of any Bid will be made at the bid opening. The amount of each Bid, together with the name of each Bidder will be recorded. Such recorded information shall be considered unofficial and shall be open to public inspection at the bid opening.

The bid tabulation, listing the Bidders and their bid amount, will formally be made available to interested parties within ten (10) days of the opening.

Section 14  Rejection of Bid Proposal:

PhilaPort reserves the right to reject any or all bids or parts thereof for failure to meet the requirements of these Instructions to Bidders or any other requirements set forth in the Bidding Documents. A Bid which reflects or shows an omission, alterations of form, additions or deductions not called for, conditional bid or uninvited alternate, or irregularities of any kind shall not be rejected but instead the irregularity shall be disregarded. PhilaPort reserves the right to waive technical defects or irregularities on bids as set forth in these Instructions to Bidders.

Section 15  Withdrawal of Bids after Bid Opening:

Within two (2) days after the opening of the bids, but before award, a Bidder may request permission to withdraw his Bid if it submits a request, in writing, to PhilaPort. The request must be addressed to the Director of the Procurement, Philadelphia Regional Port PhilaPort, 3460 N. Delaware Avenue, Philadelphia, PA 19134. The request may be hand-delivered, emailed to kbailey@philaport.com, or faxed to the same official at (215) 426-6800. The request will not be considered received unless it is delivered as set out in this Section and includes evidence that the requested withdrawal is consistent with the requirements of the Bid Withdrawal Act.

Section 16  Experience Questionnaire and Financial Statement Provided On Request:

At PhilaPort’s request, or if specifically required by the Bidding Documents, Bidders shall file an experience questionnaire on the form provided by PhilaPort and an audited financial statement. The questionnaire and statement shall be certified to be true and correct by an affidavit sworn to or affirmed before a Notary Public, or other empowered or administer oaths or affirmations. Falsification of any requested information or documentation shall result in a determination that the Bidder is not responsible, forfeiture of the bid bond and cancellation of any contract award. The Bidder must make a good-faith effort at providing complete information in response to the questions. A Bidder will be disqualified on the ground of nonresponsiveness if the effort at completing the form is substantially incomplete or demonstrates bad faith. The failure to furnish the original questionnaire or to respond to specific inquiry from PhilaPort within three (3) business days of PhilaPort’s request shall conclusively disqualify a Bidder. An apparent low
Bidder shall upon request submit the most recent audited financial statement or, if an audited financial statement is unavailable, a financial statement prepared after a compilation or review, within three (3) days of PhilaPort’s request.

Section 17 Requests for Additional And Corrected Information:

A. Evaluation of Responsibility. In evaluating the Bid Proposal Form, in addition to price, PhilaPort may consider completion time, Bidder’s experience, past record of Bidder in meeting commitments and any other general factors that may be deemed pertinent to the Bidder’s responsibility as a contractor and the best interests of PhilaPort. PhilaPort reserves the right to request Bidder to provide additional information prior to award of contract.

B. Evaluation of Responsiveness. The failure to execute or complete a blank on the Bid Form shall cause the Bid to be rejected only if the amount of the base Bid or a Unit Price cannot be determined. The failure of the Bidder to sign the Bid Proposal Form shall be conclusively treated as a nonresponsive Bid, and the Bid shall be rejected. The failure to attest to the signature made on behalf of a corporate Bidder or a Bidder which is Limited Liability Company shall not make the Bid nonresponsive.

C. Conditioned Bid. The Bidder shall not condition, qualify, or otherwise assert a stipulation of any kind in the Bid. Any condition, qualification or stipulation added to the Bid and Certification Form shall be disregarded and the Bid accepted as if the condition, qualification or stipulation did not appear. Only in the event that, notwithstanding the disregarding of the condition, qualification or stipulation, the amount of the Base Bid cannot be determined shall the Bid be rejected.

D. Incomplete and Insufficient Submittals. Provided that the integrity of the amounts of the Base Bid, Alternatives, and Unit Prices are not compromised, the failure of the Bidder to submit with his completed and executed Bid and Certification Form, (1) a document required by these Instructions, including but not limited to a Non-Collusion Affidavit, (2) documents required to establish participation in an approved Apprenticeship Program, (3) documents otherwise required to be included with the Bid, or to provide a complete document, shall be conclusively treated as an irregularity which, in the discretion of PhilaPort may be ignored and the Bid accepted, provided that the omitted document or missing portion of the document is submitted after the Bid within three (3) days of written notice from PhilaPort of the deficiency and of the opportunity to cure. In the event the Bidder fails, refuses or neglects to submit any requested information within the three (3) business days of the request, Bidder’s bid guaranty may be forfeited to the use of PhilaPort.

Section 18 Collusive Bids Will Be Rejected:

The Bids of any Bidder or Bidders who engage in collusive bidding will be rejected. Any Bidder who submits more than one Bid in such manner as to make it appear that the bids submitted are on a competitive basis from different parties will be considered a collusive Bidder. Submission of collusive bids will result in a Bidder being rejected as not responsible for subsequent projects.
Nothing in this Section prevents a Bidder from superseding a Bid by submitting a subsequent Bid, delivered prior to the bid opening, which expressly revokes the previous Bid.

Section 19 Bid Protest Procedure:

The Commonwealth Procurement Code (62 P.C. § 1711.1, as amended) governs the protest procedure, which is summarized below. In the event this general description conflicts with the statute, the statutory language controls.

A. Who may File: Any Bidder or prospective Bidder who is aggrieved in connection with the bid or the award of a contract resulting from the bid may file a protest.

1. Prospective Bidder is an entity that has not submitted a Bid in response to the Notice to Bidders.

2. Bidder is an entity that has submitted a Bid in response to the Notice to Bidders.

B. Time Limits.

1. If a protest is filed by a Prospective Bidder, a protest must be filed, in writing, with the Executive Director of PhilaPort prior to the bid opening date and time described in the Notice to Bidders.

2. If a protest is filed by a Bidder, the protest must be filed, in writing, with the Executive Director of PhilaPort within seven (7) days after the protesting Bidder knew or should have known of the facts giving rise to the protest except in no event may a protest be filed later than seven (7) days after the Notice of Award is posted on PhilaPort (www.philaport.com) website.

3. Filed – shall be defined as the date upon which the Executive Director of PhilaPort receives the written protest.

4. If the Bidder fails to file a bid protest or files an untimely protest, the he shall be deemed to have waived the right to protest the solicitation or award of the contract in any forum. Untimely protests will be disregarded by PhilaPort.

C. PhilaPort may cancel an invitation for bids or may reject all bids at any time prior to the time a contract is executed by all parties when it is in the best interests of PhilaPort. The Bidder may not submit a protest relating to cancellation of the bid or rejection of all bids.

D. A protest shall state all grounds upon which the protestant asserts the solicitation or award of the contract was improper. The protestant may submit with the protest any documents or information it deems relevant to the protest.
E. The full text of the Bid Protest Procedure can be found at 62 Pa. C.S. § 1711.1 et seq.

Section 20 Bidder Certified Not Under Debarment:

The Bidder must certify following award and in conjunction with the execution of the Contract that he is not currently under suspension or debarment by the Commonwealth, any other state, or the federal government, and if the Bidder cannot so certify, then the Bidder agrees to submit along with the Bid a written explanation of why such certification cannot be made and why the award may nevertheless be made.

Section 21 Subcontract with Debarred or Suspended Firm:

If the successful Bidder enters into subcontracts or employs any subcontractors or individuals who are currently suspended or debarred by the Commonwealth or the federal government or who become suspended or debarred by the Commonwealth or federal government during the term of this contract or any extensions or renewals thereof, PhilaPort shall have the right to require the Contractor to terminate such subcontract or employment.

Section 22 Reimbursement of Costs of Inspector General Investigation:

The Contractor shall reimburse PhilaPort and any other Commonwealth agency for the reasonable costs of investigation incurred by the Office of Inspector General for investigations of the Contractor’s compliance with the terms of this or any other agreement between the Contractor and PhilaPort which result in the suspension or debarment of the Contractor. Such costs shall include, but not be limited to, salaries of investigators, including overtime; travel and lodging expenses; and expert witness and documentary fees. The Contractor shall not be responsible for investigative costs for investigations which do not result in the Contractor’s suspension or debarment.

Section 23 Current List of Suspended and Debarred Contractors:

The Bidder may obtain a list of suspended and debarred contractors by referring to the Department of General Services website:

https://www.dgs.internet.state.pa.us/debarment_list/

or by contacting DGS:

Department of General Services  
Office of Chief Counsel  
603 North Office Building  
Harrisburg, Pennsylvania 17125  
Telephone No. (717) 783-6472
The Bidder may also secure a list of suspended and debarred contractors from the Department of Labor and Industry website:

http://www.portal.state.pa.us/portal/server.pt?open=514&objID=553544&mode=2

or by contacting L&I:

Department of Labor & Industry
Office of Chief Counsel
10th Floor
Labor & Industry Building
Harrisburg, PA 17120
Telephone No. (717) 787-4186
Fax No. (717) 787-1303

**Section 24 Assignment of Antitrust Claims:**

The Contractor and PhilaPort recognize that, in actual economic practice, overcharges by the Contractor’s suppliers, resulting from the violations of State or Federal antitrust laws, are, in fact, borne by PhilaPort. As part of the consideration for the award of this contract, and, intending to be legally bound, the Contractor assigns to PhilaPort all right, title and interest in, and to, any claims contractor now has, or may hereafter acquire, under State or Federal antitrust laws relating to the goods or services which are the subject of this contract.

**Section 25 Contractor Integrity Provisions:**

It is essential that those who seek to contract with PhilaPort observe high standards of honesty and integrity. They must conduct themselves in a manner that fosters public confidence in the integrity of PhilaPort and Commonwealth procurement processes.

In furtherance of this policy, Contractor agrees to the following:

1. Contractor shall maintain the highest standards of honesty and integrity during the performance of this contract and shall take no action in violation of state or federal laws or regulations or any other applicable laws or regulations, or other requirements applicable to Contractor or that governs contracting with PhilaPort or the Commonwealth.

2. Contractor shall establish and implement a written business integrity policy, which includes, at a minimum, the requirements of these provisions as they relate to Contractor employee activity with PhilaPort, the Commonwealth and Commonwealth employees, and which is distributed and made known to all Contractor employees.
3. Contractor, its affiliates, agents and employees shall not influence, or attempt to influence, any Commonwealth employee to breach the standards of ethical conduct for Commonwealth employees set forth in the Public Official and Employees Ethics Act, 65 Pa.C.S. §§ 1101 et seq.; the State Adverse Interest Act, 71 P.S. §776.1 et seq.; and the Governor’s Code of Conduct, Executive Order 1980-18, 4 Pa. Code § 7.151 et seq.; or to breach any other state or federal law or regulation.

4. Contractor, its affiliates, agents and employees shall not offer, give, or agree or promise to give any gratuity to a Commonwealth official or employee or to any other person at the direction or request of any Commonwealth official or employee.

5. Contractor, its affiliates, agents and employees shall not offer, give, or agree or promise to give any gratuity to a Commonwealth official or employee or to any other person, the acceptance of which would violate the Governor’s Code of Conduct, Executive Order 1980-18, 4 Pa. Code § 7.151 et seq. or any statute, regulation, statement of policy, management directive or any other published standard of the Commonwealth or PhilaPort ethics policy.

6. Contractor, its affiliates, agents and employees shall not, directly or indirectly, offer, confer, or agree to confer any pecuniary benefit on anyone as consideration for the decision, opinion, recommendation, vote, other exercise of discretion, or violation of a known legal duty by any Commonwealth official or employee.

7. Contractor, its affiliates, agents, employees, or anyone in privity with him or her shall not accept or agree to accept from any person, any gratuity in connection with the performance of Work under the contract, except as provided in the contract.

8. Contractor shall not have a financial interest in any other contractor, subcontractor, or supplier providing services, labor, or material on this project, unless the financial interest is disclosed to PhilaPort and Commonwealth in writing and PhilaPort and Commonwealth consent to Contractor’s financial interest prior to PhilaPort’s execution of the contract. Contractor shall disclose the financial interest to PhilaPort and Commonwealth at the time of bid or proposal submission, or if no bids or proposals are solicited, not later than Contractor’s submission of the contract signed by Contractor.

9. Contractor, its affiliates, agents and employees shall not disclose to others any information, documents, reports, data, or records provided to, or prepared by, Contractor under this contract without the prior written approval of PhilaPort, except as required by the Pennsylvania Right-to-Know Law, 65 P.S. §§ 67.101-3104, or other applicable law or as otherwise provided in this contract. Any information, documents, reports, data, or records secured by Contractor from PhilaPort or a third party in connection with the performance of this contract shall be kept confidential unless disclosure of such information is:

a. Approved in writing by PhilaPort prior to its disclosure; or
b. Directed by a court or other tribunal of competent jurisdiction unless the contract requires prior PhilaPort approval; or

c. Required for compliance with federal or state securities laws or the requirements of national securities exchanges; or

d. Necessary for purposes of Contractor’s internal assessment and review; or

e. Deemed necessary by Contractor in any action to enforce the provisions of this contract or to defend or prosecute claims by or against parties other than PhilaPort or Commonwealth; or

f. Permitted by the valid authorization of a third party to whom the information, documents, reports, data, or records pertain; or

g. Otherwise required by law.

10. Contractor certifies that neither it nor any of its officers, directors, associates, partners, limited partners or individual owners has been officially notified of, charges with, or convicted of any of the following and agrees to immediately notify PhilaPort contracting officer in writing if and when it or any officer, director, associate, partner, limited partner or individual owner has been officially notified of, charges with, convicted of, or officially notified of a governmental determination of any of the following:

a. Commission of embezzlement, theft, forgery, bribery, falsification or destruction of records, making false statements or receiving stolen property.

b. Commission of fraud or a criminal offense or other improper conduct or knowledge of, approval of or acquiescence in such activities by Contractor or any affiliate, officer, director, associate, partner, limited partner, individual owner, or employee or other individual or entity associated with:

   (1) Obtaining;

   (2) Attempting to obtain; or

   (3) Performing a public contract or subcontract.

   Contractor’s acceptance of the benefits derived from the conduct shall be deemed evidence of such knowledge, approval or acquiescence.

c. Violation of federal or state antitrust statutes.

d. Violation of any federal or state law regulating campaign contributions.

e. Violation of any federal or state environmental law.
f. Violation of any federal or state law regulating hours of labor, minimum wage standards or prevailing wage standards; discrimination in wages; or child labor violations.

g. Violation of the Act of June 2, 1915 (P.L. 736, No. 338), known as the Workers’ Compensation Act, 77 P.S. § 1 et seq. or the Longshore and Harbor Workers’ Compensation Act, 33 U.S.C § 901 to 950.

h. Violation of any federal or state law prohibiting discrimination in employment.

i. Debarment by any agency or department of the federal government or by any other state.

j. Any other crime involving moral turpitude or business honesty or integrity.

Contractor acknowledges that PhilaPort may, in its sole discretion, terminate the contract for cause upon such notification or when PhilaPort otherwise learns that Contractor has been officially notified, charged, or convicted.

11. If this contract was awarded to Contractor on a non-bid basis, Contractor must, (as required by Section 1641 of the Pennsylvania Election Code) file a report of political contributions with the Secretary of the Commonwealth on or before February 15 of the next calendar year. The report must include an itemized list of all political contributions known to Contractor by virtue of the knowledge possessed by every officer, director, associate, partner, limited partner, or individual owner that has been made by:

a. Any officer, director, associate, partner, limited partner, individual owner or members of the immediate family when the contributions exceed an aggregate of one thousand dollars ($1,000) by any individual during the preceding year; or

b. Any employee or members of his immediate family whose political contribution exceeded one thousand dollars ($1,000) during the preceding year.

To obtain a copy of the reporting form, Contractor shall contact the Bureau of Commissions, Elections and Legislation, Division of Campaign Finance and Lobbying Disclosure, Room 210, North Office Building, Harrisburg, PA 17120.

12. Contractor shall comply with requirements of the Lobbying Disclosure Act, 65 PA.C.S. § 13A01 et seq., and the regulations promulgated pursuant to that law. Contractor employee activities prior to or outside of formal PhilaPort and Commonwealth procurement communication protocol are considered lobbying and subjects the Contractor employees to the registration and reporting requirements of the law. Actions by outside lobbyists on Contractor’s behalf, no matter the procurement stage, are not exempt and must be reported.
13. When Contractor has reason to believe that any breach of ethical standards as set forth in law, the Governor’s Code of Conduct, or in these provisions has occurred or may occur, including but not limited to contact by a Commonwealth officer or employee which, if acted upon, would violate such ethical standards, Contractor shall immediately notify PhilaPort contracting officer or Commonwealth Inspector General in writing.

14. Contractor, by submission of its bid or proposal and/or execution of this contract and by the submission of any bills, invoices or requests for payment pursuant to the contract, certifies and represents that it has not violated any of these contractor integrity provisions in connection with the submission of the bid or proposal, during any contract negotiations or during the term of the contract.

15. Contractor shall cooperate with the Office of Inspector General in its investigation of any alleged Commonwealth employee breach of ethical standards and any alleged Contractor non-compliance with these provisions. Contractor agrees to make identified Contractor employees available for interviews at reasonable times and places. Contractor, upon the inquiry or request of the Office of Inspector General, shall provide, or if appropriate, make promptly available for inspection or copying, any information of any type or form deemed relevant by the Inspector General to Contractor’s integrity and compliance with these provisions. Such information may include, but shall not be limited to, Contractor’s business or financial records, documents or files of any type or form that refers to or concern this contract.

16. For violation of any of these Contractor Integrity Provisions, PhilaPort may terminate this and any other contract with Contractor, claim liquidated damages in an amount equal to the value of anything received in breach of these provisions, claim damages for all additional costs and expenses incurred in obtaining another contractor to complete performance under this contract, and debar and suspend Contractor from doing business with the Commonwealth. These rights and remedies are cumulative, and the use or non-use of any one shall not preclude the use of all or any other. These rights and remedies are in addition to those PhilaPort may have under law, statute, regulation, or otherwise.

17. For purposes of these Contractor Integrity Provisions, the following terms shall have the meanings found in this Paragraph 17.

   a. “Confidential information: means information that a (is not already in the public domain; b) is not available to the public upon request; c) is not or does not become generally known to Contractor from a third party without an obligation to maintain its confidentiality; d) has not become generally known to the public through act or omission of Contractor; or e) has not been independently developed by Contractor without the use of confidential information of PhilaPort or Commonwealth.

   b. “Consent” means written permission signed by a duly authorized officer or employee of PhilaPort, provided that where the material facts have been disclosed, in writing by pre-qualification, bid, proposal or contractual terms,
PhilaPort shall be deemed to have consented by virtue of execution of this contract.

c. “Contractor” means the individual or entity that has entered into this contract with PhilaPort, including those directors, officers, partners, managers, and owners having more that a five percent interest in Contractor.

d. “Financial interest” means:

(1) Ownership of more than a five percent interest in any business; or

(2) Holding a position as an officer, director, trustee, partner, employee, or holding any position of management.

e. “Gratuity” means tendering, giving or providing anything of more that nominal monetary value including, but not limited to, cash, travel, entertainment, gifts, meals, lodging, loans, subscriptions, advances, deposits of money, services, employment, or contracts of any kind. The exceptions set forth in the Governor’s Code of Conduct, Executive Order 1980-18, the 4 Pa. Code § 7.153 (b), shall apply.

f. “Immediate family” means a spouse and any unemancipated child.

g. “Non-bid basis” means a contract awarded or executed by PhilaPort with Contractor without seeking bids or proposals from any other potential Bidder or offeror.

h. “Political contribution” means any payment, gift subscription, assessment, contract, payment for services, dues, loan, forbearance, advance or deposit of money or any valuable thing, to a candidate for public office or to a political committee, including but not limited to a political action committee, made for the purpose of influencing any election in the Commonwealth of Pennsylvania or for paying debts incurred by or for a candidate or committee before or after any election.

Section 26 Product Discrimination:

A. Reciprocal Limitations Act.


i. In the award of contracts, exceeding $10,000, for the erection, construction, alteration, improvement or repair of any building or public work, or the purchase or lease of any goods, supplies, equipment, printing or materials, to give resident Bidders a preference against nonresident Bidder from any state that gives or requires a preference to Bidders
from that state. The amount of preference shall be equal to the amount of the preference applied by the state of the nonresident Bidder. A resident Bidder is a person, partnership or corporation or other business entity authorized to transact business within Pennsylvania and having a bona fide establishment for transacting business within Pennsylvania at which it was transacting business on the date when bids for the public contract were first solicited.

ii. In the erection, construction, alteration, improvement or repair of any public building or other public work, and in all purchases of goods, supplies, equipment, printing or materials, not to specify, use or purchase any goods, supplies, equipment, printing or materials which are produced, manufactured, mined, grown or performed in any state that prohibits the specification for use, or purchase of such items in or on its public buildings or other works, when such items are not produced, manufactured, mined, grown or performed in such state.

2. List of Discriminating States.

i. States which apply preference favoring in-state Bidders and the amount of such preference, (that may affect this contract), as found by the Department of General Services:

<table>
<thead>
<tr>
<th>STATE</th>
<th>PREFERENCE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arizona</td>
<td>5% (construction material from Arizona resident dealers only)</td>
</tr>
<tr>
<td>Montana</td>
<td>3%</td>
</tr>
<tr>
<td>West Virginia</td>
<td>2.5% for construction, repair improvement of any buildings.</td>
</tr>
<tr>
<td>Wyoming</td>
<td>5%</td>
</tr>
</tbody>
</table>

ii States which prohibit the use of out-of-state goods, supplies, equipment, materials or printing and the prohibition (that may affect this contract), as found by the Department of General Services:

<table>
<thead>
<tr>
<th>STATE</th>
<th>PREFERENCE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Georgia</td>
<td>Forest Products only</td>
</tr>
<tr>
<td>Indiana</td>
<td>Coal</td>
</tr>
<tr>
<td>New Jersey</td>
<td>For Bidders for the following items: major household appliances, chain link fence, portable sanitation units, glass, glazier supplies, storage batteries, carpet and cushion, shades, room air conditioning, electrical supplies, plumbing supplies, hardware supplies, fasteners,</td>
</tr>
</tbody>
</table>
lumber, building supplies, audio-visual/video equipment, fire extinguishers, fire hose, motor oils, fuel oil, photographic supplies, Venetian blinds, drapes, paper towel dispensers, water hose

New Mexico Construction


In calculating the preference for purposes of determining the low Bidder, the amount of a bid submitted by Commonwealth resident Bidder shall be reduced by the percentage preference which would be given to a nonresident Bidder by its state of residence. Similarly, the amount of a bid offering Pennsylvania goods, supplies, equipment, materials and printing shall be reduced by the percentage preference which would be given to another Bidder by the state where the goods, supplies, equipment, materials or printing are produced, manufactured, mined, grown or performed.


It has been the policy of the Commonwealth not to purchase any supplies, equipment or materials manufactured in any foreign country which prohibits the specification for or use of supplies, equipment or materials manufactured in Pennsylvania.

a. Many world trading countries, directly or indirectly by statute, regulation, policy, procedure or practice, grant or bestow a preference for supplies, equipment or materials manufactured in their country, thereby discriminating against the use of supplies, equipment or materials manufactured in the Commonwealth.

b. It is the Policy of the Commonwealth that aluminum steel products made in the United States should be purchased by all public agencies in preference to aluminum and steel products made in foreign countries which discriminate against supplies, equipment or materials manufactured in Pennsylvania.

1. Definitions

a. The Word “discriminates” means an act, regulation or policy of a foreign country which, directly or indirectly:

(i) Prevents the importation, sale or use of any supplies, materials or equipment manufactured in this Commonwealth.

(ii) Grants or bestows a preference, discount or other competitive advantage to supplies, materials or equipment manufactured in the foreign country, the effect whereof is to place similar supplies, materials or equipment manufactured in this Commonwealth at a competitive disadvantage;
(iii) Restricts the opportunities for persons having a business situs in this Commonwealth to bid on or compete for government contracts including, but not limited to, a preference for residents of the foreign country;

(iv) Solicits for, awards or negotiates public works contracts on a selective tender basis;

(v) Imposes discriminatory duties, tariffs or border taxed on the importation of supplies, materials or equipment not produced in the foreign country, the effect whereof is to place supplies, materials or equipment manufactured in this Commonwealth at a competitive disadvantage with like goods manufactured in any foreign country; and

(vi) Adopts or condones any other unfair method of competition in international trade including, but not limited to, the exportation of aluminum or steel products made in the foreign country through cartels or the subsidization of said products.

b. The word “person” means natural persons, corporations, partnerships, business units and associations existing under or authorized by the laws of the United States, the laws of any territories or the laws of any state.

c. The words “public agency” mean:

(i) Counties, cities, boroughs, townships, school districts and any other governmental unit or district;

(ii) The General State PhilaPort, the State Public School Building PhilaPort, the State Highway and Bridge PhilaPort and any other authority now in existence or hereafter created or organized by the Commonwealth;

(iii) All municipal or school or other authorities now in existence or hereafter created or organized by any county, city, borough, township or school district or combination thereof; and

(iv) Any and all other public bodies, authorities, officers, agencies or instrumentalities, whether exercising a governmental or proprietary function.

d. The words “public works” mean any structure, building, highway, waterway, street, bridge, pier, transit car or system, airport or other betterment, work or improvement whether of a permanent or temporary nature and whether for governmental or proprietary use contracted for by any public agency or financed in whole or in part by any public agency.

e. The words “aluminum or steel products made in a foreign country” mean aluminum or steel products rolled, formed, shaped, drawn, extruded, forged, cast, fabricated or otherwise similarly processed or processed by a combination of two or more of such operations, from aluminum or steel not made in the United States.
f. The word “importer” means any person registered in the Commonwealth and doing business in the Commonwealth who engages in the receiving, storing, distributing or other processing of aluminum or steel products made in a foreign country; or who engages in the solicitation or acceptance of orders or contracts for the furnishing of or supplying of aluminum or steel products made in a foreign country.

In accordance with the Trade Practices Act (71 P.S. §773.101 et seq.) the Contractor shall not use, or permit to be used, in the Work any aluminum or steel products made in a foreign country that discriminates against aluminum or steel products manufactured in Pennsylvania. The countries of Brazil, South Korea, Spain, and Argentina have been found to discriminate against certain products manufactured in Pennsylvania. Therefore, the purchase or use of those countries’ products, as listed below, is not permitted for a project. Penalties for a violation of this paragraph may be found in the Trade Practices Act. Penalties include becoming ineligible for award of any public works contracts for a period of three years.

1. **Brazil**: Welded carbon steel pipes and tubes; carbon steel wire rod; tool steel; certain stainless steel products, including hot-rolled stainless steel bar; stainless steel wire rod and cold-formed stainless steel bar; pre-stressed concrete steel wire strand; hot-rolled carbon steel plate in coil; hot-rolled carbon steel sheet and cold-rolled carbon steel sheet.

2. **Spain**: Certain stainless steel products, including stainless steel wire rod, hot-rolled stainless steel bars and cold-formed stainless steel bars; pre-stressed concrete steel wire strand; certain steel products including hot-rolled steel plate, cold-rolled carbon steel plate, carbon steel structural shapes, galvanized carbon steel sheet; hot-rolled carbon steel bars and cold-formed carbon steel bars.

3. **South Korea**: Welded carbon steel pipes and tubes; hot-rolled carbon steel plate and hot-rolled carbon steel sheet and galvanized steel sheet.

4. **Argentina**: Carbon steel wire rod and cold-rolled carbon steel sheet.

**C. Steel Products Procurement Act.**

In accordance with the Steel Products Procurement Act of March 3, 1978, P.L. 6 as amended (73 P.S. Sections 1881 et seq.), only steel products as defined in the Act shall be used or supplied in the performance of the contract or any subcontracts thereunder.

In the performance of the Contract the Contractor, subcontractors, material men or suppliers shall use only: 1) steel products, rolled, formed, shaped, drawn, extruded, forged, cast, fabricated or otherwise similarly processed by a combination of two or more of such operations, from steel made in the United States by the open hearth, basic oxygen, electric furnace, Bessemer or other steel making process; and 2) cast iron products made in the United States.

The Contractor shall certify that all steel and cast iron products to be used or supplied in the performance of the Contract comply with this Act. No payment will be made to the Contractor
for steel and cast iron products until such certification has been received.

This section shall not apply in any case where the Executive Director of PhilaPort, in writing, determines that steel and/or cast iron products as herein described are not produced in the United States in sufficient quantities to meet the Contract needs.

PhilaPort shall not provide for, or make any payments to any person who has not complied with the Act. Any such payments made by PhilaPort to anyone that should not have been made as a result of the Act shall be recoverable directly from the Contractor, subcontractor, manufacturer or supplier that did not comply with the Act.

In addition to the withholding of payments, any person who willfully violates any of the provisions of the Act shall be prohibited from submitting any bids to any public agency for a period of five (5) years from the date of the determination that a violation has occurred. In the event the person who violated the provisions of the Act is a subcontractor, manufacturer or supplier, such person shall be prohibited from performing any work or supplying any materials to a public agency for a period of five (5) years from the date of the determination that a violation has occurred.

The Contractor shall include the provisions of the Steel Products Procurement Act in every subcontract and supply contract, so that the provisions of the Act shall be binding upon each subcontractor and supplier.

Where trade names, catalog numbers and manufactures of material or equipment are specified, they are mentioned therein for the purpose of establishing a standard of quality, performance and appearance, and for establishing a standard of competitive bidding. The use of this descriptive information will not relieve the Contractor from compliance with all aspects of the Act.

Section 27  Apprenticeship Training Program Participation:

To qualify as a responsive bidder for the purposes of this bid, the Bidder must certify (1) that the Bidder (or the labor force) participates at the time of the bid submission in an approved Apprenticeship Program as defined in the General Conditions for each craft or trade of the labor force contemplated to perform the work, (2) that such Program is currently registered with the Pennsylvania Apprenticeship and Training Council and (3) that such Program has apprentices and trainees currently participating.

To qualify as a responsible contractor and to comply with contractual requirements, the awarded Contractor shall utilize labor enrolled in an approved Apprenticeship Program registered with the Pennsylvania Apprenticeship and Training Council for each craft or trade of the labor force necessary to perform the work for the full duration of the contract Work.

Section 28  Diversity Inclusion Policy and Plan:

PhilaPort has adopted a policy on diversity inclusion, set forth in Part X of the Contracting,
Procurement, and Leasing Policies and Procedures, revised as of November 2015 (the “Diversity Inclusion Policy” or the “Policy”). In order to implement this Policy, PhilaPort has further adopted the “Diversity Inclusion Plan (Construction),” appearing here as Attachment “A”. Bidders must comply with the requirements of the Plan to be eligible for the award of the contract, in accordance with the provisions of Attachment “B”.

Section 29 Award of Contract:

If PhilaPort awards a Contract, it will be made to the lowest responsive, responsible Bidder within sixty (60) days from the Bid Opening Date. This 60-day period may be extended by written consent of the lowest responsible Bidder(s) or by operation of law. Notice of Award of Contract will be made by letter mailed to the Contractor and will be effective upon the date mailed. If the lowest Bidder withdraws his bid, declines to extend the bid or refuses the award of contract, PhilaPort may award the Contract to then next lowest responsive, responsible Bidder or reject all bids and re-bid the Contract. The proposed contract shall be considered awarded when both the Bidder and PhilaPort have executed the Agreement. No contract with PhilaPort exists until the Agreement is fully executed.

Section 30 Execution of Contract, Bond and Return of Insurance Certificates:

Within ten (10) days after receipt of the Contract, the successful Bidder, must:

A. Sign and return the Contract to the Philadelphia Regional Port PhilaPort, 3460 N. Delaware Avenue, Philadelphia, PA 19134; and

B. Sign and return payment and performance bonds, on a form acceptable to PhilaPort executed by a surety company or companies qualified to do business in Pennsylvania:

   a. A performance bond at 100 percent of the contract amount, conditioned upon the faithful performance of the contract in accordance with the plans, specifications and conditions of the contract. Such bond shall be solely for the protection of PhilaPort. The performance bond shall remain in effect for at least twelve (12) months following the date of final acceptance of the Work.

   b. A payment bond at 100 percent of the contract amount. Such bond shall be solely for the protection of claimants supplying labor or materials to the prime contractor to whom the contract was awarded, or to any of his subcontractors, in the prompt payment of all such material furnished or labor supplied or performed in the prosecution of the work. “Labor or materials” include public utility services and reasonable rentals of equipment, but only for the periods when the equipment rented is actually used at the site. ; and
C. Sign and return all insurance certificates required by the General and/or Special Conditions to the Contract.

D. As PhilaPort is an independent agency of the Commonwealth, for the purposes and within the meaning of the Act of October 15, 1980 (P.L. 950, No. 164), known as the Commonwealth Attorneys Act, all Contracts must be approved as to form and legality by the Office of the Attorney General.

Section 31 Failure to Execute Contract:

Failure or refusal of the Contractor to properly execute the Contract Documents and/or to furnish the required Bonds and/or to furnish the required insurance certificate within the 10-day time will be viewed as a refusal to accept the Award. In the event any of these documents are not returned or properly submitted, the successful Bidder shall be required to pay PhilaPort the lesser of the following amounts:

A. The amount of the bid guaranty, or

B. The difference between the amounts specified in the bid of the lowest responsible Bidder and such larger amount for which PhilaPort may enter into a contract with another party to perform the Work covered by said bid.

If the successful Bidder fails or refuses to properly execute the Contract Documents and/or to furnish the required Bonds and/or to furnish the required insurance certificates within the 10-day time, PhilaPort may award the Contract to the next lowest responsible Bidder, or reject all bids and re-bid the Contract.

Section 32 Proof of Surety’s Responsibility on Contract Bond:

The surety company, which is designated by the lowest responsive, responsible Bidder for the faithful performance of the contract and prompt payment of materials, equipment and labor, shall, with his Contract Bond, furnish to PhilaPort a certificate showing that the amount of the Bond is within the limit of net retention, or evidence that appropriate reinsurance or other security has been obtained in conformance with Section 661 of the Pennsylvania Insurance Company Law of 1921 (40 P.S. § 832).

Section 33 Reinsurance:

If the surety has entered into an agreement for reinsurance under the foregoing paragraph, the bond shall be supported by a duplicate original of the reinsurance agreement. The reinsurance agreement must contain a “direct liability to insured” clause, enabling PhilaPort to maintain an action against the company reinsured jointly with the reinsurer, and upon recovering judgment against such reinsured, to have recovery against such reinsurer, for payment to the extent to which it is liable under such reinsurance and in discharge thereof.
Section 34 Veteran’s Preference:

PhilaPort recommends that contractors give preference in employment on PhilaPort projects to veterans of the Armed Services of the United States of America.

Section 35 Provisions Concerning The Americans With Disabilities Act:

During the term of this contract, the Contractor agrees as follows:

A. Pursuant to federal regulations promulgated under the authority of the Americans with Disabilities Act, 28 C.F.R. 35.202 et seq., the contractor understands and agrees that no individual with a disability shall, on the basis of the disability, be excluded from participation in this contract or from such activities provided for under this contract. As a condition of accepting and executing this contract, the Contractor agrees to comply with the “General prohibitions Against discrimination,” 28 C.F.R. 35.130, and all other regulations promulgated under Title II of the American with Disabilities Act which are applicable to the benefits, services, programs, and activities provided by PhilaPort and the Commonwealth of Pennsylvania through contracts with outside contractors.

B. The Contractor shall be responsible for and agrees to indemnify and hold harmless PhilaPort and the Commonwealth of Pennsylvania from all losses, damages, expenses, claims, and demands, suits, and actions brought by any party against PhilaPort and or the Commonwealth of Pennsylvania as a result of the Contractor’s failure to comply with the provisions of paragraph A above.

Section 36 Environmental Statement:


Section 37 Applicable Laws:

The Contractor shall obey all Federal, State, County, and municipal laws and ordinances in any way pertaining to the Work and shall obtain all permits that may be necessary for his performance if required.

The Bidder is hereby specifically notified that this Project is subject to those statutes, rules and regulations shown on the following list and the Work must be carried out in compliance with these statutes, rules and regulations.
STATE LAW (Updated 6/1/07)

I. Purdon’s Statutes – Title 3 (Agriculture)


PA Pesticide Control Act of 1973, Act of March 1, 1974 (P.L. 90, No. 24), as amended, 3 P.S. 111.21 et seq.


Noxious Weed Control Law, Act of April 7, 1982 (P.L. 228, No. 74), as amended, 3 P.S. 255.1 et seq.

Conservation District Law, Act of May 15, 1945 (P.L. 547 § 1), as amended, 3 P.S. 849 et seq.


II. Purdon’s Statutes – Title 16 (Counties)


III. Purdon’s Statutes – Title 18 (Crimes and Offenses)


IV. Purdon’s Statutes – Title 24 (Education)


V. Purdon’s Statutes – Title 30 (Fish)

VI. **Purdon’s Statutes – Title 32 (Forests, Waters and State Parks)**

(Relating to water power and water supply permits), Act of June 14, 1923 (P.L. 704, § 1), as amended, 32 P.S. 591 et seq.

Water Well Drillers License Act, Act of May 29, 1956 (P.L. (1955) 1840, § 1), as amended, 32 P.S. 645.1 et seq.


Dam Safety and Encroachments Act, Act of November 26, 1978 (P.L. 1375, No. 325), as amended, 32 P.S. 693.1 et seq.

(Relating to Stream Clearance), Act of June 5, 1947 (P.L. 422, § 1), as amended, 32 P.S. 701 et seq.

(Relating to Potomac River Pollution), Act of May 29, 1945 (P.L. 1134 § 1), as amended, 32 P.S. 741 et seq. Repealed in Part. Section 4 of Act 1981, May 1, P.L. 22 No.9, repeals this section to “the extent it required one of the members of the Interstate Commission on the Potomac River Basin to be a member of the Pennsylvania Commission on Interstate Cooperation.”

(Relating to Schuylkill River Pollution), Act of June 4, 1945 (P.L. 1383, § 1), as amended, 32 P.S. 751.1 et seq.

(Relating to Delaware River Pollution), Act of April 19, 1945 (P.L. 272, § 1) as amended, 32 P.S. 815.31 et seq.


Ohio River Valley Water Sanitation Compact, Act of April 2, 1945 (P.L. 103 § 1), as amended, 32 P.S. 816.1 et seq.

Brandywine River Valley Compact, Act of September 9, 1959 (P.L. 848, § 1), as amended, 32 P.S. 818 et seq.

Wheeling Creek Watershed Protection and Flood Prevention District Compact, Act of August 2, 1967 (P.L. 189, § 1), as amended, 32 P.S. 819.1 et seq.

Chesapeake Bay Commission Agreement, Act of June 25, 1985 (P.L. 64, No. 25), as amended, 32 P.S. 820.11 et seq.


Bluff Recession and Setback Act, Act of May 13, 1980 (P.L. 122, No. 48), as amended, 32 P.S. 5201 et seq.


VII. Purdon’s Statutes – Title 34 (Game)


VIII. Purdon’s Statutes – Title 35 (Health and Safety)

(Related to public eating and drinking places), Act of May 23, 1945 (P.L. 926, § 1), as amended, 35 P.S. 655.1 et seq._Repealed in Part. Section 6(b) of Act 1994, Dec. 12, P.L. 903, No. 131, repealed this section in so far as it is inconsistent with said act (3 Pa. C.S.A. § 6501 et seq.

The Public Bathing Law, Act of June 23, 1931 (P.L. 899 § 1), as amended, 35 P.s. 672 et seq. (Related to the protection of public water supply), Act of June 22, 1937 (P.L. 1987, art. 1, § 1), as amended, 35 P.S. 691.1 et seq.

PA Safe Drinking Water Act, Act of May 1, 1984 (P.L. 206, No. 43), as amended, 35 P.S. 721.1 et seq.

PA Sewage Facilities Act, Act of January 24, 1966 (P.L. (1965) 1535 § 1), as amended, 35 P.S. 750.1 et seq. Repealed in Part. Section 15 of Act 1990, July 1, P.L. 277, No. 67, repealed this section insofar as it related to fee payments.

(Related to Pollution from abandoned mines), Act of December 15, 1965 (P.L. 1075, § 1), as amended, 35 P.S. 760.1 et seq.


(Related to Camp Regulation), Act of November 10, 1959 (P.L. 1400 § 1), as amended 35 P.S. 3001 et seq.


Solid Waste Management Act, Act of July 7, 1980 (P.L. 380, No. 97), as amended, 35 P.S. 6018.101 et seq. Repealed in Part. Section 905(b) of Act 1988, Feb. 9, P.L. 31 No. 12, § 101, the Low-Level Radioactive Waste Disposal Act (35 P.S. § 7130.101 et seq.), repealed this section insofar as it is inconsistent with said act.

Radiation Protection Act, Act of July 10, 1984 (P.L. 688, No. 147, § 101), as amended, 35 P.S. 7110.101 et seq. Repealed in Part. Section 17(b) of Act 1992, Dec. 18, P.L. 1638, No. 180, provides that this section is repealed insofar as it is inconsistent with said act.

Worker and Community Right-to-Know Act, Act of October 5, 1984 (P.L. 734, No. 159), as amended, 35 P.S. 7301 et seq.

IX. Purdon’s Statutes – Title 36 (Highways and Bridges)


(Related to Junkyards along Highways), Act of July 28, 1966 (P.L. 91, § 1, Sp. Sess.), as amended, 36 P.s. 2719.1 et seq.

Highway Vegetation Control Act, Act of December 20, 1983 (P.L. 293, No. 79), as amended, 36 P.S.2720.1 et seq.

X. Purdon’s Statutes – Title 37 Appendix (Historical & Museums)

History Code, Act of May 26, 1988 (P.L. 414, No. 72 § 1), as amended, 37 Ps.C.S.A. 101 et seq.

XI. Purdon’s Statutes – Title 43 (Labor)

Related to General Safety), Act of May 18, 1937 (P.L. 654, § 1) as amended, 43 P.S. 25-1 et seq.

XII.  Purdon’s Statutes – Title 52 (Mines and Mining)


(Related to Coal Land Improvements), Act of July 19, 1965 (P.L. 216, No. 117 § 1), as amended, 52 P.S. 30.101 et seq.

(Related to Mine Fires and Subsidence), Act of April 3, 1968 (P.L. 92, No. 42, § 1), as amended, 52 P.S. 30.201 et seq.


(Related to discharge of coal into streams), Act of June 27, 1913 (P.L. 640, § 1), as amended, 52 P.S. 631 et seq.

(Related to Caving-in, Collapse, Subsidence), Act of May 27, 1921 (P.L. 1198, § 1), as amended, 52 P.S. 661 et seq.

(Related to Subsidence), Act of September 20, 1961 (P.L. 1538, § 1), as amended, 52 P.S. 672.1 et seq.

Anthracite Strip Mining and Conservation Act, Act of June 27, 1947 (P.L. 1095, § 2), as amended, 52 P.S. 681.1 et seq. Repealed in Part. Section 16 of Act 1971, Nov. 30, P.L. 554, No. 147, provided that this section repealed insofar as it is inconsistent with Act No. 147.

(Related to control and drainage of water from coal formations), Act of July 7, 1955 (P.L. 258 § 1), as amended, 52 P.S. 682 et seq.


(Related to Abandoned Mines), Act of May 7, 1935 (P.L. 141 § 1), as amended, 52 P.S. 809 et seq.

(Related to maps and plans of mines), Act of June 15, 1911 (P.L. 954, § 1), as amended, 52 P.S. 823.

Surface Mining Conservation and Reclamation Act, Act of May 31, 1945 (P.L. 1198, § 1), as amended, 52 P.S. 1396.1 et seq. Repealed in Part. Section 27 of Act 1984, Dec. 19, P.L. 1093, No. 219, provides that, except as provided in § 3304 of this title, this section “is repealed to the extent that it applies to the surface mining of minerals other than bituminous and anthracite coal.”

(Related to cave-in or subsidence of surface above mines), Act of July 2, 1937 (P.L. 2787, § 1), as amended, 52 P.s. 1407 et seq.

(Related to Coal Stripping), Act of June 18, 1941 (P.L. 133 § 1), as amended, 52 P.S. 1471 et seq.

(Related to Coal under State Lands), Act of June 1, 1933 (P.L. 1409, § 1), as amended, 52 P.S. 1501 et seq.


(Related to Coal Mine Subsidence Insurance Fund), Act of August 23, 1961 (P.L. 1068 § 1), as amended, 52 P.S. 3201 et seq.


Noncoal Surface Mining Conservation and Reclamation Act, Act of December 19, 1984 (P.L. 1093, No. 219, § 1), as amended, 52 P.S. 3301 et seq.

XIII. Purdon’s Statutes – Title 58 (Oil and Gas)

Oil and Gas Conservation Law, Act of July 25, 1961 (P.L. 825, § 1), as amended, 58 P.S. 401 et seq.

PA Used Oil Recycling Act, Act of April 9, 1982 (P.L. 314, No. 89), as amended, 58 P.S. 471 et seq.


XIV. Purdon’s Statutes Title 63 (Professions and Occupations)

Sewage Treatment Plant and Waterworks Operators’ Certification Act, Act of November 18, 1968 (P.L. 1052, No. 322, § 1), as amended, 63 P.S. 1001 et seq.
XV. Purdon’s Statutes – Title 64 (Public Lands)

PA Appalachian Trail Act, Act of April 28, 1978 (P.L. 87 No. 41 § 1), as amended, 64 P.S. 801 et seq.

XVI. Purdon’s Statutes – Title 71 (State Government)


XVII. Purdon’s Statutes – Title 72 (Taxation and Fiscal Affairs)


(Related to Pollution control services), Act of March 4, 1971 (P.L. 6, No. 2 § 602.1, added 1971, Aug. 31, P.L. 362, No. 93 § 6), as amended, 72 P.S. 7602.1 et seq.

Purdon’s Statutes – Title 73 (Trade and Commerce)

Infrastructure Development Act, Act of July 11, 1996 (P.L. 677, No. 116 § 1), as amended, 73 P.S. 393.21 et seq.

(Related to Explosives), Act of July 1, 1937 (P.L. 2681, § 1), as amended, 73 P.S. 151 et seq.; Suspended in Part. This section is suspended insofar as it is in conflict with the provisions of Reorganization Plan No. 8 of 1981. See 71 P.S. § 751-35.

(Related to Explosives), Act of July 10, 1957 (P.L. 685, § 1), as amended, 73 P.S 164 et seq. Suspended in Part. Section 164 is suspended insofar as it is in conflict with the provisions of Reorganization Plan No. 8 of 1981. See 71 P.S. 751-35.

(Related to Black Powder), Act of May 31, 1974 (P.L. 304, No. 96 § 1) 73 P.S. 169 et seq.

(Related to excavation and demolition), Act of December 10, 1974 (P.L. 852, No. 287, § 1), as amended, 73 P.S. 176 et seq.

XVIII. Purdon’s Statutes – Title 75 (Vehicles)


XX. Purdon’s Statutes – Title 77 (Workmen’s Compensation)

Worker’s Compensation Act, Act of June 2, 1915 (P.L. 736, art. 1, § 101), as amended, 77 P.S. 1 et seq.


XXI. Other Statutes

(Relating to Medical Waste-Manifesting and Transporter Licensing), Act of July 13, 1988 (P.L. 525, No. 93§ 1), 35 P.S. § 6019.1 et seq.


XXII. Pennsylvania Constitution – Article I, Section 27
(Adopted May 18, 1971)

FEDERAL LAW


Clean Air Act (42 U.S.C. 7401-7642).

Clean Water Act [see Federal Water Pollution Control Act].


Federal Water Pollution Control Act (33 U.S.C. 1251-1387).


Public Health Service Act (42 U.S.C. 300f-300j-11).

Safe Drinking Water Act [ see Public Health Services Act secs. 1401-1451 (42 U.S.C. 300f-300j-26).]


Section 38. Prevailing Wage:

Pennsylvania Prevailing Wage Act 442: All employees performing work on the site under this contract shall be paid at least the applicable prevailing wages for the respective occupation classifications designated, as set forth in the minimum wage schedule attached, for the applicable part of the specification. The Contractor shall post the general prevailing minimum wage rates for each craft and classification involved, as determined by the secretary, 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 Prevailing Minimum Wage Predetermination, if applicable to the project, is a separate section of these Contract Documents, attached hereto and made a part hereof.

1. The general prevailing minimum wage rates including contributions for employees benefits as shall have been determined by the Secretary of Labor and Industry which must be paid to the workman employed in the performance of the Contract are included in this Project Manual.

   The Contract shall specifically provide that the Contractor shall pay no less than the wage rates as determined in the decision of the Secretary of Labor and Industry and shall comply with the conditions of the Pennsylvania Prevailing Wage Act approved August 15, 1961 (Act No. 442), as amended August 9, 1963, (Act No. 342), and the Regulations issued pursuant thereto, to assure the full and proper payment of said rates.

2. The Contract shall contain the stipulation that such workmen shall be paid no less than such general prevailing minimum wage rates and such other provisions to assure payment thereof as heretofore set forth in this Section.

3. The Contract provisions shall apply to all work performed on the contract by the Contractor and to all work performed on the contract by all Subcontractors.

4. The Contractor shall insert in each of their subcontracts all of the stipulations contained in these required provisions and such other stipulations as may be required.

5. The Contract shall provide that no workmen may be employed on the public work except in accordance with the classifications set forth in the decisions of the Secretary of Labor and Industry. In the event that additional or different classifications are necessary the procedure set forth in Section 7 of these Regulations shall be followed.
6. The Contract shall provide that all workmen employed or working on the public work shall be paid unconditionally, regardless of whether any contractual relationship exists or the nature of any contractual relations which may be alleged to exist between any Contractor, Subcontractor and workmen, not less than once a week without deduction or rebate, on any account, whether directly or indirectly, except authorized deductions, the full amounts due at the time of payment, computed at the rates applicable to the time worked in the contract, the Act, or these Regulations shall prohibit the payment of more than the general prevailing minimum wage rates as determined by the Secretary to any workman on the public work.

7. The Contract shall provide that the Contractor and each Subcontractor shall post for the entire period of construction the wage determination decisions of the Secretary of Labor and Industry, including the effective date of any changes thereof, in a prominent and easily accessible place or places used by them to pay workmen their wages. The posted notices of wage rates must contain the following information:
   a. Name of project.
   b. Name of public Bid of which it is being constructed.
   c. The crafts and classifications of workmen listed in the Secretary’s general prevailing minimum wage rate determination for the particular project.
   d. The general prevailing minimum wage rates determined for each craft and classification and the effective date of any changes.
   e. The statement advising workmen that if they have been paid less than the general prevailing minimum wage rate for their job classification or that the Contractor and/or Subcontractor are not complying with the Act or these Regulations in any manner whatsoever, they may file a protest in writing with the Secretary of Labor and Industry within three (3) months of the date of the occurrence, objecting to the payment to any Contractor to the extent of the amount or amounts due or to become due to them as wages for work performed on the public work project. Any workmen paid less than the rate specified in the contract shall have civil right of action for the difference between the wage paid and the wages stipulated in the contract, which right of action must be exercised within six (6) months from the occurrence of the event creating such right.

8. The Contract shall provide that the Contractor and all Subcontractors shall keep an accurate record showing the name, craft and/or classification, number of hours worked per day and the actual hourly rate of wage paid (including employee benefits) to each workman employed by them in connection with the public work and such record must include any deductions from each workman. The record shall be preserved for two years from the date of payment and shall be open at all reasonable hours to the inspection of the public body awarding the contract and to the Secretary of Labor and Industry or his duly authorized representatives.

9. The Contract shall provide that apprentices shall be limited to such members as shall be in accordance with a bona fide apprenticeship program registered with and approved by the Pennsylvania Apprenticeship and Training Council and only apprentices whose training and employment are in full compliance with the provisions of the Apprenticeship and Training Act approved July 14, 1961 (Act No. 304) and the Rules and Regulations issued pursuant thereto shall be employed on the public work project. Any workman using the tools of a
craft who does not qualify as an apprentice within the provisions of this subsection shall be paid the rate predetermined for journeyman in that particular craft and/or classification.

10. Wages shall be paid without any deductions except authorized deductions. Employers not parties to a contract requiring contributions for employee benefits which the Secretary of Labor and Industry has determined to be included in the general prevailing minimum wage rate shall pay the monetary equivalent thereof directly to the workman.

11. Payment of compensation to workmen for work performed on public work on a lump sum basis, or a piece work system, or a price certain for the completion of a certain amount of work, or the production of a certain result shall be deemed a violation of the Act and these Regulations, regardless of the average hourly earnings resulting therefrom.

12. The Contract shall also provide that each Contractor and each Subcontractor shall file a notarized statement each week and a final statement at the conclusion of the work on the contract with PhilaPort, under oath, and in form satisfactory to the Secretary of Labor and Industry, certifying that all workmen have been paid wages in strict conformity with the provisions of the contract as prescribed by this Section 3 of these Regulations, or if any wages remain unpaid to set forth the amount of wages due and owing to each workman respectively. Classification of workman used on the certified payroll form shall exactly match the classifications put forth by the Department of Labor and Industry in their prevailing wage determination for the project.

13. The provisions of the Act and these Regulations shall be incorporated by reference in the contract.

39. Non-Discriminating Provision:

A. The Contractor agrees that he will comply with the provisions of the Pennsylvania Human Relations Act in providing equal employment opportunities in connection with all work performed by him at the job site pursuant to this contract.

The Contractor, therefore, agrees:

1. The Contractor will not discriminate or permit discrimination by his agents, servants or employees against any employee or applicant for employment with record to hiring, tenure of employment, promotion, terms, conditions or privileges of employment at the job site covered by this contract, because of race, color, religion, age or national origin, and will take such affirmative action as in hereinafter set forth to prevent same.

2. The Contractor will, in all publications or advertisements for employees to work at the job site covered by this contract, placed by or on behalf of the Contractor, state that all qualified applicants will receive consideration for employment without regard to race, color, religion, age or national origin.
3. The Contractor will send to each labor union or representative of the workers with which he has a collective bargaining agreement or other contract or understanding, a notice to be provided by the Pennsylvania Human Relations Commission, advising the said labor union or workers representative of the Contractor’s commitments under this section, and shall post copies of the notice in conspicuous places available to his employees and applicants for employment.

4. The Contractor shall supply the Owner with a periodic report, called a “Compliance Report”, relating to work performed at the job site under this contract as may be required by the Pennsylvania Human Relations Commission. The Commission shall at all times have access to the employment records of said Contractor for purposes of investigation to ascertain compliance with rules, regulations, and orders of the Pennsylvania Human Relations Commission, relating to discrimination.

5. The Contractor shall insert the provisions of subsection c-1, 2, 3 and 4 of the above in all subcontracts which are entered into by the Contractor under this contract requiring work to be done at the job site, as covenants to be binding upon such Subcontractors.

6. Compliance by the Contractor with subsections c-1, 2, 3, 4 and 5, above shall discharge the Contractor from liability hereunder, relating to non-discriminatory provisions of this agreement.

7. The Liability of the Subcontractor: The Subcontractor of the Contractor under subsection c-5 above shall have the same responsibilities and obligations as the Contractor to comply with the provisions of subsections c-1, 2, 3, 4 and 5 thereof, and shall be subject to the applicable penalties for failure to comply as hereinafter set forth in subsection c-8 hereinafter.

8. Penalties for failure to comply: It is hereby agreed that the failure to comply with the foregoing requirements shall constitute a substantial breach of this contract.

B. In the event the Pennsylvania Human Relations Commission, after investigation and hearing, shall determine that the Contractor or Subcontractor, as the case may be, has failed to comply with any of the provisions of subsections c-1, 2, 3, 4, 5 and 6 hereof, the Commission in addition to issuing any order it deems appropriate pursuant to Section 9 of the Pennsylvania Human Relations Act, shall certify such findings to the Owner with a recommendation for termination of the contract or subcontract, as the case may be, or with a recommendation that such Contractor or Subcontractor be declared ineligible for any further public works contracts or subcontracts for a period of not more than two years from the date of such recommendations.

C. Should the Owner adopt the recommendation to direct the Contractor to terminate a subcontract entered into by the Contractor under this contract, written notice of this fact shall be given to the Contractor by registered mail addressed to the Contractor registered office in Pennsylvania, and it shall then be the obligation of the Contractor to terminate such subcontract pursuant to said written notice.
D. Should the Owner adopt the recommendation to declare the Contractor or Subcontractor, as the case may be, ineligible for further public works contracts or subcontracts, written notice of this fact and of the duration of such period of ineligibility shall be given to the Contractor or Subcontractor by registered mail addressed to the Contractor or Subcontractor registered office in Pennsylvania.

E. From any order of the Pennsylvania Human Relations Commission, the Contractor or Subcontractor, as the case may be, shall have a right of appeal as in other cases provided by law, and the Owner shall not act upon the recommendation of the Commission specified in subsection 8 above until the Contractor or Subcontractor has exhausted the right-to-appeal provided by law, or the time for such appeal shall have expired.
Attachment “A”

Diversity Inclusion
Plan, Adopted
November 2015

Refer to Part 3 of the Bid Document
Attachment “B”

Minimum Participation Levels for the Project

Refer to Part 3 of the Bid Document
PART 2
BID FORM
I. Monetary Section:

The undersigned, ________________ (“Bidder”), having familiarized himself with the local conditions affecting the cost of the Work and with the Bidding and Contract Documents, including (A) this Bid Form, which includes (i) the Monetary Section, (ii) the Bidder Responsiveness Section, (iii) the Bidder Responsibility Section, (iv) the Project Point of Contact Section, (v) the Acknowledgment of Disclaimers Section and (vi) the Representation and Authorization Section, (B) the Instructions to Bidders, (C) the Diversity Inclusion Plan Forms, (D) General Conditions, and (E) the Plans and Specifications, hereby proposes to perform the Work, and to provide and furnish all labor, material, necessary tools, equipment, and all utility and transportation services necessary to perform and complete in a workmanlike manner all of the Work required to be completed by October 15, 2019, for the following prices:

Not to Exceed Total Base Bid Amount:

$________________________________________________ $_______________________

Price Written in Words Price Written in Figures
II. **Bidder Responsiveness Section:**

A. The Bidder certifies to the best of his knowledge, information and belief that:

i. That for the Bidder and his Subcontractors required to be disclosed or approved by PhilaPort, and as of the date of its execution of this Bid, neither the Bidder, nor any such Subcontractors, are under suspension or debarment by the Commonwealth or any governmental entity, instrumentality, or authority and, if the Bidder cannot so certify, then it agrees to submit, along with its Bid, a written explanation of why such certification cannot be made and why the Contract should nonetheless be awarded to Bidder.

ii. That as of the date of its execution of this Bid, the Bidder has no tax liabilities or other Commonwealth obligations, or has filed a timely administrative or judicial appeal if such liabilities or obligations exist, or is subject to a duly approved deferred payment plan if such liabilities exist.

iii. That the Bidder possesses all required business, contracting and trade licenses required to perform the Work.

iv. That the Bidder possesses all the technical qualifications and resources, including equipment, personnel and financial resources, to perform the Work.

v. (1) That the Bidder (or the labor force) participates at the time of the bid submission in an approved Apprenticeship Program as defined in the General Conditions for each craft or trade of the labor force contemplated to perform the work, (2) that such Program is currently registered with the Pennsylvania Apprenticeship and Training Council and (3) that such Program has apprentices and trainees currently participating.

vi. That the information provided in connection with PhilaPort’s Diversity Inclusion Plan Forms is accurate and the mandatory information on form is filled out completely.

vii. That the Bidder shall perform on the site and with HIS own organization at least 20 percent of the total amount of Work to be performed under this contract.

B. The Bidder shall perform the following Work:
Percentage of Work to be performed by my organization _____% Estimate cost of Work to be performed by my organization

$____________________________

III. Bidder Responsibility Section:

A. The Bidder certifies that:

i. He has a satisfactory record of past contract performance and past law compliance that demonstrates a solid history of both technical competency and business integrity sufficient to justify receiving a Port PhilaPort contract; and

ii. He currently possesses all qualifications, skills, resources, equipment personnel, financial resources and other required performance capabilities needed to successfully complete the prospective contract it is seeking to perform; and

iii. He will comply with all relevant security requirements;

iv. He will have sufficient workforce that possess Transportation Worker Identification Credentials to gain access and properly perform the Work by the date of Notice to Proceed with the Work.

v. He will utilize labor enrolled in approved Apprenticeship Programs as defined in the General Conditions for the full duration of the contract Work.

B. The Bidder certifies the following responses to the questions posed to assist PhilaPort in its determination of Bidder Responsibility:

1. Has the Bidder been suspended and/or debarred or voluntarily agreed not to bid as a result of an action by any federal, state or local government agency or authority in the past three years?

   Yes   No

2. Has any officer, director, owner or managerial employee of the Bidder been convicted of a felony relating to construction, maintenance, service or repair contracting industries?

   Yes   No

3. Has the Bidder defaulted on any project in the past three years?

   Yes   No
4. Has the Bidder had any type of business, contracting or trade license revoked or suspended by any government agency or authority in the past three (3) years?

   Yes   No

5. Has the Bidder been found in violation of any other law relating to its contracting business, including, but not limited to antitrust laws, licensing laws, tax laws, wage or hour laws, environmental or safety* laws, by a final decision of a court or government agency authority in the past three (3) years?

   Yes   No

*For purposes of this question, violations of safety laws may be limited to serious or willful safety violations.

6. Has the Bidder been the subject of voluntary or involuntary bankruptcy proceedings at any time in the past three years?

   Yes   No

C. Bidder’s Vendor Data Management Unit Number is:_______________________

IV. Bidder’s Point of Contact Section:

   Contact Information for the Bidder on this project (for purposes of affirming bid price, issuing notice to proceed, insurance information, diversity information, etc.):

   Name: _________________________________

   Title: _________________________________

   Phone: _________________________________

   Email: _________________________________

V. Acknowledgment and Disclaimers Section:

   It is understood that the right is reserved by PhilaPort to reject any or all bids and to waive any informalities in the Bid, as may be provided in the Instructions to Bidders.

   Submission of false or misleading information or statements in connection with this Certification shall render the Bidder ineligible to perform work for PhilaPort and/or shall be considered a
material breach of any contract entered and entitle PhilaPort to all applicable remedies available at law or in equity.

**Further, in the event Contractor fails to gain entry or cannot perform Work due to noncompliance, the Authority reserves the right to provide escorts to be billed to the Contractor with no increase in cost under the contract or terminate the contract for failure to perform.**

**VI. Representation and Authorization Section:**

By making this Bid, Bidder understands, represents, acknowledges and certifies:

a) That the foregoing representations regarding the past performance and present qualifications of the undersigned Bidder are true and correct;

b) The Bidder has read and understands the terms and conditions of the Invitation for Bids and this Bid is made in accordance with those terms and conditions;

c) The item(s) offered in the Bid will be in conformance with the specifications referenced in the Instructions for Bids without exceptions;

d) The price(s) and amount of the Bid have been arrived at independently and without consultation, communication, or agreement with any other contractor, bidder or potential bidder;

e) Neither the price(s) nor the amount of the Bid, and neither the approximate price(s) nor the approximate amount of the bid, have been disclosed to any other firm or person who is a bidder or potential bidder, and they will not be disclosed prior to the bid opening;

f) No attempt has been made or will be made to induce any firm or person to refrain from bidding on the contract, or to submit a bid higher than the bid, or to submit an intentionally high or noncompetitive bid or other form of complementary bid;

f) No attempt has been made or will be made to induce any firm or person to refrain from bidding on the contract, or to submit a bid higher than the bid, or to submit an intentionally high or noncompetitive bid or other form of complementary bid;

g) The Bid is made in good faith and not pursuant to any agreement or discussion with, or inducement from, any firm or person to submit a complementary or other noncompetitive bid;

h) This bid has been completed by an authorized representative of the Bidder that the sufficient knowledge and information to address all matter addressed herein;

i) If an award is made to the Bidder, the Bidder agrees that it intends to be legally bound to the contract that is formed between PhilaPort and the Bidder; and

j) If an award is made to the Bidder, the Bidder will enter into and execute a contract based upon this bid, without delay, upon notice of award of contract, and will not withdraw this bid in accordance with the Instructions to Bidders and Applicable Law.
Project 19-048.2
Heating System Renovation at Port Administration Building

[Signature pages to follow; select the page that is appropriate to your form of business organization.]
Name of Bidder (Printed)

_______________________________________

Signature of Individual

Trading and doing business as:

_______________________________________

Business Address:

_______________________________________

_______________________________________

_______________________________________

Tax Identification Number:

_______________________________________

*If fictitious or trade name is employed in conduct of business, complete, by deletion as appropriate, the following statement:

[Foregoing fictitious or trade name (has) (has not) been registered by the individual proprietorship under Pennsylvania Law.]
Name of Partnership

Name of General Partner (Printed)

By: _______________________________ Witness: ________________________________
(Signature of General Partner)

Business Address:

________________________________________
________________________________________
________________________________________

Tax Identification Number:

________________________________________

The partners constituting the partnership herein named are:

Partner: _____________________________  Address: _____________________________
________________________________________
________________________________________

Partner: _____________________________  Address: _____________________________
________________________________________
________________________________________

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

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

________________________________________

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

[Foregoing fictitious or trade name (has) (has not) been registered by the partnership under Pennsylvania Law.]
[SIGNATURE PAGE FOR CORPORATE BIDDER]

Name of Corporation

Attest: ____________________________

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

By: ____________________________

Signature of President, Vice President or other authorized representative*

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

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

Tax Identification Number:

______________________________

(1) Complete the following statement: The Corporation has been organized and is existing under laws of the State/Commonwealth of: _______________________________.

(2) If Corporation has been organized under laws of a State other than those of the Commonwealth of Pennsylvania, complete, by deletion as appropriate, the following statement: [The Corporation (has) (has not) been granted a certificate of authority to do business in the Commonwealth of Pennsylvania under applicable laws.]

(3) If Corporation has been organized under laws other than those of the Commonwealth of Pennsylvania and has NOT been granted a certificate of authority, complete, by deletion as appropriate, the following statement: [The Corporation (has) (has not) applied for a certificate of authority to do business in the Commonwealth of Pennsylvania and (has) (has not) attached a copy of the pending application to this Bid.]
Name of Limited Liability Company

Attest: ________________________________

Signature of an Authorized Representative*

Signature of Authorized Representative**

(Print Name of Representative) _____________________________

(Print Name of Representative)

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

** Check the box which applies to this Bid:

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

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

☐ This Bid has been executed by a representative of the LLC who is not a Manager or a Member of the LLC, and instead who holds the office of ___________________ (insert title), and the execution of this Bid is fully authorized by the Certificate, by the Operating Agreement and by Resolutions of the LLC. Copies of the relevant documents are provided with the Bid or can be provided upon request within three (3) working days. The Bidder and the individuals signing and attesting to the execution of this document further represent that (1) execution of the Bid is carrying on business in the usual way; (2) the LLC authorizes the execution of this Bid even if execution and submission of this Bid is not carrying on business in the usual way for the LLC; and (3) to the best of the individuals’ information and belief, the Owner has no knowledge of the Member’s or the Manager’s lack of actual authority, or of any applicable and relevant restriction on his or her authority.

Tax Identification Number: _____________________________

(1) Complete the following statement: The LLC has been organized and is existing under laws of the State/Commonwealth of ____________________________

(2) If the LLC has been organized under laws of a State other than those of the Commonwealth of Pennsylvania, complete, by deletion as appropriate, the following statement:
(3) If the LLC has been organized under laws other than those of the Commonwealth of Pennsylvania and has NOT been granted a certificate of authority, complete, by deletion as appropriate, the following statement:
[The LLC (has) (has not) applied for a certificate of authority to do business in the Commonwealth of Pennsylvania and (has) (has not) attached a copy of the pending application to this Bid.]
PREVAILING WAGE RATES
<table>
<thead>
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<th>Project Name:</th>
<th>Heating System Renovations at PAB</th>
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<td>Toll Free Phone Number:</td>
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<td>Project County:</td>
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# BUREAU OF LABOR LAW COMPLIANCE

## PREVAILING WAGES PROJECT RATES

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<th>Effective Date</th>
<th>Expiration Date</th>
<th>Hourly Rate</th>
<th>Fringe Benefits</th>
<th>Total</th>
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PART 3
GENERAL CONDITIONS
GENERAL CONDITIONS OF

PHILADELPHIA REGIONAL PORT AUTHORITY

CONTRACTS

(Revised as of September 26, 2018)
# INDEX TO THE GENERAL CONDITIONS OF
PHILADELPHIA REGIONAL PORT AUTHORITY CONTRACTS

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GENERAL CONDITIONS OF
PHILADELPHIA REGIONAL PORT AUTHORITY
CONSTRUCTION CONTRACTS

I. Definitions:

A. The following terms and expressions used in the Contract Documents shall be defined and understood as follows:

“Agreement” shall mean the document executed by PhilaPort and the Contractor that incorporates the additional Contract Documents.

“City” shall mean the City of Philadelphia.

“Claim Settlement Conference” shall mean the dispute resolution process, as more particularly described in Article X.

“Commonwealth” shall mean the Commonwealth of Pennsylvania.

“Contract” shall mean the complete contractual understanding between PhilaPort and the Contractor. The Contract may also be referred to as the “Agreement.”

“Contract Documents” shall mean the documents described in Article VI of the Contract and otherwise identified in these General Conditions.

“Contractor” shall mean the party of the second part to the Contract.

“Contract Sum” shall mean the amount stated in Article III of the Contract for the payment to the Contractor.

“Contracting Officer” The Contracting Officer shall be the Procurement Director prior to the issuance of the notice to proceed. Subsequently, the Contracting Officer shall be the Chief Engineer of PhilaPort.

“Date of Completion” shall mean the date determined in accordance with the provisions of Article IV of the Agreement for the substantial completion of the Work.

“Day(s),” whether or not capitalized, shall mean the number of days, excluding the first and including the last day of such period. Whenever the last day of any such period shall fall on a Saturday or Sunday or on any day made a legal holiday by the laws of the Commonwealth or the United States, such day shall be omitted from the computation.

“Dispute Designee” shall mean the Chief Counsel of PhilaPort, or any deputy or substitute who may be so designated in writing by the Executive Director.
“Engineer” shall mean either the Chief Engineer of PhilaPort, or any successor or successors duly appointed in writing by the Chief Engineer, or any deputy or substitute who may be so designated, in writing, by the Executive Director or through a duly authorized representative within the scope of the particular duties assigned such representative. PhilaPort may also designate an outside design professional as the Professional to perform duties on behalf of the Engineer.

“Executive Director” shall mean the Executive Director of PhilaPort, or any deputy or substitute who may be so designated in writing by the Executive Director.

“FDR Meeting” shall mean a Field Dispute Review Meeting, as more particularly described in Article X.

“Inspector” shall mean the representative of the Engineer assigned to the inspection of the Work under the Contract.

“PhilaPort” shall mean the Philadelphia Regional Port Authority, also referred to as, “Owner” and “PRPA.”

“Plans” shall mean the general plans and designs accompanying the Specifications and such supplementary drawings as may be furnished from time to time.

“Professional” shall mean the Engineer unless designated otherwise.

“Project” shall mean the total of the Work to be performed under the Contract and any other separate prime contracts as so designated by PhilaPort.

“Samples” are physical examples furnished by the Contractor to illustrate materials, equipment or workmanship, and to establish standards by which the Work will be judged.

“Shop drawings” are drawings, diagrams, illustrations, schedules, performance charts, brochures, catalog data, and other data which are prepared by the Contractor or any Subcontractor, manufacturer, supplier or distributor, and which illustrate some portion of the Work.

“Site” shall mean the location where the construction or services will be performed or where the materials or equipment will be used pursuant to the Contract.

“Special Conditions” shall mean those special conditions which modify the General Conditions.

“Specifications” shall mean the written documentation accompanying the Plans, which set forth the Work to be performed and the methods to be used to perform the Work.

“Subcontractor” shall mean persons, firms, or corporations having a direct contract with the Contractor to perform a portion of the Work or to furnish materials or equipment.

“Substantial Completion” or “Substantially Complete” shall mean 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.

“Work” shall mean the subject matter of the Contract, i.e., the labor or service to be performed and/or the material and/or equipment to be supplied, delivered and/or installed as stated in Article II of the Contract or otherwise as described in the Contract Documents.

“Working Day” shall mean a calendar day except Saturday, Sunday, and any day made a legal holiday by the laws of the Commonwealth or the United States.

B. Wherever in the Specifications or the Plans the words “directed”, “required”, “permitted”, “ordered”, “designated”, “prescribed”, or words of similar meaning are used, it shall be understood that the direction, requirement, permission, order, designation, or prescription of the Engineer is intended, and similarly the words “approved”, “acceptable”, “satisfactory”, or words of similar meaning, shall mean approved by, or acceptable to, or satisfactory to the Engineer, subject in each case to the final determination of the Executive Director.

II. Contract Award & Contractor Responsibility:

A. PhilaPort’s Right to Award Separate Contracts:

PhilaPort reserves the right to award other contracts in connection with other portions of the Project under these or similar conditions of the Contract. When separate prime contracts are awarded for different portions of the Project, the “Contractor” in the Contract Documents in each case shall be the contractor who signs a separate prime contract.

B. Mutual Responsibility of Contractors:

1. If any part of the Contractor’s Work depends for proper execution or results upon the work of any other prime contractors or their subcontractors, the Contractor shall inspect and promptly report in writing to the Engineer and PhilaPort any apparent discrepancies or defects in such work that render it unsuitable for such proper execution and results. Failure of the Contractor to so inspect and report shall constitute an acceptance of the other prime contractors’ or their subcontractors’ work as fit and proper to receive the Contractor’s Work, except as to defects which may develop in the other prime contractors’ or their subcontractors’ work after the execution of the Contractor’s Work.

2. The Work shall be conducted so as not to interfere with the work of other contractors. If any part of the Contractor’s Work depends for proper execution or results upon work being done by other prime contractors or their subcontractors not under contract with the Contractor, the Contractor shall inspect and promptly report in writing to the Engineer and PhilaPort any interference, defects, or delays in the work done or being done by the other prime contractors or their subcontractors. In the event that any prime contractor shall not complete the various portions of the Project in general harmony, and another
prime contractor shall be caused damage or injury by the failure to so act in harmony, the
prime contractor damaged or injured shall have the right to settle by agreement or
arbitration such claim or disputes in accordance with the provisions of Section XI herein.
PhilaPort, however, shall not be liable to any prime contractor for any increased costs or
damages resulting from the defective work, interference, or delays of other prime
contractors.

C. Cooperation with Other Contractors:

1. The Contractor shall cooperate with any other contractors on concurrent work that may
be on or adjacent to the Contractor’s Work, and shall afford reasonable facilities and
access to them. Except as provided in Section XI, herein, the Engineer will decide any
matters in dispute as to the performance of the Work, including access to the Site and
priority of performance on either side of the division line between contiguous Contract
sections.

2. The Contractor shall afford other prime contractors and their subcontractors reasonable
opportunity for the introduction and storage of their materials and equipment and the
execution of their work, and shall properly connect and coordinate the Contractor’s Work
with the work awarded by PhilaPort to other contractors.

3. Where any portion of the Work is done in combination with or affects in any way the
progress of the work of other contractors, the Contractor shall cooperate with such
contractors and shall perform the details of the Contract at such time and in such a
manner that the Work and all other work may proceed without interruption. Where
electrical, plumbing, heating, or mechanical equipment is installed under separate
contracts, concurrently with construction contracts, the equipment contractors shall keep
in close touch with the construction work; and the contractor for the main construction
shall give the equipment contractors at least twenty-four (24) hours’ notice, excepting
Saturdays, Sundays, and those days made a legal holiday by the laws of the
Commonwealth or the United States, of any intention to place concrete, do backfilling, or
perform similar work affecting the installation of such equipment. The equipment
contractors shall thereupon promptly furnish and install their equipment as required.
Should the equipment contractors fail to do such work within a reasonable time after
having been so notified, and the progress of the Work is thereby delayed, the Engineer
shall have the right to order the installation work performed by another contractor and to
deduct the cost thereof from any monies due under the equipment contract.

D. Execution of the Contract Documents:

By executing the Contract, the Contractor represents that the Contractor has visited the Site
and by careful personal examination is satisfied as to the Contract Documents and the
physical condition of the location where the Work is to be performed, and that the Contractor
has correlated these personal observations with the requirements of the Contract Documents.
The Contractor shall assume all risks resulting from the Contractor’s reliance upon test data
provided for reference only by PhilaPort as provided in Section 3.C of the Instructions to
Bidders, and the Contractor shall assume all risks resulting from any changes in the conditions of the Site which may occur during the progress of the Work except as provided in Section VIII.E herein.

E. Subcontracts:

1. The Contractor shall not assign the Contract or any part thereof, and the Contractor shall not assign any right to any monies to be paid to the Contractor under the Contract without the prior written consent of PhilaPort. The Contract as a whole shall not be sublet. No portion of the Work shall be sublet without the approval of the Engineer, and no Subcontractor shall be employed unless in the opinion of the Engineer the Subcontractor is reliable, responsible, and competent to perform the Work in compliance with the Contract Documents. All entities so employed shall be bound by the terms and provisions of the Contract, and neither the Contractor nor the Contractor’s sureties will be relieved from the terms and conditions of the Contract or their duties or responsibilities under the same by reason of such employment.

2. The Contractor shall perform at least twenty percent (20%) of the total amount of the Work with the Contractor’s own organization based upon the Contract Sum.

3. All Work performed for the Contractor by a Subcontractor shall be pursuant to an appropriate agreement between the Contractor and the Subcontractor (and, where appropriate, between Subcontractors and sub-subcontractors). All agreements between the Contractor and Subcontractors and between Subcontractors and sub-subcontractors for Work performed under the Contract shall be forwarded to PhilaPort for approval prior to the commencement of any Work by a Subcontractor or a sub-subcontractor and shall contain provisions, acceptable to PhilaPort, that:
   a. preserve and protect the rights of PhilaPort, and the Engineer with respect to the Work to be performed under the subcontract so that the subcontracting thereof will not prejudice any such rights;
   b. require that such Work be performed in accordance with the Contract Documents;
   c. require submission to the Contractor of applications for payment under each subcontract to which the Contractor is a party, in reasonable time to enable the Contractor to apply for payment in accordance with Section XIV, herein;
   d. require that all claims for additional costs, extensions of time or otherwise with respect to subcontracted portions of the Work shall be submitted to the Contractor (via any Subcontractor or sub-subcontractor where appropriate) in the time and manner provided in the Contract Documents for like claims by the Contractor against PhilaPort;
   e. require that each Subcontractor to fully warrant and guarantee for the benefit of PhilaPort the effectiveness, fitness for the purpose intended, quality and
merchantability of any item provided and/or installed by such Subcontractor;

f. require that the Subcontractor is without privity of contract to PhilaPort and that the Subcontractor agrees by signing the subcontract that the Subcontractor neither acquires nor intends to acquire any rights against PhilaPort pursuant to a third party beneficiary theory or any other theory; and

g. obligate each Subcontractor (and sub-subcontractor) to specifically consent to all provisions of this Section II.E.

F. Contractor’s Obligations:

The Work to be done under the Contract is indicated in detail in the Contract Documents. The Contractor shall furnish all labor, materials, plans, tools, and appliances necessary to complete the Work to the satisfaction of the Engineer in the manner and within the time required in the Contract Documents at the prices bid, agreed upon, and fixed therefore. If, at any time, the Contractor’s methods, force, or equipment appear to the Engineer to be unsafe, insufficient, or inadequate for the proper performance of the provisions of the Contract, the Engineer may order the Contractor to make such changes as the Engineer may deem necessary, and the Contractor shall comply with such orders, but the failure of the Engineer to make such demands shall not relieve the Contractor of its obligations under the Contract Documents. The Contractor shall maintain an office where orders and instructions may be delivered, and shall give personal attention to the faithful performance of the Work. The Contractor shall employ a competent representative or superintendent who shall have full authority to receive and execute orders, and to supply such labor, tools, and materials as may be required for the proper performance of the Work. The Contractor shall be responsible to the Engineer and to PhilaPort and to all other Contractors for the acts and/or omissions of the Contractor’s employees and Subcontractors, their agents and employees, and all other persons performing any of the Work under a contract with the Contractor. The Contractor, its agents and employees, shall act in an independent capacity and shall not act or be deemed to act as employees, officers, or agents of PhilaPort or the Commonwealth.

G. Supervision and Procedures:

1. The Contractor shall be solely responsible for all means, techniques, and portions of the Work to be performed under the Contract, whether by the Contractor, a Subcontractor or otherwise.

2. The Contractor shall provide continuous supervision of the Work by a duly authorized and competent superintendent. At the time that PhilaPort, or the Engineer acting on behalf of PhilaPort, issues the notice to proceed with the Work, the Contractor shall submit to PhilaPort the name and qualifications of a superintendent acceptable to PhilaPort. The Contractor shall not change the superintendent without the prior written approval of PhilaPort, and the Contractor must submit to PhilaPort, in writing, the justification for any such change, along with the name and qualifications of the individual whom the Contractor proposes to be the new superintendent.
3. PhilaPort may demand of the Contractor the dismissal of any person employed by the Contractor who, in the sole opinion of PhilaPort, is incompetent or guilty of misconduct.

4. PhilaPort may withhold any payments which are or may become due the Contractor or PhilaPort may suspend the Work at the expense of the Contractor, if the Contractor fails to comply with the provisions of this Section II.G.

H. Contractor Integrity:

1. The following terms used in this Section II.H shall be defined and understood as follows:

   a. “Confidential” means information that is not public knowledge, or available to the public on request, disclosure of which would give an unfair, unethical, or illegal advantage to another desiring to contract with PhilaPort.

   b. “Consent” means written permission by a duly authorized member or employee of PhilaPort, provided that where the material facts have been disclosed, in writing, by prequalification or contractual terms, PhilaPort shall be deemed to have consented by virtue of execution of the Contract.

   c. “Financial Interest” means ownership of more than a five percent (5%) interest in any business; or holding a position as an officer, director, trustee, partner, employee, or the like, or holding any position of management.

   d. “Gratuity” means any payment of more than nominal monetary value in the form of cash, travel, entertainment, gifts, meals, lodging, loans, subscriptions, advances, deposits of money, services, employment or contracts of any kind.

2. The Contractor shall maintain the highest standards of integrity in the performance of the Contract and shall take no action in violation of Federal or Commonwealth laws, regulations, or other requirements that govern contracting with the Commonwealth or PhilaPort.

3. The Contractor shall not disclose to others any confidential information gained by virtue of the Contract.

4. The Contractor shall not, in connection with the Contract or any other contract with PhilaPort or the Commonwealth, directly or indirectly, offer, confer, or agree to confer any pecuniary benefit on anyone as consideration for the decision, opinion, recommendation, vote, other exercise of discretion, or violation of a known legal duty by any member or employee of PhilaPort or the Commonwealth.

5. The Contractor shall not, in connection with the Contract or any other contract with PhilaPort or the Commonwealth, directly or indirectly, offer, give, or agree or promise to give to anyone any gratuity for the benefit of or at the direction or request of any member
or employee of PhilaPort or the Commonwealth.

6. Except with the consent of PhilaPort or the Commonwealth, neither the Contractor nor anyone in privity with the Contractor shall accept or agree to accept from, or give or agree to give to, any person, any gratuity from any person in connection with the performance of the Work under the Contract except as provided therein.

7. Except with the consent of PhilaPort, the Contractor shall not have a financial interest in any other contractor, Subcontractor providing services, labor, or materials for the Work.

8. The Contractor, upon being informed that any violation of this Section II.H has occurred or may occur, shall immediately notify PhilaPort in writing.

9. The Contractor, by execution of the Contract and by the submission of any bills or invoices for payment pursuant thereto, certifies and represents that the Contractor has not violated any of these provisions.

10. The Contractor shall, upon request of PhilaPort or the Office of State Inspector General, reasonably and promptly make available to PhilaPort and that office and its representatives, for inspection and copying, all business and financial records of the Contractor of, concerning, and referring to the Contract or which are otherwise relevant to the enforcement of this Section II.H

11. For a violation of this Section II.H, PhilaPort may terminate the Contract and any other contract with the Contractor, claim liquidated damages in an amount equal to the value of anything received in breach of this Section II.H, claim damages for all expenses incurred in obtaining another contractor to complete performance under the Contract, and debar and suspend the Contractor from doing business with PhilaPort. These rights and remedies are cumulative, and the use or nonuse of any one shall not preclude the use of all or any other. These rights and remedies are in addition to those PhilaPort and/or the Commonwealth may have under law, statute, regulation or otherwise.

I. Offset of Tax Liability:

1. By executing the Contract, the Contractor:
   a. Certifies that the Contractor has no outstanding tax liability to the Commonwealth;
   b. Authorizes the Department of Revenue of the Commonwealth to release information related to its tax liability to PhilaPort and the Commonwealth’s Department of General Services; and
   c. Authorizes the Commonwealth and PhilaPort to set off any state and local tax liabilities of the Contractor or any of its subsidiaries, as well as any other amount
due to the Commonwealth from the Contractor, against any payment due to the Contractor under the Contract.

2. The certification of no outstanding tax liability is a material representation of fact upon which reliance is placed by PhilaPort in entering into the Contract. If it is later determined that the Contractor knowingly rendered an erroneous certification, PhilaPort may find the Contractor in default and terminate the Contract. Erroneous certification may also be grounds for the initiation of civil or criminal proceedings.

J. Commonwealth Audit:

1. The funds for the Contract are subject to audit by PhilaPort and other agencies and representatives of the Commonwealth in accordance with applicable laws and regulations. PhilaPort reserves the right to perform additional audits of a financial/compliance, economy/efficiency or program results nature, if deemed necessary.

2. The Contractor will submit to PhilaPort copies of any audit conducted by or at the request of the Contractor that involves the funds for the Contract.

K. Contractor Responsibility Provision:

1. By executing the Contract, the Contractor certifies that it is not currently under suspension or debarment by the Commonwealth, any other state or the federal government. The Contractor also acknowledges that if it is currently under suspension or debarment, its bid, in most instances, will not be accepted or considered.

2. If the Contractor enters into any subcontracts under the Contract with subcontractors who are currently suspended or debarred by the Commonwealth during the term of the Contract or any extensions or renewals thereof, PhilaPort shall have the right to require the Contractor to terminate such contracts.

L. Professional Services:

If the Professional is one other than the Engineer, at the time of execution of the agreement between PhilaPort and the Professional, PhilaPort may at PhilaPort’s sole discretion require the Professional to give security for the full and faithful performance of such agreement by the Professional. Nothing herein creates any rights on the part of the Contractor or any other party.

M. Status and PhilaPort of the Engineer:

Unless otherwise delegated to the Professional, the Engineer shall have the status and authority as provided in this Section II.M. The Engineer shall have responsibility for the general supervision and direction of the Work, the interpretation of the Plans and Specifications, the ordering of additions to or deductions from the Work, and the
determination of procedure. The Engineer shall give all orders and directions contemplated under the Contract Documents. The actions of the Engineer shall in no way alter the status of the Contractor as an independent contractor, and no action of the Engineer shall be interpreted as making the Contractor an agent of PhilaPort. The Engineer shall in all cases determine the amount, quality, acceptability, and fitness of the Work to be paid for under the Contract, and shall have the authority to reject all Work which does not conform to the Contract Documents. The Engineer shall determine all other questions that may arise in relation to the execution of the Work. The Engineer shall adjust and decide any differences or conflicts that may arise between the Contractor and other contractors for concurrent work.

N. Third-party Actions

1. The Agreement between PhilaPort and the Contractor and the other Contract Documents, and information supplied to the Contractor in connection with this Project, including any deficiency, inconsistency or misrepresentation therein, shall not create any cause of action in favor of or against any third party, whether such action may be for breach of contract, breach of warranty, negligence, misrepresentation or other tort, or otherwise including claims against the architect and its consultants, and their employees, officers and representatives.

2. Except when Contractor is required to pursue a claim directly against another contractor or a Subcontractor as directed elsewhere in the Contract Documents, Contractor agrees that any and all claims, disputes or legal actions filed or pursued by the Contractor in connection with this Contract, the Contract Documents or the Project, shall be filed or pursued only against PhilaPort under the claims procedures set forth in the General Conditions and that no claims or legal actions will be filed or pursued against PhilaPort’s design professionals, administrators, officers, directors, their employees, representatives, or consultants, or their employees or representatives. Contractor agrees that this paragraph shall survive termination of this agreement. Contractor also agrees that this paragraph shall be binding whether or not it claims prior breach of this contract and that this paragraph shall apply to any and all claims including breach of contract, breach of warranty, negligence, misrepresentation or other tort, or otherwise.

3. If any portion of the Contract Documents shall be in conflict with any other portion after the application of the rules of interpretation set forth elsewhere in these General Conditions, the various documents comprising the Contract Documents shall govern in this order and sequence, with the document listed first controlling over the document listed thereafter:

   a. Amendments and other Modifications issued subsequent to the execution of this Agreement
   b. Agreement or Contract between PhilaPort and the Contractor
c. Addenda issued prior to execution of the Contract  
d. General Conditions, as amended and modified  
e. Notice or Notices to Proceed  
f. General or Special Requirements  
g. Plans and Specifications  
h. Instructions to Bidders  
i. Performance and Payment Bonds  
j. Other documents referenced in the Contract Documents or attached to another  
  Contract Document and not specifically excluded as a Contract Document

Where two documents are of equal precedence, the document with the later date of  
execution shall control.

III. General Legal Compliance:

A. Laws and Ordinances:

The Contractor shall give all notices and comply with all applicable laws, ordinances,  
regulations, rules, and orders of any public authority bearing on the Work, as may be  
amended from time to time (“Applicable Laws”). If the Contractor observes that any of the  
Contract Documents are in conflict with any Applicable Laws in any respect, the Contractor  
shall promptly notify the Engineer in writing. If the Contractor performs any Work knowing  
it to be contrary to Applicable Laws, with or without such written notice to the Engineer, the  
Contractor shall assume full responsibility therefor and shall bear all costs attributable  
thereto.

B. Hours and Conditions of Employment:

The Contractor agrees to abide and be bound by the laws of the Commonwealth relating to  
and regulating the hours and conditions of employment by Acts of Assembly in such case  
made and provided.

C. Americans with Disabilities Act:

1. Pursuant to federal regulations promulgated under the authority of the Americans With  
   Disabilities Act, 28 C.F.R. § 35.101 et seq., the Contractor understands and agrees that no  
   individual with a disability shall, on the basis of the disability, be excluded from  
   participation in the Contract or from activities provided for under the Contract. As a  
   condition of accepting and executing the Contract, the Contractor agrees to comply with  
   the “General Prohibitions Against Discrimination,” 28 C.F.R. § 35.130, and all other  
   regulations promulgated under Title II of the Americans With Disabilities Act which are  
   applicable to the benefits, services, programs, and activities provided by the  
   Commonwealth through contracts with outside contractors.
2. The Contractor shall be responsible for and agrees to indemnify and hold harmless the Commonwealth and PhilaPort from all losses, damages, expenses, claims, demands, suits, and actions brought by any party against the Commonwealth or PhilaPort as a result of the Contractor’s failure to comply with the provisions of this Section III.C.

D. Equal Employment Opportunities:

1. In accordance with Pa. Stat. Ann. tit. 55, § 697.16, the nondiscrimination and contract compliance plans used by PhilaPort are required to be the same as those used by the Commonwealth’s Department of General Services.

2. During the term of the Contract, the Contractor agrees to comply with the following “nondiscrimination clause”:

   a. The Contractor shall not discriminate against any employee, applicant for employment, independent contractor, or any other person because of race, color, religious creed, ancestry, national origin, age, or sex. The Contractor shall take affirmative action to ensure that applicants are employed, and that employees or agents are treated during employment, without regard to their race, color, religious creed, ancestry, national origin, age, or sex. Such affirmative action shall include, but is not 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. The Contractor shall post in conspicuous places, available to employees, agents, applicants for employment and other persons, a notice setting forth the provisions of this nondiscrimination clause.

   b. The Contractor shall in advertisements or requests for employment placed by it or on its behalf state that all qualified applicants will receive consideration for employment without regard to race, color, religious creed, ancestry, national origin, age, or sex.

   c. The Contractor shall send each labor union or workers’ representative with which it has a collective bargaining agreement or other contract or understanding, a notice advising said labor union or workers’ representative of its commitment to this nondiscrimination clause. Similar notice shall be sent to every other source of recruitment regularly utilized by the Contractor.

   d. It shall be no defense to a finding of noncompliance with the Contract Compliance Regulations (the “Contract Compliance Regulations”, 16 Pa. Code Chapter 49) issued by the Pennsylvannia Human Relations Commission (the “Commission”) or with the terms and provisions of this nondiscrimination clause that the Contractor had delegated some of its employment practices to any union, training program, or other source of recruitment which prevents it from meeting its obligations. However, if the evidence indicates that the Contractor was not on
notice of the third-party discrimination or made a good faith effort to correct such
discrimination, such factor shall be considered in mitigation in determining
appropriate sanctions.

e. Where the practices of a union or any training program or other source of
recruitment will result in the exclusion of minority group persons, so that the
Contractor will be unable to meet its obligations under the Contract Compliance
Regulations or pursuant to the terms and provisions of this nondiscrimination
clause, the Contractor shall then employ and fill vacancies through other
nondiscriminatory employment procedures.

f. The Contractor shall comply with the Contract Compliance Regulations, which
are incorporated herein by reference as if fully set forth herein, and with all laws
prohibiting discrimination in hiring or employment opportunities. In the event of
the Contractor’s noncompliance with the terms and provisions of this
nondiscrimination clause or with any such laws, the Contractor may, after hearing
and adjudication, be terminated or suspended, in whole or in part, and the
Contractor may be declared temporarily ineligible for other contracts with
agencies of the Commonwealth, and such other sanctions may be imposed and
remedies invoked as provided by the Contract Compliance Regulations.

g. The Contractor shall furnish to PhilaPort and the Commission, all necessary
employment documents and records and shall permit access by PhilaPort and the
Commission to the Contractor’s books, records, and accounts, for purposes of
investigation to ascertain compliance with the provisions of the Contract
Compliance Regulations. If the Contractor does not possess documents or records
reflecting the necessary information requested, it shall furnish such information
on reporting forms supplied by PhilaPort or the Commission.

h. The Contractor shall actively recruit minority Subcontractors and Subcontractors
with substantial minority representation among their employees. The Contractor
shall comply with its obligations under the Diversity Inclusion Plan, including
specifically the periodic submittal of forms and reports.

i. The Contractor shall include the provisions of this nondiscrimination clause in
every subcontract, so that such provisions will be binding upon each
Subcontractor.

j. The terms used in this nondiscrimination clause shall have the same meanings as
used in the Contract Compliance Regulations.

k. The Contractor’s obligations under this nondiscrimination clause are limited to
the Contractor’s facilities within the Commonwealth, or, where the Contract is for
the purchase of goods manufactured outside of the Commonwealth, the facilities
at which such goods are actually produced.
3. It is hereby agreed that any failure to comply with the foregoing nondiscrimination clause shall constitute a substantial breach of the Contract. It is further agreed that in the event PhilaPort, or the Commission if the Commission assumes sole responsibility for the determination of the compliance status of the Contractor, determines after a hearing and adjudication that the Contractor or any Subcontractor or any person acting on behalf of the Contractor or of any Subcontractor hereunder, has failed to comply with any of the provisions of the foregoing nondiscrimination clause, PhilaPort or the Commission may provide for the fixed-period suspension of the remaining obligations under the Contract pending compliance by the Contractor with the Contract Compliance Regulations; provided that the failure of the Contractor to comply with the adjudication within the fixed-period stated in the order, but not fewer than thirty (30) days, shall be considered a material breach and shall give the Commonwealth the right to bring an action against the Contractor and the surety on the Contractor’s bond to recover expenses incurred in re-letting the Contract, delay in performance, or other verifiable damages.

E. Prevailing Wages:

1. The Contractor and all Subcontractors are subject to the provisions, duties, obligations, remedies, and penalties of the Pennsylvania Prevailing Wage Act, Pa. Stat. Ann. tit. 43, §165-1 et seq., which is incorporated herein by reference as if fully set forth herein. Not less than the prevailing minimum wages as determined by the Secretary of Labor and Industry of the Commonwealth shall be paid to all workers employed by the Contractor and all Subcontractors.

2. The Contractor and all Subcontractors of whatever tier agree to employ or utilize labor that participates in an approved Apprenticeship Program as defined herein for each craft or trade of the labor force performing the Work. An approved Apprenticeship Program is one that is registered at the time the Contract is executed with the Pennsylvania Apprenticeship and Training Council. Apprentices employed on the Project shall be those participating in the approved Apprenticeship Program and whose training and employment are in full compliance with the provisions of the Act dated July 14, 1961 (P.L. 604), as amended, known as “The Apprenticeship and Training Act” and the rules and regulations issued pursuant thereto. Any employee using the tools of a craft who does not qualify as an apprentice within the provisions shall be paid the minimum wage predetermined for journeymen in that particular craft and/or classification.

3. Should the Contract Documents include information on Davis-Bacon wage rates, Contractor shall pay the higher of the Pennsylvania Prevailing Wage rate and the Davis-Bacon wage rate.

F. Preferential Hiring of Veterans:

The Contractor, Subcontractor(s) or any person in either of their behalf, shall carry out the provisions of Section 1 of the Act of August 1, 1975 (P.L. 233, No. 92), 51 Pa. C.S.A. §7106, which concerns the giving of preferences to honorably discharged persons who have served in the armed forces of the U.S. during any war or armed conflict, in determining who shall be
employed on public works, which act in part provides:

Whenever the Commonwealth issues specifications for the construction, alteration or repair of any public works, such specifications shall include a provision under which the contractors and subcontractors shall agree to give a preferential rating similar to that given by the Commonwealth to any soldier making application for employment upon such public works.

G. Environmental Laws:


2. If the Contractor must undertake additional Work due to the enactment of new or the amendment of existing statutes, rules or regulations occurring after the submission of the Contractor’s bid, PhilaPort shall issue a change order setting forth the additional Work that must be undertaken, which shall not invalidate the Contract. The cost of such a change order shall be determined in accordance with Section VIII.E herein, provided, however, that such additional costs to undertake Work not specified in the invitation for bids shall not be approved unless written authorization is given the Contractor prior to the undertaking of such additional Work.
3. PhilaPort shall not be responsible for any asbestos, PCBs, petroleum, hazardous waste, radioactive materials, or other toxic materials uncovered or revealed at the Site which were brought to the Site by the Contractor, any Subcontractor, anyone else for whom the Contractor is responsible, or any other person.

H. Taxes:

The Contractor shall pay all sales, mercantile, consumer, use, service, and other similar taxes which are required by Applicable Laws for the Work or portions thereof provided by the Contractor. The Contractor is required to pay Pennsylvania Sales and Use Taxes and may claim an exemption only for some construction materials. The Contractor shall pay all Federal Excise Taxes if due.

I. Permits and Licenses:

The Contractor shall obtain all permits and licenses required by Federal, State, and local laws, ordinances, and regulations which are applicable to the Contractor and the Work, unless otherwise specifically directed; and the Contractor shall pay all necessary fees, costs, or expenses incurred in obtaining such permits and licenses including, but not limited to, building permits, water permits, air permits and certificates of occupancy. In addition, the Contractor will be required to pay the fee where a service is rendered or materials, supplies, or equipment is provided.

J. Maintenance of Waterways:

1. In and around navigable waterways, the Work shall be carried on in full compliance with applicable requirements of the United States Department of Defense, Coast Guard, the Philadelphia Department of Commerce, and any other governmental agency having jurisdiction. Movement of boats and vessels of all kinds shall be maintained unless interference is permitted otherwise by the United States Department of Defense and the Navigation Commission for the Delaware River and its Navigable Tributaries, and any other governmental agency having jurisdiction, and then only within the limits and times specified. Should the Contractor, during the progress of the Work, sink or lose any material, plant, machinery, etc., which may be dangerous to or obstruct navigation, the Contractor shall forthwith recover and remove the same. The Contractor shall give immediate notice to the proper authorities of such obstruction, and, if required, shall, under the directions of said authorities, mark or buoy such obstructions until the same are removed.

2. Upon the completion of the Work affecting waterways of any character, all equipment shall be removed, and material deposited in such waterways shall also be removed unless otherwise ordered or permitted, so as to leave an unobstructed channel of not less than the
same width and depth and with the banks, retaining structures, or wharves in a condition at least equal to that existing before the beginning of the Work.

IV. Specific Legal Requirements:

A. Assignment of Antitrust Claims:

The Contractor and PhilaPort recognize that in actual economic practice, overcharges by the Contractor’s Subcontractors resulting from violations of State or Federal antitrust laws are in fact borne by PhilaPort. As part of the consideration for the award of the Contract, and intending to be legally bound, the Contractor assigns to PhilaPort all right, title and interest in and to any claims the Contractor now has or may hereafter acquire under State or Federal antitrust laws relating to the goods or services which are provided under the Contract.

B. Accidents:

The Contractor shall be deemed and considered an independent contractor with respect to the Work, and shall assume all risks and responsibility for casualties of every description in connection with the Work. The Contractor shall have charge of the Work until completion and acceptance, and shall alone be liable and responsible for any accidents to persons and any loss or damage to property, buildings, or adjacent work that may occur as a consequence of or during the progress of the Work, whether such damage or accident is due to the negligence of the Contractor’s servants, agents, employees, or whether such damage or accident is due to the inherent nature of the Work. It is not the intention of this Section IV.B or of anything herein provided to confer a third party beneficiary right of action upon any person whatsoever and nothing hereinbefore or hereinafter set forth shall be construed so as to confer upon any person other than PhilaPort a right of action either under the Contract or in any manner whatsoever.

C. Indemnification:

The Contractor shall indemnify, defend, and hold harmless PhilaPort, the agent of PhilaPort acting as Construction Manager, the Commonwealth, and the tenants of any facilities affected by the Work, and their officers, employees, and agents, from and against any and all losses, costs (including litigation costs and counsel fees), claims, suits, actions, damages, liability, and expenses in connection with loss of life, bodily injury, personal injury, or damage to tangible property to the extent occasioned wholly or in part by the Contractor’s act or omission or the act or omission of the Contractor’s agents, contractors (including subcontractors and suppliers), officers, employees, or servants pursuant to the Contract.
D. Intellectual Property:

As part of the consideration for the award of the Contract, the Contractor agrees to assign to PhilaPort all of its rights, title, and interest in its inventions, patents, patent applications, copyrights, ideas, improvements, trade secrets, know-how, technical data, drawings and manufacturing information (the “Intellectual Property”) which arise out of or relate to the Work, Plans, or Specifications, but only insofar as such have been prepared for the purposes of the Project. The Contractor shall promptly disclose the Intellectual Property to PhilaPort, and shall keep confidential the Intellectual Property which is not publicly known. Upon request by PhilaPort, the Contractor shall take all actions, including execution of documents, to assist PhilaPort in documenting, recording, registering, perfecting, or otherwise securing, maintaining, and enforcing the Intellectual Property rights, title and interest. Upon request by PhilaPort, the Contractor shall promptly deliver to PhilaPort all documents or other tangible materials which comprise or embody the Intellectual Property.

E. Patented Appliances, Products or Processes:

To the fullest extent permitted by law, the Contractor agrees to indemnify, defend, and hold harmless PhilaPort, all its members, officers, and employees from all suits and actions of every name, nature, and description brought against them, or any of them, for or on account of the use of patented appliances, products, processes, constructions, designs, or methods, or the infringement of any patent, trademark, or copyright, and the Contractor shall pay all royalties, charges, and penalties which may become due or payable by reason of such use or infringement. Prior to the issuance of the final estimate, upon request by the Engineer, the Contractor shall submit evidence of the full payment of such royalties, charges, and penalties, or in lieu thereof the Contractor shall give such security, approved by PhilaPort’s legal counsel, as may in the opinion of the Engineer be necessary to indemnify and hold harmless PhilaPort, all its members, officers, and employees as aforesaid.

F. No Estoppel or Waiver of Legal Rights:

Neither PhilaPort nor the Engineer shall be precluded or estopped by the approved applications for payment or payments made or given by any of them or by any of their agents or employees, under any provision or provisions herein, at any time, either before or after the completion and acceptance of the Work and payment thereof, from showing the true and correct amount and character of the Work performed by the Contractor; nor from showing at any time, that any such approved applications for payment or payments are untrue or incorrectly made in any particular; or that the Work or any part thereof does not conform to the Contract Documents. PhilaPort shall have the right to reject the whole or any part of the aforesaid Work should the said approved applications for payment or payments be found or be known to be inconsistent with the terms of the Contract Documents, or otherwise improperly given; and PhilaPort shall not be precluded or estopped, notwithstanding any such approved applications for payment or payments, from demanding and recovering from the Contractor or the surety or both such damages as PhilaPort may sustain by reason of the failure to comply with the terms of the Contract Documents, or on account of any overpayments made. Neither the acceptance by PhilaPort or the Engineer or any of their
agents or employees, nor any certificate approved for payment of money, nor any payments for, nor acceptance of the whole or any part of the Work by PhilaPort, nor any extension of time, nor any position taken by PhilaPort or its employees, shall operate as a waiver of any portion of the Contract or any power herein reserved by PhilaPort or any right to damages; nor shall any waiver of any breach of the Contract be held to be a waiver of any other subsequent breach.

G. Legal Relations and Responsibilities:

1. The Contract is not to be construed as being made for the benefit of any person or political subdivision not a party to the Contract, nor shall the Contract be construed to authorize any person or political subdivision not a party to the Contract to maintain any lawsuit hereunder, nor shall the Contract be construed to constitute the basis for the maintenance of any lawsuit by any person, other than as provided in Section IV(B) herein, or political subdivision not a party hereto.

2. The Contractor acknowledges that PhilaPort, as an agency of the Commonwealth, enjoys sovereign immunity as provided in Section 18 of the Philadelphia Regional Port Authority Act, 55 P.S. §697.18.

H. Unauthorized Acts:

Any act of an PhilaPort representative, official, agent, or employee, that is not within the scope of that person’s authority or employment as delineated in the Contract Documents, shall not be binding on PhilaPort nor shall it be deemed to be a defense by the Contractor for the breach of any of the conditions and provisions of the Contract.

I. Successors and Assigns:

The Contract shall be binding on the parties hereto, their heirs, executors, administrators, successors, and assigns, but it may not be assigned by the Contractor without the prior written consent of PhilaPort.

J. Governing Law:

The Contract shall be governed by and construed and enforced in accordance with the laws of the Commonwealth of Pennsylvania, without giving effect to the principles of conflicts of law thereof.

V. Standards of Review & Project Compliance:

A. Sketch Drawings:
If the Contractor requires sleeves and openings for the Work in any deck, concrete slab or wall, the Contractor shall furnish to PhilaPort and all other prime contractors involved a complete set of location sketch drawings in triplicate showing size and shape of openings. Each prime contractor shall be responsible for reviewing the drawings in order that there will be no interference and/or conflict in their respective portions of the Work. When this review is finalized, the Contractor shall submit these drawings to PhilaPort and the Engineer in a final workable form.

B. Chases and Openings:

1. The contractor for general construction will construct or have built into building walls, partitions, and floors all such chases and openings as are required. Each prime contractor will be responsible to see that the chases and openings affecting their work are installed in accordance with the Plans submitted to the contractor for general construction.

2. All construction pertaining to the cutting of chases and openings shall be done to the entire satisfaction of PhilaPort and the Engineer. Should the cutting of such chases and openings be required after construction of walls, partitions, floors or other work are completed, PhilaPort may require such work to be performed in a manner so as to result in unmarred work even to the extent of requiring the removal and rebuilding of walls, partitions, and other work, all of which shall be at the sole cost and expense of the responsible prime contractor.

C. Shop Drawings and Samples:

1. The Contractor shall submit all necessary shop drawings or catalog data to the Engineer in accordance with a priority schedule established by the Engineer.

2. When drafting is required, transparent reproductions of shop drawings (one of each drawing) shall be submitted by the Contractor during the checking period prior to the required submittal and within the time period which is established in the Contract Documents, in order to enable the Engineer to make corrections in pencil, reproduce them for the Engineer’s records, and return for correction the original shop drawing tracings. The Contractor shall include in the Contractor’s submittal one line print of each transparency for the Engineer to keep as a record. Until shop drawings have received the Engineer’s approval as being in compliance with the Contract Documents, the Contractor shall resubmit them in the manner last marked for correction. When shop drawings are noted “Approved” for compliance with the Contract Documents by the Engineer, the Contractor shall have ten (10) sets of final shop drawings or catalog data printed and furnished to the Engineer. Where no special drafting is involved, such as cuts of standard equipment, catalog cuts, and other matter so printed in quantity, the printed matter may be submitted instead of the transparencies.

3. The Contractor shall review, stamp with approval and submit, with reasonable promptness in an orderly sequence so as to cause no delay in the Work or in the work of
any other contractor, all shop drawings and samples required by the Contract Documents or required subsequently by the Engineer for modifications. Shop drawings and samples shall be properly identified as specified, or in such manner as the Engineer may require. If the shop drawings show variations from the Contract Documents because of standard shop practice or other reason, the Contractor shall make specific mention of such variations on the shop drawings and in the Contractor’s letter of submission, in order that, if accepted, suitable action may be taken for proper adjustment by way of increase or decrease in the Contract Sum; otherwise, the Contractor will not be relieved of the responsibility for executing the Work in complete conformity with the Contract even though the shop drawings, samples or catalog data have been approved.

4. By approving and submitting shop drawings and samples, the Contractor thereby represents that the Contractor has determined and verified all applicable field measurements, field construction criteria, materials, catalog numbers and similar data, or will do so, and that the Contractor has checked and coordinated each shop drawing and sample with the requirements of the Work and the Contract Documents.

5. The Engineer will review and approve shop drawings and samples with reasonable promptness, but the Engineer’s review and approval is only for conformance with the design concept of the Project and with the information given in the Contract Documents. The Engineer’s approval of a separate item shall not indicate approval of an assembly in which the item functions.

6. The Contractor shall make any corrections required by the Engineer and shall resubmit the required number of corrected copies of shop drawings or new samples until approved, which resubmission shall be acted upon by the Engineer with reasonable promptness. When resubmitting shop drawings, the Contractor shall direct specific attention to any revisions made, other than the corrections requested by the Engineer on previous submissions, by noting such revisions on the resubmitted shop drawings.

7. The Engineer’s approval of shop drawings or samples shall not relieve the Contractor of responsibility for any deviation from the requirements of the Contract Documents, unless the Contractor has informed the Engineer in writing of such deviation at the time of submission, has noted the deviation on the shop drawings, and the Engineer and PhilaPort have given written approval of the specific deviation; nor shall the Engineer’s approval relieve the Contractor from responsibility for errors or omissions in the shop drawings or samples.

8. No portion of the Work requiring a shop drawing or sample submission shall be commenced until the submission has been approved by the Engineer. Any Work commenced by the Contractor prior to final approval of the shop drawings and/or samples by the Engineer shall be performed by the Contractor at the Contractor’s own risk.

D. Plans and Specifications:
1. The Plans, with all notes thereon, and the Specifications are intended to be correlative and of equal force and effect. However, if a discrepancy arises between them, the more stringent standard shall apply. The Plans give general dimensions and sizes, and such details as are required to cover special features. Figures shall have preference over scale in reading dimensions. The Plans and Specifications are intended to provide a standard of quality and quantity. The Contractor is required to field verify all dimensions, sizes, quantities, etc. prior to beginning Work.

2. The organization of the Specifications into divisions, sections and articles, and the arrangement of drawings shall not control the Contractor in dividing the Work among any Subcontractors or in establishing the extent of the Work to be performed by any trade. The thorough and complete coordination of all aspects of the Project is the responsibility of the Contractor.

3. Where the Work is shown in complete detail on only a portion of a drawing, or there is an indication of continuation the remainder being shown in outline, the Work drawn out in detail shall be understood to apply to other like portions of the Work. On all Work of a remodeling nature or installation within present buildings, the actual situation at the Site controls any information given which may affect the quantity, size and quality of materials required for a satisfactorily completed Contract, whether or not such information is indicated on the Plans or within the Specifications.

4. The Contractor shall maintain at the Site for PhilaPort and the use of the Engineer one (1) copy of all Plans, Specifications, bulletins, addenda, approved shop drawings, catalog data, manufacturers’ operating and maintenance instructions, certificates, warranties, guarantees and other operating and maintenance data, change orders, and other modifications, including as-built drawings (to be printed on mylar), in good order and marked daily by the Contractor to record all approved changes made during the Work. These shall be turned over to the Engineer by the Contractor at the time of the Substantial Completion of the Contract for the purpose of assembling and correlating said material for use by PhilaPort.

E. Copies Furnished and Ownership of the Contract Documents:

1. Unless otherwise provided in the Contract Documents, the Contractor will be furnished, free of charge by PhilaPort (or the Engineer acting on behalf of PhilaPort), one (1) complete set of Plans and Specifications if such are needed for the Work. If additional sets are required, PhilaPort (or the Engineer, at the direction of PhilaPort) shall be reimbursed by the Contractor for the cost of providing the additional sets.

2. All Plans, Specifications and copies thereof furnished by PhilaPort or the Engineer are and shall remain the property of PhilaPort. They are not to be used on any other project, and with the exception of one (1) set for each party to the Contract, are to be returned at the completion of the Work to PhilaPort within thirty (30) days of PhilaPort’s request for such documents.
3. The Contractor expressly agrees and acknowledges that the Engineer and PhilaPort will not be responsible for the acts or omissions of any contractor under the Project, or any Subcontractor, or any of their agents or employees, or any other persons performing any of the Work under the Project.

4. If corrective work or drawings are required of the Engineer due to defective or nonconforming work by the Contractor, the cost for additional professional services shall be borne by the Contractor, provided that the Engineer submits those costs to PhilaPort and the Contractor within thirty (30) days after the completion of said additional services. PhilaPort shall review for approval the corrective work and/or drawings which are prepared by the Engineer in order to determine that the corrective work and/or drawings fall within the original scope of the Contract.

F. Standards of Quality:

1. Where trade names, catalog numbers and manufacturers of material or equipment are specified in the Contract Documents, except where specific requirements are noted, they are mentioned therein for the purpose of establishing a standard of quality, performance, and appearance, and for establishing a standard of competitive bidding. Should the Contractor desire to deliver or install material or equipment other than that which is specified, the Contractor shall certify that the proposed substitute material or the equipment is equal in quality, performance and appearance to that identified in the Specifications, and the Contractor shall submit to the Engineer and PhilaPort, subsequent to the award of the Contract, a request to deliver or install such material or equipment. The Contractor’s request shall include a comprehensive description of the proposed substituted material or equipment, including engineering, construction, dimension and performance data, along with a statement of cost involved. Within thirty (30) days after receipt of the Contractor’s request, the Engineer, with the approval of PhilaPort, shall render a written determination to the Contractor which shall be final and conclusive. If the Contractor shall refuse or fail to proceed as directed by PhilaPort, PhilaPort may declare the Contractor in default.

2. The Contractor shall be responsible for any and all costs incurred as a result of any substitution. If the cost of the substituted item is less than the specified item, PhilaPort is entitled to a credit for the difference between the cost of the substituted item and the cost of the item specified.

G. Quantities are Approximate:

When quantities of the various classes of the Work to be done and materials to be furnished under the Contract are stated, they are estimated and approximate. When stated in the Proposal they are given only for the purpose of comparing the bids on a uniform basis. PhilaPort does not guarantee that the amount stated will correspond to the actual amounts that are eventually comprised in the Work, and no claim for damages, for anticipated profit, or for loss of profit, will be allowed the Contractor in the event of a disagreement with the final estimate of the Work completed. PhilaPort reserves the right to increase or decrease the
quantities or to entirely omit any of the items as contained in the Proposal, to the extent found necessary by the Engineer.

H. Methods to be Approved:

Before commencing the Work, the Contractor shall, when required by the Engineer, submit for approval the proposed methods of performing the Work, including maintaining travel, underpinning, bulkheading, shoring, sinking foundations, handling spoils, lighting, maintaining structures, street surfaces, and drainage, and all other branches of operations. Such approval is reserved in order to safeguard PhilaPort’s interest, but it will in no way relieve the Contractor of the obligation or responsibility for the safe and proper conduct of the Work.

I. Completeness of Data:

The term “structures” as used in the Contract shall apply to all surface, subsurface and overhead structures of whatever character within the zone of influence of the Work, including buildings situated in or adjacent to the excavation. Where these structures are shown or indicated on the Plans, the information given is in accordance with the best information in the possession of PhilaPort, but is approximate only. The data is not warranted to be either complete or correct, and the Contractor shall assume all risks resulting from the conditions differing from the approximations shown.

J. Lines and Grades; City Datum:

Vertical dimensions are given in United States standard feet and fractions thereof. Unless otherwise stated, elevations preceded by a plus (“+”) or a minus (“-”) sign refer respectively to distances above or below the established City Datum, which is two and one quarter (2.25) feet above mean high water on the Delaware River at Chestnut Street, Philadelphia. Dimensions locating buildings and structures shall be verified and checked in the field by the Contractor before proceeding with construction details affected thereby. Any of the Work improperly done without lines, levels or instructions shall be removed and replaced by the Contractor at the Contractor’s own expense. Failure to do so in the sole judgment of the Engineer may be considered by PhilaPort as a violation of the Contract.

K. As-Built Documents:

At the time of Substantial Completion, as such term is defined in Section XVI herein, the Contractor shall provide to the Engineer one set of all as-built drawings, and six copies of each shop drawing, catalog data, manufacturers’ operating and maintenance instructions, certificates, warranties, written guarantees and related documents required by the Contract Documents. In addition, the Contractor shall supply electronic copies of each as-built drawings in Auto Cad latest version and .PDF.

If any portion of the Work is designed by the Contractor (for example, sprinkler calculations) the engineer of record performing such work shall issue a letter of certification indicating that
the work as installed meets the design intent, is in compliance with applicable codes and that it is approved by said engineer.

VI. **Insurance:**

**A. Contractor’s Insurance:**

1. The Contractor shall, at its sole cost and expense, procure and maintain in full force and effect, covering the performance of the Work, the types of insurance specified in this Section VI.A. The insurance shall be procured from reputable insurers, acceptable to PhilaPort and authorized to do business in the Commonwealth. The insurance required, except the Professional Liability Insurance, shall be written on an “occurrence” basis and not a “claims-made” basis. In no event shall Work be performed pursuant to the Contract until the required evidence of insurance has been furnished and approved to PhilaPort. If the Contractor fails to obtain or maintain the required insurance, PhilaPort shall have the right to treat such failure as a material breach of the Contract and to exercise all appropriate rights and remedies. The Contractor shall provide for at least thirty (30) days’ prior written notice to be given to PhilaPort in the event coverage is materially changed, cancelled or non-renewed.

2. PhilaPort, the Commonwealth, and the tenants of any facilities affected by the Work, their officers, employees, and agents are to be named as additional insureds on the General Liability Insurance policy of the Contractor. In addition, an endorsement to the insurance policy is required stating that the coverage afforded PhilaPort, the Commonwealth, and the tenants of any facilities affected by the Work, and their officers, employees, and agents as additional insureds will be primary to any coverage available to the Contractor.

3. The amount of insurance required by this Section VI.A is as follows:

   a) **Workers Compensation and Employers Liability and/or Harbor Worker’s Compensation Act, the Jones Act or other Maritime Employer’s Liability Act:**


      2. Employers Liability: $500,000 each accident - bodily injury by accident; $500,000 each employee - bodily injury by disease; and $500,000 policy limit - bodily injury by disease.

      3. Other States’ coverage and Pennsylvania endorsement.

   b) **General Liability Insurance:**

      1. Limit of Liability: $1,000,000 per occurrence combined single limit for bodily injury and property damage; $1,000,000 personal and advertising injury; and $2,000,000 general aggregate.
2. Coverage: Premises operations; blanket contractual liability; personal injury liability (employee exclusion deleted); products and completed operations; independent contractors; employees and volunteers as additional insureds; cross liability; and broad form property damage (including completed operations)

c) Automobile Liability:

1. Limit of Liability: $1,000,000 per occurrence combined single limit for bodily injury and property damage liability.

2. Coverage: Owner, non-owned and hired vehicles.

d) Professional Liability Insurance (if required):

1. Professional Liability Insurance for projects that involve design services, including, but not limited to, design/build contracts.

2. Limit of Liability: $1,000,000 with a deductible not to exceed $25,000.


4. Coverage for occurrences happening during the performance of the Work shall be maintained in full force and effect under the insurance policy or “tail” coverage for a period of at least two (2) years after completion of the Work.

e) Pollution Liability Insurance at a minimum of $1,000,000 per occurrence with an aggregate of $2,000,000.

4. Certificates of insurance evidencing the required coverages shall be submitted to PhilaPort’s Insurance Department at least ten (10) days before work on site is begun. This ten (10) day requirement for advance documentation of coverage may be waived in situations where such waiver will benefit PhilaPort, but under no circumstances shall the Contractor actually begin Work without providing the required evidence of insurance. PhilaPort reserves the right to require the Contractor to furnish certified copies of the original policies of all insurance required under the Contract Documents at any time upon ten (10) days’ prior written notice to the Contractor.

5. It is expressly understood and agreed that the furnishing of insurance pursuant to this Section VI.A shall in no way limit the liability or responsibilities and obligations of the Contractor as provided in the Contract Documents.

6. Where applicable, all insurance shall provide coverage for work being performed within fifty (50) feet of a railroad.
B. Contractor’s Liability Insurance:

1. The Contractor’s certificate of insurance for general liability shall contain the following statement: “The risks covered in this policy include all risks inherent in performing demolition work, including but not limited to the following: explosion, collapse, and underground hazards.”

2. The Contractor’s certificate of insurance for workmen’s compensation shall contain the following statement: “All workers performing demolition work under this contract are covered under the classification for demolition workers.”

3. The Contractor’s and the Subcontractors’ liability insurance shall include adequate protection against the special hazard of blasting in the amount of at least three hundred thousand dollars ($300,000).

VII. Safety:

A. Safety of Persons and Property:

1. The Contractor shall take all necessary precautions for the safety of, and shall provide all reasonable protection to prevent damage, injury or loss to:
   
   a. all employees on the Site, and all other persons who may be affected by the Work;
   
   b. the Work, whether in storage on or off the Site, under the care, custody or control of the Contractor or any Subcontractors or sub-subcontractors; and
   
   c. other property at the Site or adjacent thereto which may be affected by the Work, including trees, shrubs, lawns, walks, pavements, roadways, structures and utilities not designated for removal, relocation or replacement in the course of the Work.

2. All damages or loss to any property referred to in Sections VII.A.1.b and c caused in whole or in part by the Contractor, any Subcontractor, any sub-subcontractor, or anyone directly or indirectly employed by any of them or by anyone for whose acts any of them may be liable, shall be remedied by the Contractor, except damage or loss attributable to faulty Plans or Specifications or to the acts or omissions of PhilaPort or Engineer or anyone employed by either of them or for whose acts either of them may be liable, and not attributable to the fault or negligence of the Contractor.

3. The Contractor is responsible for safety. The Contractor shall submit a site specific safety plan. The Contractor shall comply with all applicable, laws, ordinances, rules, regulations and orders of any public authority having jurisdiction for the safety of persons or property or to protect them from damage, injury or loss. The Contractor shall erect
and maintain as required by existing conditions and progress of the Work, until the acceptance of the completion of the Contractor’s portion of the Project, all reasonable safeguards for safety and protection, including posting danger signs and other warnings against hazards, promulgating safety regulations and notifying owners and users of adjacent utilities.

4. If and when the use of explosives and other hazardous materials or equipment is necessary for the prosecution of the Work, the Contractor shall observe the utmost care, performing such Work with experienced workers and in accordance with all Federal, Commonwealth, City and institutional regulations, so as not to endanger life or property. Rock encountered within a minimum of five (5) feet of pipe lines or buildings shall be removed without blasting. All explosives shall be stored in a secure and safe manner, in strict conformity with all Commonwealth and City regulations and all such storage shall be marked clearly, “Dangerous-Explosives” and shall be in the care of competent watch people at all times.

5. Prior to the initiation of any work on site, the Contractor shall designate a responsible member of the Contractor’s organization at the Site whose duty shall be the prevention of accidents. This person shall be the Contractor’s superintendent unless otherwise designated in writing by the Contractor to PhilaPort and the Professional.

6. The Contractor shall not load or permit any part of the Work to be loaded so as to endanger the safety of the Work.

B. Safety Precautions and Programs:

The Contractor shall be responsible for initiating, maintaining and supervising all Federal, Commonwealth and City safety precautions and programs required on the Site during the term of the Contract.

C. Emergencies:

In any emergency affecting the safety of persons or property, the Contractor shall act, at the Contractor’s discretion, to prevent threatened damage, injury or loss. Any additional compensation or extension of time claimed by the Contractor on account of emergency work shall be determined as provided in Sections VIII.E through I herein.

D. Access to Fire Hydrants and Fire Alarm Boxes:

The Contractor must comply with all applicable fire codes and regulations. Fire hydrants shall be left at all times clear of obstructions and readily accessible for fire apparatus and no material or other obstructions shall be placed within fifteen (15) feet of a fire hydrant. Fire alarm boxes shall be supported and protected and maintained so as to be readily accessible and open to view. Excavations shall be decked or bridged, where necessary, to permit the safe passage of fire apparatus and to give access to fire hydrants and to adjacent buildings for the extinguishing of fires. Where necessary, branch pipes shall be extended from the nozzles
of the fire hydrants for convenient attachment to the fire engines. The pipes connecting the fire hydrants to the mains shall be protected from freezing, and the fire hydrants (particularly the high pressure type) shall, where necessary, be braced or tied to the connecting pipes to prevent movement under water pressure.

E. Safety and Sanitary Provisions:

The Contractor shall provide means and appliances and shall enforce suitable rules for the safe performance of the Work and for the safety and health of workers. The completed portions of the Work shall be kept clean and in a sanitary condition. The Contractor shall provide and maintain properly secluded sanitary facilities, in accordance with existing Federal, Commonwealth and City regulations, for the exclusive use of workers. When directed by PhilaPort, the Contractor shall dismantle and remove these facilities.

F. Danger Signals:

The Contractor, at the Contractor’s own expense, shall erect and maintain all necessary warning buoys, barricades, red lanterns, and danger signals as required by the applicable laws and regulations. The lights shall be kept burning from sunset until sunrise, and necessary watchpersons shall be provided for the safety of the public. The Contractor shall observe such rules relative to signals and safeguards as the police regulations, harbor and other regulations, laws, and ordinances require.

VIII. Contract Time and Change Orders:

A. Contract Time:

1. Time is an essential element and of the essence of the Contract. Unless otherwise specifically provided in the Contract Documents, or authorized in writing by PhilaPort or the Engineer, the Contractor shall begin the Work within ten (10) Working Days from the date of notice to proceed, and shall complete all of the Work under the Contract on or before the date determined in accordance with the Agreement.

2. The Contractor will not be required to proceed with the Work, if, for any reason for which the Contractor is not responsible, the Work cannot be commenced within three (3) months from the date of execution of the Contract, and in such case, at the request of the Contractor, the Contract shall be declared null and void. This shall not apply to contracts, the beginning of which is dependent upon the progress of other contracts, where this condition is plainly indicated by PhilaPort in the Contract Documents or in another order written by PhilaPort.

3. Should PhilaPort cause any delay in the completion of the Contract, by failure to give possession of the Site, by changes in the Plans and Specifications, or by requiring for any cause the suspension of the Work, the Contractor will be entitled to a reasonable extension of the time specified for the completion of the Work. Any claim arising from
such delay must be made in writing to the Engineer immediately upon the occurrence of the delay, and the Engineer will determine what allowance, if any, shall be made, but no additional compensation for consequential damages arising from such delay will be allowed. The time allowed for any delay will be added to and will correspondingly extend the Date of Completion.

4. For a contract whose Date of Completion is on or before a specified number of calendar days, no allowance will be made for non-Working Days or delays due to unfavorable weather, to the removal, relocation or fulfillment of other requirements by utilities, or to the failure to obtain material and equipment.

5. For a contract whose Date of Completion is on or before a specified number of Working Days, allowances will be made for days or portions of days, in increments of one-quarter day, for conditions entirely beyond the control of the Contractor. An allowance shall be made for unsuitable weather necessitating a suspension of the Work or other unfavorable conditions when the operation which controls the progress of the Work is suspended. A record of the Working Days shall be kept by PhilaPort; and this record shall be available to the Contractor on request. The Contract time shall start with the first Working Day after the date of the notice to proceed and the scheduled Date of Completion shall be that established by the specified number of Working Days plus the allowances.

6. Notwithstanding the above provisions of this Section VIII, the Contractor will not be liable or responsible for delays or damage to the Work caused by acts of God, acts of public enemy, acts of Government, quarantine restrictions, general strikes throughout the trade, or freight embargoes not caused or participated in by the Contractor.

B. Liquidated Damages:

1. **Delay in completion of the Work.** The Contractor acknowledges and agrees that PhilaPort will incur substantial damages if the Work is not performed in accordance with the requirements of this Agreement. The parties agree that it would be extremely difficult and impractical under the presently known and anticipated facts and circumstances to ascertain and fix actual damages that PhilaPort would incur under these circumstances, and, accordingly, the parties agree that PhilaPort’s remedy shall be to recover from the Contractor as liquidated damages, and not as a penalty the Contract Sum multiplied by 0.005 for each and every calendar day that the Work remains incomplete. The liquidated damages identified in this Section relate solely to the Contractor’s delay in completing the Work in accordance with the requirements of this Agreement and not to other breaches, actions or omissions of the Contractor. The liquidated damages identified in this Section shall not limit PhilaPort’s remedies for other breaches, actions, or omissions of the Contractor, including termination for failure to complete the Work.

2. **Failure to meet Diversity Inclusion participation levels.** The Contractor acknowledges that the diversity and inclusion commitments submitted as part of its bid were an integral part of its bid and contracting requirements. The Contractor and agrees that PhilaPort will incur substantial damages to its efforts to promote diversity and inclusion if the
commitment levels for the Work are not achieved in accordance with the requirements of this Agreement. The parties agree that it would be extremely difficult and impractical under the presently known and anticipated facts and circumstances to ascertain and fix actual damages that PhilaPort would incur under these circumstances, and, accordingly, the parties agree that PhilaPort’s remedy shall be to recover from the Contractor as liquidated damages, and not as a penalty the dollar value of the participation committed multiplied by 0.10. The liquidated damages identified in this Section relate solely to the Contractor’s failure to meet its commitment of diversity and inclusion in accordance with the requirements of this Agreement and not to other breaches, actions or omissions of the Contractor. The liquidated damages identified in this Section shall not limit PhilaPort’s remedies for other breaches, actions, or omissions of the Contractor, including termination for failure to complete the Work.

C. Progress Schedule:

1. Immediately upon receipt of notice of the award of the Contract, the contractor for general construction on the Project shall furnish to each separate prime contractor within seven (7) days a schedule for the proposed prosecution of the Work under the Contract. Thereafter, each separate prime contractor shall submit to the contractor for general construction within fourteen (14) days after receipt of notice of the award of the Contract, a schedule for the proposed prosecution of the Work under their respective contracts. The contractor for general construction shall then submit to the Engineer and PhilaPort within twenty-one (21) days after receipt of notice of the award of the Contract, a complete set of progress schedule signed by all prime contractors indicating their approval, and showing in detail to the satisfaction of the Engineer and PhilaPort, the proposed coordinated dates for the performance of each phase of work under each contract on the Project. The date of notice from the Engineer to proceed with the Work will be the actual start date of the Contract. The time period from the date of the notice from the Engineer to proceed with the Work to the commencement of on-site Work is part of the time period of the Contract, and is for the purpose of performing all off-site Work including the preparation by the Contractor of all documents required by PhilaPort. No extensions of time will be granted to the Contractor for the time period commencing with the notice from the Engineer to proceed with the Work and ending with the commencement of on-site Work. In the event that PhilaPort, for any period after the commencement of on-site Work, grants an extension of time for sixty (60) days or more to the Contractor, the Contractor shall prepare a revised progress schedule and obtain the signatures of all prime contractors indicating their approval, and shall forward the revised progress schedule to the Engineer within twenty (20) days from the approval of the extension. In no event will the granting of an extension of time to any contractor under the Project automatically entitle any other prime contractor to an extension of time. In the event that the Contractor is the only contractor under the Project, the Contractor shall submit a progress schedule to the Engineer and PhilaPort within ten (10) days of receipt of notice of the award of the Contract.

2. The Contractor is to routinely update the schedule to accurately reflect the work that has
been performed as well as keep the future tasks on schedule with the completion date. The project schedule should be submitted to PhilaPort at least on a monthly basis.

3. The Contractor shall complete portions of the Work in such order of time as may be stated in the Specifications or as required in the progress charts as approved by all prime contractors and PhilaPort. PhilaPort may require the Contractor, at no additional cost to PhilaPort, to supply additional forces, equipment, tools and materials and/or provide for an increase in working hours, and/or increase the number of Working days per week in order to keep up with the progress chart. If the Contractor shall refuse or fail to proceed as directed by PhilaPort, PhilaPort may find the Contractor in breach of the Contract and/or declare the Contractor in default.

4. PhilaPort shall have the right to use or occupy any completed or partially completed portions of the Work, whether or not the time may have expired for completing the entire Work or said portions of the Work, but such use or occupancy shall not be deemed an acceptance of the Work so taken or used, or any portion thereof. Prior, however, to such use or occupancy, PhilaPort shall inspect the Work to be occupied to determine if it is in conformity with the Contract, and any subsequent damage thereto due solely to the use and occupancy of the completed portion, will not be the responsibility of the Contractor.

D. Progress Meetings:

Progress meetings may be held as often as required by the Engineer and must be attended by the Contractor and his representatives who are authorized to make decisions and representations affecting the progress of the Work on the Project. The dates and time of progress meetings will be given to all concerned parties and these conferences shall be attended whether or not a particular contractor may be affected. A failure to attend shall be construed to be a violation of the contract.

E. Change Orders:

1. If changes in the design of any portion of the Work or the requirements of the Specifications are deemed necessary by the Engineer in order to carry out and complete more fully the Work agreed to be performed under the Contract, the Engineer may order alterations to or changes in the Work covered by the Contract Documents, and the Contractor shall comply with such orders. All such changes in the Work shall be authorized by change order. If such changes increase the cost of the Work to the Contractor, additional compensation will be allowed by PhilaPort. If such changes diminish the cost of the Work to the Contractor, the amount of such diminution shall be deducted by PhilaPort in its sole discretion. No consequential loss of profit on account of changes or of the Work not executed will be allowed the Contractor, but the Contractor may be entitled to an extension of time on this account.

2. A change order is a written order to the Contractor, signed by PhilaPort and issued after the execution of the Contract, authorizing a change in the Work or an adjustment in the Contract Sum or the Date of Completion. The Contract Sum and the Date of Completion
may be changed only by a change order.

3. The cost or credit to PhilaPort resulting from a change in the Work shall be determined in one or more of the following ways in accordance with the current administrative procedures of PhilaPort, at the option of PhilaPort:

   a. by unit prices stated in the Proposal, Specifications, or from prices agreed upon in the breakdown sheet;

   b. by a detailed cost breakdown properly itemized, the breakdown shall include size, quantity, type, etc. and may include a maximum of fifteen percent (15%) markup to labor costs for overhead and profit and a maximum of ten percent (10%) markup to material costs for overhead and profit; or

   c. if neither method set forth in Sections VIII.E.3.a and b are utilized after good faith negotiations, PhilaPort may direct the Contractor to proceed with the Work involved on a force account basis for which payment shall be made as provided in Section VIII.I herein.

4. If unit prices are stated in the Contract Documents or subsequently agreed upon, and if the quantities originally contemplated are so changed in a proposed change order that application of the agreed unit price to the quantities of Work proposed will create a hardship on PhilaPort or the Contractor, the applicable unit prices shall be equitably adjusted by a change order to prevent such hardship.

5. If the Contractor claims that additional cost or time is involved because of:

   a. any written interpretation issued;

   b. any order issued by the Engineer to stop the Work, provided that the Contractor was not at fault; or

   c. any written order for a minor change in the Work;

then, pursuant to Section VIII.F herein, the Contractor shall make such claims for additional cost or time and PhilaPort shall determine if such claims are appropriate.

6. Upon the issuance of a change order, the Contractor shall proceed to perform the Work in accordance with the Contract Documents, even if the amount of additional payment or credit or adjustment in the Contract Sum or the extent of any change in the Date of Completion, if any, resulting from such Work has not yet been determined and even if there is a disagreement between PhilaPort and the Contractor as to whether the Contractor is entitled to additional payment or an extension of time for performing such Work.
7. Should concealed conditions be encountered which are unascertainable from the Contract Documents, visits to the Site and reasonable investigation, and which are at variance with the conditions indicated by the Contract Documents; or should there be encountered unknown physical conditions below the surface of the ground of an unusual nature, differing materially from those ordinarily encountered and generally recognized as inherent in work of the character provided for in the Contract; the Contract Sum shall be equitably adjusted by a change order upon claim by either party made within seven (7) Working Days after the first observance of the conditions. No adjustment shall be made to the Contract Sum, however, for concealed conditions encountered during the cutting and patching of the Work.

F. Claims for Additional Cost or Time:

1. If the Contractor wishes to make a claim for an increase in the Contract Sum or an extension in the Date of Completion, the Contractor shall give PhilaPort written notice thereof in accordance with the requirements of Section X.A herein, but in no case more than thirty (30) days after the occurrence of the event giving rise to such claim. This notice shall be given by the Contractor before proceeding to execute the Work, except in an emergency endangering life or property, in which case the Contractor shall proceed in accordance with Section VII.C herein. No such claim shall be valid unless so made. If PhilaPort and the Contractor cannot agree on the amount of the adjustment in the Contract Sum or the Date of Completion, it shall be determined by PhilaPort. Any determination to change the Contract Sum or Date of Completion resulting from such claim, shall be authorized by a change order.

2. No claims for increased costs, charges, expenses, or damages of any kind, unless otherwise provided herein, shall be made by the Contractor against PhilaPort for any delays or hindrances from any cause whatsoever, including but not limited to strikes, walkouts or work stoppages during the progress of any portion of the Work; provided, however, that PhilaPort, in its discretion, may compensate the Contractor for any such delays by extending the Date of Completion, which extension shall constitute the exclusive remedy between the parties.

G. Minor Changes in the Work:

PhilaPort may order minor changes in the Work not involving an adjustment in the Contract Sum or an extension of the Date of Completion and not inconsistent with the intent of the Contract Documents. Such changes may be effected by written field order as provided in Section VIII.H herein or by other written order. Such changes shall be binding on PhilaPort and the Contractor.

H. Field Orders:

After an interpretation of the Contract Documents by the Engineer, PhilaPort may issue
written field orders consistent with the Contract Documents without changing the Contract Sum or Date of Completion. The Contractor shall carry out such field orders promptly.

I. Force Account:

1. Payment under Force Account will be for the actual and necessary direct cost of the Work in accordance with the orders of the Engineer, and in addition thereto the percentage of such cost hereafter stated. “Actual and necessary direct cost” shall be deemed to include the following:

   a. For contracts for Goods and Materials only, the actual and necessary direct cost of the work done under Force Account as noted above, ten percent (10%) will be added to the actual expenditure in Work.

   b. For Service contracts and Construction contracts, the actual and necessary direct cost shall be:

      1. The actual expenditure for labor for the time actually engaged in the Work, including the distributed cost of foremen in direct charge of such labor, insurance, taxes, and other payments applicable to such labor.

      2. The actual expenditure for materials used by or incorporated in the Work.

      3. A reasonable hourly, weekly or monthly rental as applicable, as determined by the Engineer, for use of motor trucks and special equipment such as power-operated shovels, cranes, drills, paving breakers, etc. (but not including small hand tools or company provided vehicles), at a rate not to exceed the current local rate charged for the type of equipment used, for the time that such equipment is required on the Site for the performance of Force Account work exclusively. The rental price shall be for the equipment provided on the Site and shall include transportation to and from the Site, fuel, power, lubricants, operating tools, repairs, insurance, depreciation, replacements, and the sharpening of drills and other tools required to keep them in the best working condition.

2. To the actual and necessary direct cost of the Work done under Force Account as noted above, fifteen percent (15%) will be added to the expenditure for labor as set forth in Section VIII.I.1.b.1 above and ten percent (10%) will be added to the expenditure for materials as set forth in Section VIII.I.1.b.2 above. No additions will be allowed to the rental of trucks and special equipment as set forth in Section VIII.I.1.b.3 above. These percentages, and the rental price for equipment furnished, shall be deemed to cover the cost of heat, light, use and upkeep of small hand tools, administration, engineering, superintendence, all loss, damage, risk, and expenses incidental to the Work and profit. The Contractor shall have no claim in excess of the above, such payments being in full compensation for the performance of the Work and the furnishing of such materials and for all expenses in connection therewith and incidental thereto.
3. Should the Contractor sublet any portion of the Work to be executed under Force Account with the approval of PhilaPort, payment for that portion will be computed as the actual and necessary direct cost as defined above, exclusive of any profit to the Subcontractor, plus the percentages allowed, plus five percent (5%) of the total paid to the Subcontractor.

4. The Contractor shall submit daily a statement in duplicate of the Work done on a Force Account basis within twenty-four (24) hours of the time the Work is done, and representatives of PhilaPort and the Contractor shall make daily comparison of the actual and necessary direct costs incurred, as given therein. After correction, if necessary, this comparison shall be signed by each and filed with the Engineer and the Contractor. The Contractor shall submit to the Engineer monthly, prior to each current estimate, four (4) copies of an itemized statement of the amount and value of labor and/or materials furnished, accompanied by the original receipted bills for commodities purchased or for the Work performed under a subcontract, and by an affidavit certifying the correctness of the said statement. The Engineer shall have access to any books, vouchers, records, and memoranda showing the labor employed and/or the materials actually used on the specific operation and the actual net cost thereof.

5. Work done under Force Account shall be subject to all of the requirements of the Contract Documents. It shall be performed in an orderly and economical way, and the prices paid for labor and/or materials and the method of performing the Work shall be subject to the approval of the Engineer. No Work will be paid for under Force Account unless it is ordered as such in writing.

IX. Acceptance of Work:

A. Tests:

1. If the Contract Documents, laws, ordinances, rules, regulations, or orders of any public authority having jurisdiction hereof require any of the Work to be inspected, tested or approved, the Contractor shall give PhilaPort timely notice of its readiness and of the date arranged so that the Engineer may observe such inspection, testing, or approval.

The Contractor shall bear all costs of such inspections, tests and approvals unless otherwise provided. With regard to samples:

   a. All expenses incurred in the collection, packing, and delivering of samples or materials or equipment to the testing site shall be paid for by the Contractor.

   b. The Contractor shall pay the costs of transporting samples to the laboratory and the testing of same, except where otherwise noted in the General Conditions, Specifications, or called for in the Contract Documents.
c. Approved samples to be incorporated in the Work shall be returned to the Contractor by the testing laboratory under the supervision of the Contractor.

2. If after the commencement of the Work, PhilaPort determines that any portion of the Work requires special inspection, testing, or approval, PhilaPort will, by written authorization, instruct the Contractor to order such special inspection, testing, or approval, and the Contractor shall give notice as provided for in this Section IX.A. If such special inspection or testing reveals a failure of the Work to comply with the requirements of the Contract Documents or with respect to the performance of the Work, with laws, ordinances, rules, regulations, or orders of any public authority having jurisdiction hereof, the Contractor shall bear all costs thereof, including the Engineer’s additional services made necessary by such failure; otherwise, PhilaPort shall bear such costs, and an appropriate change order shall be issued.

3. Required certificates of inspection, testing, or approval shall be obtained by the Contractor and promptly delivered by the Contractor to the Engineer and PhilaPort.

4. If the Engineer wishes to observe the inspections, tests, or approvals required by this Section IX, the Engineer shall do so promptly and, where practicable, at the source of supply.

5. Neither the observations of the Engineer in the administration of the Contract, nor inspections, tests, or approvals by persons other than the Contractor shall relieve the Contractor from obligations to perform the Work in accordance with the Contract Documents.

B. Uncovering the Work:

1. If any Work should be covered contrary to the request of PhilaPort or Engineer, it must, if required by PhilaPort or Engineer, be uncovered for its observation and replaced, at the Contractor’s expense.

2. If any other Work has been covered which PhilaPort or Engineer has not specifically requested to observe prior to being covered, PhilaPort or Engineer may request to see such Work and it shall be uncovered by the Contractor. If such Work is found to be in accordance with the Contract Documents, the cost of uncovering and replacement shall, by an appropriate change order, be charged to PhilaPort. If such Work is found not in accordance with the Contract Documents, the Contractor shall pay such costs unless it is found that this condition was caused by another prime contractor, and in that event PhilaPort shall pay the Contractor for such costs and require reimbursement of such costs from the responsible prime contractor.

C. Correction of the Work:
1. The Contractor shall promptly correct all Work rejected by PhilaPort or Engineer as
defective or nonconforming or as failing to conform to the Contract Documents, whether
observed before or after the Date of Substantial Completion and whether or not
fabricated, installed or completed. The Contractor shall bear all costs of correcting such
rejected Work, including the cost of the Engineer’s additional services thereby made
necessary and any additional cost incurred by PhilaPort.

2. If, within one (1) year after the date of final acceptance of all Work required under the
Contract Documents, or within such other period of time as may be prescribed by law or
by the terms of any applicable special guarantee required by the Contract Documents, any
of the Work is found by PhilaPort to be defective or not in accordance with the Contract
Documents, the Contractor shall correct it promptly after receipt of a written notice from
PhilaPort to do so, unless PhilaPort has previously given the Contractor a written
acceptance of such specific condition. PhilaPort shall give such notice promptly after
discovery of the condition. The performance bond required shall provide a guarantee in
the sum of one hundred percent (100%) of the total Contract Sum for the correction and
remedy of such defect. Should the Contractor or the Contractor’s surety fail to comply
with the orders of the Engineer to replace or repair defective material, workmanship, or
equipment within ten (10) days from the date of notice thereof, PhilaPort shall have the
right to declare the Contractor and/or the Contractor’s surety in default, and to proceed
with the correction of the defect.

3. All such defective or nonconforming Work under Sections IX.C.1 and 2 shall be
promptly removed from the Site by the Contractor, and the Work shall be corrected to
comply with the Contract Documents without cost to PhilaPort.

4. The Contractor shall bear the cost of making good all work of other prime contractors or
Subcontractors destroyed or damaged by such removal or correction.

5. If the Contractor does not remove such defective or nonconforming Work within the time
fixed by written notice from PhilaPort, PhilaPort may remove it and may store the
materials and/or equipment at the expense of the Contractor. If the Contractor does not
pay the cost of such removal and storage within ten (10) days thereafter, PhilaPort may
upon ten (10) additional days’ written notice sell such Work at auction or at private sale
and shall account for the net proceeds thereof, after deducting all the costs that should
have been borne by the Contractor pursuant to the provisions of this Section IX.C. If
such proceeds of sale do not cover all costs which the Contractor should have borne, the
difference shall be charged to the Contractor and an appropriate change order shall be
issued. If the payments then or thereafter due the Contractor are not sufficient to cover
such amount, the Contractor and/or the Contractor’s surety shall pay the difference to
PhilaPort.

6. If the Contractor fails to correct such defective or nonconforming Work, PhilaPort may
correct the Work at the Contractor’s expense.

7. The obligations of the Contractor under this Section IX.C shall be in addition to and not
in limitation of any obligations imposed upon the Contractor by special guarantees required by the Contract Documents or otherwise prescribed by law.

D. Acceptance of Nonconforming Work:

If PhilaPort elects to accept nonconforming Work, it may do so instead of requiring its removal and correction, in which case a change order shall be issued to reflect an appropriate reduction in the Contract Sum or, if the amount is determined after final payment, it shall be paid by the Contractor and/or the Contractor’s surety.

E. Materials and Workmanship:

Where no requirements are specified for materials or for the methods of testing materials or equipment, they shall at least be equal to the latest standard or tentative specifications of nationally recognized standardizing agencies, including, but not limited to, the American Society for Testing and Materials, the American Water Works Association, the American Society of Mechanical Engineers, the latest codes of the National Board of Fire Underwriters or, as they may be applicable, the regulations of the pertinent Departments of the City and the Commonwealth.

The materials used in the Work shall conform to the requirements of the Specifications and shall be those best adapted for the kind of service required. The workmanship shall be equal to the best standard practice. Work of reconstruction and restoration of Commonwealth, City, PhilaPort, or privately owned structures shall be in accordance with the rules and regulations of the owners thereof. No materials shall be used on the Work until accepted and approved by the Engineer.

F. Inspection:

All of the Work shall be subject to supervision and inspection by the Engineer, and the Contractor shall cooperate and afford every facility for the inspection of the Work. Authorized representatives of PhilaPort shall be permitted access at all reasonable times to all portions of the Work, and to such portions of the place of manufacture of fabricated materials as may be necessary for complete inspection. Before beginning the Work, the Contractor shall notify the Engineer of the type and source of supply of the principal materials which the Contractor proposes to furnish, and, as soon as possible thereafter, shall furnish samples of materials, fixtures, and appliances offered for approval. Before beginning the fabrication of materials, or before shipping materials of a specified type, the Contractor shall notify the Engineer in ample time to permit inspection at the place of manufacture, should the Engineer so desire. Such materials shall be delivered to the Site or other location as designated in the Contract Documents properly marked for identification and shall be subject to re-inspection and final acceptance or rejection. Materials shall be delivered in sufficient time to allow for proper sampling and testing. All materials rejected by the Engineer as unsuitable or not in conformity with the Plans or Specifications shall be immediately removed. Unless otherwise specifically provided for, the cost of inspection and testing will be borne by the Contractor. Work shall be done only during regular working hours unless specifically authorized or
directed otherwise by the Engineer. The presence of the Inspector shall not lessen the obligation of the Contractor in accordance with the Contract Documents, or be deemed a defense on the part of the Contractor for infraction thereof. The Inspector is not authorized to revoke, alter, enlarge, relax, or release any of the requirements of the Contract Documents.

G. Investigation of the Work:

Should the Engineer at any time have reason to suspect that defective Work has been done, the Engineer may order an investigation made, and the Contractor shall furnish the necessary labor, appliances, Plans, Specifications, and all other material which PhilaPort finds relevant to the investigation. If any part of the Work is thus found to be defective, the Contractor shall reconstruct it to the satisfaction of the Engineer, and the cost thereof and of the investigation shall be at the sole expense of the Contractor. If the Work is found to be in accordance with the Contract Documents, the Contractor will be reimbursed for the expense incurred because of the examination.

H. Defective Work:

The Contractor shall remove, at the Contractor’s own expense, any Work determined by the Engineer to be defective and not in accordance with the Contract Documents, and shall rebuild and replace the same without additional compensation. Failure to do so shall be deemed a violation of the Contract and subject to the procedures established in Section XI.A herein. Any omission or failure on the part of the Engineer to disapprove or reject any Work shall not be construed to be an acceptance of any such defective Work.

I. Restoration of Prior Conditions:

1. The Contractor shall remove promptly from the Site all rubbish and all unused materials and tools, and as the Work progresses the Site shall be carefully cleaned and kept clean from such rubbish and refuse. Before the Work will be considered as having been completed, the Site and places affected by the Work shall be thoroughly cleared and left clean by the Contractor; free from debris, construction plant, buildings, and materials; fit for travel or other proper use; and in as good of a condition as existed before the Work was begun. Grass plots disturbed shall be resodded or planted anew and shrubbery destroyed shall be replaced. Structures shall be broom clean, free from stains, spots or other blemishes, and ready for use, and all glass shall be washed. The restoration work shall be governed by the record of existing conditions made and filed in the office of the Engineer prior to the commencement of the Work.

2. If the Contractor fails to comply with this Section IX.I, PhilaPort may assign the Work to another contractor and the cost thereof shall be charged to the Contractor.

3. If a dispute arises between the Contractor and any other prime contractor as to their respective responsibilities under this Section IX.I, PhilaPort may authorize another contractor to perform the maintenance duties hereunder and charge the cost thereof to the several contractors as PhilaPort shall determine to be just.
X. Disputes & Contract Violations between the Contractor and PhilaPort:

A. Three-Step Resolution Process

1. The Contractor and PhilaPort agree that any and all disputes arising out of this Contract, which total more than five thousand dollars ($5,000.00) in value, are subject to a three-step resolution process described in this Article X. The Contractor and PhilaPort agree that participation in each preceding step is a condition precedent to the Contractor's right to pursue any and all unresolved disputes to the next step. The Contractor expressly agrees that it shall carry on the Work during any proceedings under this Article X unless otherwise agreed by the Contractor and PhilaPort in writing.

B. Step One: FDR Meeting

1. The FDR Meeting is the initial step in identifying and attempting to reach a timely and equitable resolution of the variety of issues that arise on any construction project. The nature and structure of each FDR Meeting shall be flexible and consist of an informal, good-faith discussion of the current status of the Project, and identification of potential and actual disputes.

2. Project Intervals: A FDR Meeting will be scheduled by the Engineer to discuss issues arising as of the following intervals of the Project:

   a. At any time an issue or dispute arises and more than 3% of the Contract Sum has been expensed by the Contractor and the Contractor provides written notice to the Engineer of such issue or dispute; and
   b. 50% of the Contract duration has elapsed; and
   c. 75% of the Contract duration has elapsed; and
   d. 100% of the Contract duration has elapsed; or
   e. At any time deemed necessary by PhilaPort.

3. Location: PhilaPort will schedule a mutually convenient date and time for each FDR Meeting. If possible, the FDR Meeting should be convened at the Project site.

4. Attendees: All prime contractors and the Engineer shall attend each FDR Meeting. The Engineer will chair the Meeting.

5. Procedure: As the Project progresses and the time for a FDR Meeting approaches, PhilaPort should establish the date for the meeting during Progress Meetings.

6. The Contractor must fill out a FDR Meeting form, a copy of which can be provided by PhilaPort. This form should be submitted to PhilaPort and provided to the other prime contractors approximately one (1) week prior to the FDR meeting. The information on this form should provide sufficient information to allow attendees to research potential
disputes, review the Contract Documents, review the project schedule and examine site conditions prior to the FDR Meeting. In all cases of misunderstanding and disputes, allegations that verbal instruction was given will not be considered. The Contractor must produce written documentation in support of its contentions and shall advance no claim in the absence of such written documentation, or use or attempt to use any conversation with any parties against the Engineer or PhilaPort, or in prosecuting any claim against the Engineer or PhilaPort.

7. PhilaPort shall convene the FDR Meeting and, if necessary, ensure that attendees are introduced to each other.

8. The FDR Meeting shall not be subject to 2 Pa.C.S. (relating to administrative law and procedure).

9. Neither audio recording nor videotaping will be allowed during the FDR Meeting.

10. No transcripts will be taken but attendees are free to take their own notes.

11. The FDR Meeting may be moved out to the field for visual inspection of the condition if necessary to understand and resolve the issue.

12. PhilaPort will allow all parties a reasonable time to present and discuss the disputes raised in the prime contractors' FDR Meeting forms.

13. A representative of the Contractor (an employee in the field familiar with the day-to-day work on this Contract) shall present a description of:

   a. The Work performed since the last FDR Meeting; and

   b. The Work to be performed in the near future; and

   c. The status of disputes raised at the previous FDR Meeting; and

   d. New disputes that have arisen since the previous FDR Meeting. For each new dispute, the representative shall:

      i. Set forth the schedule impacts, which may only be presented using the current project schedule; and

      ii. Set forth a proposed solution to the dispute, including:

         1. Days needed in any extension of time; and/or

         2. Damages attributed to the dispute; and

         3. Identification of the party the Contractor believes is responsible for
creating the dispute.

14. A representative of PhilaPort (and/or another prime contractor if so identified in above) shall present a description of:

   a. Their understanding of the Work performed since the last FDR Meetings; and

   b. The Work to be performed in the near future; and

   c. The status of disputes raised at the previous FDR Meeting; and

   d. A response to the new dispute(s) raised by the Contractor, including:

      i. PhilaPort’s and/or the Contractor's view of the schedule impact, which may only be presented using the current project schedule; and

      ii. PhilaPort’s and/or the Contractor's response to the original Contractor's proposed solution; and

      iii. The identity of the party PhilaPort and or the Contractor believes is responsible for creating the dispute.

15. Within two weeks of the FDR Meeting, PhilaPort will render a written decision on the issues raised during the FDR Meeting. The decision will be issued to all attendees. The decision is not binding upon any party. PhilaPort will include in the decision the name of the employee or other representative who will serve as the Dispute Designee.

16. If any party is dissatisfied with the decision reached at the FDR Meeting, they may appeal the decision to the second step in the dispute process.

17. ANY ISSUE OR DISPUTE ARISING ON THE PROJECT MUST BE PRESENTED AT THE FIRST FDR MEETING AFTER THE DISPUTE AROSE. IF A CONTRACTOR FAILS TO RAISE AN ISSUE AT THE APPROPRIATE FDR MEETING THEN THE CONTRACTOR IS DEEMED TO HAVE WAIVED THE ISSUE.

18. ONLY CLAIMS RAISED DURING AN FDR MEETING MAY BE APPEALED TO THE CLAIM SETTLEMENT CONFERENCE STAGE.

C. Step Two: Claim Settlement Conference

1. The second step in the dispute resolution process is a Claim Settlement Conference, which is a more formal step in the process and is described in general in §1712.1 of the Commonwealth Procurement Code.

2. Time to File A Claim: Under this second step of the process, a Contractor may appeal the FDR Meeting decision by submitting a written claim to the Dispute Designee.
a. ANY ISSUE OR DISPUTE ARISING ON THE PROJECT THAT IS NOT MUTUALLY RESOLVED AT THE FDR MEETING STAGE MAY ONLY BE APPEALED TO THE CLAIM SETTLEMENT CONFERENCE STAGE. IF THE CONTRACTOR FAILS TO PURSUE ANY UNRESOLVED FDR MEETING ISSUE TO A CLAIM SETTLEMENT CONFERENCE WITHIN THE 6-MONTH TIME FRAME SET FORTH BELOW, THEN THE CONTRACTOR IS DEEMED TO HAVE WAIVED THE ISSUE.

b. A CLAIM ACCRUES UPON THE DATE OF THE AUTHORITY’S WRITTEN DECISION IN STEP ONE. IF THE CONTRACTOR DECIDES TO APPEAL THE DECISION REACHED AT THE FDR MEETING, THE CONTRACTOR MUST FILE AN APPEAL OF THE DECISION TO THE DISPUTE DESIGNEE WITHIN SIX MONTHS OF THE DATE OF THE AUTHORITY’S WRITTEN DECISION. IF THE CONTRACTOR FAILS TO FILE A WRITTEN REQUEST WITHIN THIS TIME PERIOD, THE CONTRACTOR IS DEEMED TO HAVE WAIVED ITS RIGHT TO ASSERT THE CLAIM IN ANY FORUM. THE DISPUTE DESIGNEE WILL DISREGARD UNTIMELY CLAIMS.

3. Contents of the Claim: The claim filed by the Contractor with the Dispute Designee shall state ALL GROUNDS upon which the Contractor asserts a controversy exists. The claim must contain, at a minimum:

   a. A Claim Settlement Conference Request Form, a copy of which can be provided by PhilaPort

   b. The documentation submitted by the Contractor to PhilaPort during the FDR Meeting to substantiate the Contractor's view of the issue; and

   c. PhilaPort’s decision.

4. Date of the Claim Settlement Conference: The Dispute Designee will schedule a mutually convenient date and time for the Claim Settlement Conference.

5. Attendees: All parties identified in the claim packet or deemed necessary by PhilaPort shall attend the Claim Settlement Conference. At a minimum, the Contractor and the Engineer shall attend the Claim Settlement Conference.

6. Procedure: The Dispute Designee will convene the Claim Settlement Conference.

   a. The Claim Settlement Conference shall not be subject to 2 Pa.C.S. (relating to administrative law and procedure).

   b. Neither audio recording nor videotaping will be allowed during the Claim Settlement Conference.
c. No transcripts will be taken but attendees are free to take their own notes.

d. The Dispute Designee will allow all parties a reasonable time to present and discuss the issues.

e. A representative of the Contractor shall present a description of the issue, including:

   i. The factual background of the issue;

   ii. The schedule impacts, which may only be presented using the current project schedule; and

   iii. The proposed solution to the dispute, including:

      1. Days needed in any extension of time; and/or

      2. Damages attributed to the dispute; and

      3. Identification of the party the Contractor believes is responsible for creating the dispute.

f. A representative of PhilaPort (or other prime contractor if so identified above) shall present a description of, including

   i. A response to the dispute(s) raised by the Contractor; and

   ii. PhilaPort’s and/or the Contractor's view of the schedule impact, which may only be presented using the current project schedule; and

   iii. PhilaPort’s and/or the Contractor's response to the Contractor's proposed solution; and

   iv. Identification of the party PhilaPort and/or the Contractor believes is responsible for creating the dispute.

7. The Dispute Designee will render a final determination on the issue(s) raised during the Claim Settlement Conference within 120 days of the receipt of the claim by the Dispute Designee. The parties may, during the 120-day period, mutually agree to extend the 120-day deadline. If extended, PhilaPort will issue written confirmation of the extension. If no decision is rendered within the 120 days, the claim is deemed to be denied on the 120th day. The determination of the Dispute Designee shall be the final order of PhilaPort with regard to the issue(s).

D. Step Three: Filing a Claim at the Board of Claims
1. The third step in the dispute resolution process is filing a Statement of Claim with the Board of Claims, which is a more formal step in the process and is described in general in §1712.1 and §1721 et seq. of the Commonwealth Procurement Code.

2. Time to File a Statement of Claim: Within fifteen (15) days of:
   
   a. The mailing date of the Dispute Designee’s final determination denying a claim; or
   
   b. Within 135 days of the date the Contractor files a claim with the Dispute Designee, if no final determination has been rendered and no extension has been agreed to, whichever occurs first, the Contractor may proceed to the third stage of the dispute resolution process by filing a claim with the Board of Claims in Harrisburg.

3. ONLY CLAIMS THAT WERE RAISED ON A TIMELY BASIS DURING A CLAIM SETTLEMENT CONFERENCE MAY PROCEED TO THE BOARD OF CLAIMS.

XI. Disputes Between Contractors:

   A. Damage; Injury; Delay

1. Should the Contractor, personally or by any Subcontractor or their respective agents, servants, or employees, cause damage or injury to the property or work of any prime contractor or contractors, or by failing to perform the Work hereunder with due diligence (including the Work of the Subcontractors), delay any prime contractor or contractors who shall suffer additional expense or damage thereby, the parties involved in such dispute shall settle by agreement or arbitrate said claim, dispute or disputes by referring same to the American Arbitration Association. Said dispute or disputes shall be determined pursuant to the applicable arbitration rules of the American Arbitration Association then in effect. PhilaPort shall not be a party to disputes or actions between prime contractors or subcontractors concerning such additional expense or damage, and such disputes shall not be subject to the Board of Claims proceedings provided for in Section X.A.1 herein. It is agreed by all parties that disputes or actions between contractors concerning the additional expense or damage hereinbefore mentioned shall not delay completion of the Work which shall be continued by the parties, subject to the rights hereinbefore provided. It is agreed by the parties to the Contract (PhilaPort as promisee and the Contractor as promisor) that the intent of this Section XI.A.1 is to benefit the other prime contractors on the Project or related projects and to serve as an indication of the mutual intent of PhilaPort and the Contractor that this Section XI.A.1 raise such other prime contractors to the status of third party beneficiaries only as to the terms and conditions of Sections II.A and B and XI herein. The Contractor agrees that these Sections as a benefit to the Contractor and that they specifically exclude claims against PhilaPort for delay or other damages resulting from the actions and omissions of other contractors and subcontractors.
B. Breach

1. The Contractor agrees that all claims, disputes and other matters in question between prime contractors, which arise out of, or are related to the Contract or the breach thereof, shall be settled by agreement or resolved by arbitration in accordance with the applicable arbitration rules of the American Arbitration Association then in effect, unless the parties mutually agree otherwise. The agreement to arbitrate shall be in consideration of the fact that all other prime contractors agree to the same arbitration provision as provided in each separate prime contract required for the Project, and shall be specifically enforceable under the prevailing arbitration law. The award rendered by the arbitrators shall be final, and judgment may be entered upon it in accordance with applicable law in any court having jurisdiction thereof. PhilaPort shall not be a party to the arbitration nor shall such claim or dispute be subject to the Board of Claims proceedings provided for in Section X.A.1 herein.

C. Demand for Arbitration

1. Notice of the demand for arbitration shall be filed in writing with the other prime contractors and with the Philadelphia Regional Office of the American Arbitration Association or such other location as the American Arbitration Association may request, and a copy shall be filed with the Engineer and PhilaPort. The demand for arbitration shall be made within a reasonable time after the claim, dispute or other matter in question has arisen. PhilaPort shall not be a party to the claim, dispute or other matter in question, but shall be a witness in any arbitration at the request of any party to the arbitration.

XII. Contract Violations:

A. Violations of the Contract:

1. If the Contractor shall abandon the Work, or, in the sole opinion of the Engineer neglect or fail to perform the Work with promptness and diligence, or unreasonably delay the Work so that it may not be completed within the time specified in the Contract, or if the Contractor shall neglect or refuse to furnish on a timely basis suitable materials in place of any which may be rejected by the Engineer as unsuitable, or shall refuse or neglect to furnish and supply on a timely basis a sufficiency of properly skilled workers and necessary equipment or either, or if the Contractor shall execute any of the Work improperly, carelessly, or in bad faith, and refuse to remove on a timely basis any of the Work which, in the opinion of the Engineer, is defective and unsuitable, and to replace it on a timely basis in accordance with the Contract Documents, or if the Contractor shall default in the performance of any of the terms, conditions, and provisions of the Contract Documents, then and in that event the Executive Director may provide written notice to the Contractor and the Contractor’s surety to remedy the neglect or default, and require the Contractor to comply with the terms, conditions, and provisions of the Contract which are being violated. If the said notification is without effect forty-eight (48) hours after the delivery thereof, or twenty-four (24) hours when, in the opinion of the Executive Director, immediate action is necessary to safeguard life or property, the Executive
Director shall have the right to declare the Contractor in default, and to notify the Contractor to discontinue the Work or any part thereof under the Contract, and to call upon the surety to complete the same through contractors which meet the approval of the Executive Director and, in the opinion of the Executive Director, have qualifications at least equal to those required of the original Contractor. If the surety fails to begin to fully and completely perform the Work by means of such approved contractors within ten (10) days, or within twenty-four (24) hours when, in the opinion of the Executive Director, immediate action is necessary to safeguard life or property, the Executive Director shall have the right to declare the surety in default and, at the Executive Director’s option:

a. to determine the Work which needs to be completed to maintain conditions; to obtain bids, if circumstances will allow, for all or any portion of the Work; and to enter into a new contract to complete the Work of the original Contractor; or

b. in the case of an emergency, including but not limited to danger to life or property, or serious interference with traffic or the movement of cargo, to terminate the Work, and to then and there secure in the open market, from any person or party, at the then-current market prices, the materials of the quality and quantity required, the necessary workers and mechanics, and the required equipment to continue the Work and complete the Contract.

2. Upon default by the Contractor as hereinabove set forth, all monies due the Contractor upon estimates, retained percentage or otherwise, materials delivered, materials built into the Work, and the Contractor’s plant (including, but without limitation, tools, appliances, materials, and equipment on the Site), shall upon such default become the property of PhilaPort for use in the completion of the Work, and resort shall be had thereto by PhilaPort to the extent necessary to maintain and complete the Work and reimburse PhilaPort for its outlays and expenditures.

3. In case of such default by the Contractor, the remedies herein provided shall be in addition to, and not in substitution of, the rights and remedies which would otherwise be vested in PhilaPort, all of which rights and remedies are specifically reserved to PhilaPort. The failure of PhilaPort to exercise any of the remedies herein provided shall not preclude PhilaPort from seeking any other appropriate remedy or remedies.

4. The use of specific remedies herein provided shall not prevent subsequent or concurrent resort to any other remedy which by law or equity would be vested in PhilaPort for the recovery of damages or otherwise, in the event of default by the Contractor.

5. The Contractor and the Contractor’s surety shall pay to PhilaPort on demand, all loss, expense, cost, or damage suffered or incurred by PhilaPort by reason of any default.

XIII. Suspension of Work:
A. Suspension of the Work Due to Unfavorable Conditions:

1. If, in the judgment of PhilaPort, the Contractor is taking undue risk of damage by proceeding with the Work during unfavorable weather or other conditions, which is not for the joint benefit of PhilaPort and the Contractor, or for the sole benefit of PhilaPort, then PhilaPort may suspend the Work temporarily, either wholly or in part for such periods as may be necessary on account of unsuitable weather or other conditions unfavorable to the safe and proper prosecution of the Work. In the case of such suspension, a proper extension of time will be allowed as provided herein, but no allowance will be made to the Contractor for any expenses or damages resulting therefrom. It shall be clearly understood that the failure of PhilaPort to suspend the Work shall not relieve the Contractor of the Contractor’s responsibility to perform the Work in accordance with the Contract Documents.

2. PhilaPort has the right to require a suspension of the Work if in its opinion unforeseen conditions warrant such a suspension. When PhilaPort directs resumption of the Work, the Contractor shall resume full operations within a period of ten (10) days after receipt of written notice to do so. PhilaPort shall not be held liable for any damage or anticipated profits on account of the Work being suspended. Any Work done by the Contractor during the period of suspension shall be the Contractor’s responsibility and the Contractor shall receive no payment therefor unless the Work is subsequently resumed and the Work done during the interval of suspension can be utilized in the resumed Work. Suspensions of Work as outlined above shall not in themselves operate to extend the Date of Completion. Requests for extensions of time must be submitted in writing by the Contractor setting forth the Contractor’s reasons for such an extension.

B. Suspension of the Work for the Convenience of PhilaPort:

1. PhilaPort may, in writing, order the Contractor to suspend all or any part of the Work for such period of time as it may determine to be appropriate for the convenience of PhilaPort, except that this Section XIII.B shall not apply under the conditions enumerated in Section XII.A herein.

2. If the performance of all or any part of the Work is, for an unreasonable period of time, suspended by PhilaPort, an adjustment shall be made for any increase in the cost of performance of the Contract (excluding anticipated profit) necessarily caused by such unreasonable suspension, and the Contract shall be modified in writing accordingly. However, no adjustment shall be made under this Section XIII.B for any suspension to the extent:

   a. that performance would have been so suspended by any other cause, including the fault or negligence of the Contractor; or

   b. for which an equitable adjustment is provided for or excluded under any other provision of the Contract.
3. No claim under this Section XIII.B shall be allowed unless the claim, in an amount stated, is asserted in writing as soon as practicable after the termination of such suspension, but not later than the date of final inspection under the Contract.

C. Suspension of the Work and Fault of the Contractor:

Should the Contractor fail to comply with the orders of PhilaPort relative to any particular part of the Work, PhilaPort may suspend the Work on any or all parts until its orders respecting the particular parts are complied with. In the case of such a suspension, which shall be considered due to the fault of the Contractor, no extension of time shall be given and no allowance will be made for the expenses incurred by the Contractor during the period of such suspension.

XIV. Termination:

A. Termination by the Contractor:

If the Work is stopped for a period of thirty (30) days or more under an order of any court or other public authority having jurisdiction thereof, through no act or fault of the Contractor or any Subcontractor or their agents or employees or any other persons performing any of the Work, including other prime contractors, or if the Work should be stopped for a period of thirty (30) days or more by the Contractor for PhilaPort’s or the Commonwealth’s failure to make payment pursuant to Section XV.F herein, then the Contractor may, upon seven (7) days’ written notice to PhilaPort, terminate the Contract and recover payment for all Work performed as provided in Section XV.E herein.

B. Termination by PhilaPort:

1. PhilaPort shall have the right at any time and for any reason, to terminate the Contract. In such case, the Contractor shall be paid (and shall accept payment) for that portion of the entire Contract actually performed to the date of termination, excluding, however, any loss of anticipated profits. Disputes as to the sum then payable to the Contractor shall be settled in accordance with the provisions of Section X.A herein.

2. Such termination shall be effective in the manner and at the time specified in the notice of termination and shall be without prejudice to any claims which PhilaPort may have against the Contractor. Upon receipt of such notice from PhilaPort, the Contractor shall immediately discontinue all Work and the placing of all orders for materials and equipment, facilities and supplies in connection with the performance of the Work, and shall proceed to cancel promptly all existing orders and terminate Work under all subcontracts so far as such orders and Work are chargeable to the Contract; provided, however, that the Contractor shall take such measures for the protection of the property of PhilaPort as may be directed by PhilaPort. Upon termination of the Contract, full and complete adjustment and payment of all amounts due the Contractor arising out of the Contract as determined by an audit conducted by or for PhilaPort, shall as soon as practicable after such termination be made as follows:
a. the Contractor shall be reimbursed for all costs incurred to the date of termination, including reasonable overhead and expenses directly applicable to the Project, made in the performance of the Contract less amounts previously paid;

b. the Contractor shall be reimbursed for all costs to which the Contractor has been subjected to or which the Contractor is legally liable for by reason of the termination of the Contract, including reasonable costs relating to cancellation of orders, termination of subcontracts, and other similar charges to the extent the Contractor is liable therefor;

c. the Contractor shall be reimbursed for the reasonable cost of providing protection of the property of PhilaPort as directed by the notice of termination;

d. the sum total of the payments made under this Section XIII.B shall not exceed the authorized total amount of the Contract less payments previously made;

e. title to all property accruing to PhilaPort by reason of the termination of the Contract shall immediately vest in PhilaPort and the Contractor shall execute and deliver to PhilaPort all papers necessary to transfer title;

f. coincident with the making of final payment, the Contractor shall furnish PhilaPort with a final release; and

g. PhilaPort or its representatives shall be afforded full access to all books, correspondence and papers of the Contractor relating to the Contract in order to determine the amount due thereunder.

XV. Payments:

A. Scope of Payments:

Payment for the cost of all labor, materials, and services required to be done or furnished to complete the Work, as specified in the Contract Documents (except where payment is otherwise specifically provided), will be made at the price(s) specified in the bid. If the Work includes the supply and/or installation of materials, the prices bid shall each cover the supply and/or installation, in a good, sound, substantial, and workmanlike manner, of everything required for and incidental to the full completion of the Work of that item as called for by the Plans and/or as specified, including its proportionate share of the expense of all plant, tools, and equipment required; the cost of all bonds, fees, and permits; of all administration, superintendence, and insurance; and of any loss or damage arising out of the nature of the Work, from the action of the elements, from any unforeseen difficulties encountered in the performance of the Work, and from risks of all kinds connected with the Work.
B. Mobilization:

The Contractor may include in the Contractor’s breakdown a line item for mobilization in an amount of 1.5 percent of the contract award up to a maximum of $90,000. Mobilization costs shall be limited to the cost of the Contractor’s field office and the cost of heat, lights and telephone for the field office.

C. Payment to Subcontractors:

In accordance with 55 P.S. § 697.11(a), and 62 P.S.C.A § 3933, the Contractor will pay for all materials furnished and services rendered for the performance of the Contract, and any Subcontractor furnishing such materials or rendering such services may maintain an action to recover for the same against the Contractor, as though the Subcontractor was named in the Contract, provided that the action is brought within one (1) year after the time the cause of action accrued, and without prejudice to any other rights or remedies available pursuant to contract, statute or law.

D. Progress Payments:

1. Unless otherwise provided in the Contract Documents, during the progress of the Work, the Contractor shall prepare periodic current estimates of the value of the Work performed and shall submit to PhilaPort itemized applications for payment to the Accounts Payable Department of PhilaPort on the form provided by PhilaPort. The applications shall be supported by data substantiating the Contractor’s right to payment, as PhilaPort may require. The Engineer and PhilaPort will review the applications for validity.

2. Prime Contractor shall submit monthly HUB reports. Specifically, Prime Contractor shall submit the Prime Contractor HUB Monthly Reporting Form Summarizing Payments (see Exhibit 2 of PhilaPort’s Diversity & Inclusion Policy) made for each project as well as proof of payment in the form of invoices from subcontractors. Both form and proof of payment to subcontractors should be submitted to the Finance Department along with the Prime Contractor’s monthly invoicing. PhilaPort reserves the right to reject the monthly progress payment request if the HUB monthly reporting is not deemed sufficient.

3. Unless otherwise provided in the Contract Documents, and as provided in Section XV.E herein, upon the determination of PhilaPort as to reasonableness, payments may be made to the Contractor on account of materials or equipment especially fabricated for the Work, which materials or equipment are delivered and suitably stored at the Site or on PhilaPort property. However, such payments shall be conditioned upon submission by the Contractor of bill of sale forms provided by or otherwise acceptable to, PhilaPort to establish PhilaPort’s title to such materials or equipment. The Contractor shall remain responsible for all losses of materials and equipment which remain under the Contractor’s custody and control regardless of the exclusions in the insurance policies as required under PhilaPort’s bill of sale form or the location of such, whether on or off of the Site.
4. Unless otherwise provided in the Contract Documents, the Contractor warrants and guarantees that title to all materials and equipment covered by an application for payment, whether incorporated in the Project or not, will pass to PhilaPort upon the receipt of such payment by the Contractor, free and clear of all liens, claims, security interests or encumbrances; and that no materials or equipment covered by an application for payment will have been acquired by the Contractor, or by any other person performing the Work at the Site or furnishing materials and equipment for the Project, subject to an agreement under which an interest therein or an encumbrance thereon is retained by the seller or otherwise imposed by the Contractor or such other person.

E. Application for Payment:

1. If the Contractor has made an application for payment, and subject to the schedule for payment provided in Section XIV.D herein, the Engineer will, within seven (7) days after the receipt of the application, unless otherwise provided in the Contract Documents, process the application for payment to PhilaPort, with a copy to the Contractor, for such amount as the Engineer determines to be properly due, or state in writing the Engineer’s reasons for withholding the application.

2. By approving an application for payment, the Engineer shall not thereby be deemed to represent that the Engineer has made exhaustive or continuous inspections to check the quality or quantity of the Work, or that the Engineer has reviewed the Contractor’s means, methods, techniques, sequences or procedures, or that the Engineer has made any examination to ascertain how or for what purpose the Contractor has used the moneys previously paid on account of the Contract Sum.

3. In the case of projects funded by Commonwealth capital funds, after the Engineer and PhilaPort have approved the application for payment, PhilaPort shall forward the application for payment to the Commonwealth and the Commonwealth shall make payment directly to the Contractor in the manner provided in the Contract Documents. In the case of projects funded by PhilaPort operating funds, payment shall be made to the Contractor by PhilaPort in the manner provided in the Contract Documents. In the absence of good and sufficient reasons, within twenty (20) days of the receipt of payment by the Contractor, the Contractor shall pay all Subcontractors, with whom the Contractor has contracted, their earned share of the payment the Contractor received.

4. No application for a progress payment, nor any progress payment, nor any partial or entire use or occupancy of the Project shall constitute an acceptance of any Work not in accordance with the Contract Documents, nor shall any payment constitute a waiver by PhilaPort of its right to assert a claim with respect to any matter arising under or relating to the Contract or the services provided thereunder.

5. Progress payments on contracts other than equipment contracts, will be reduced by ten percent (10%) until the Substantial Completion of the Work, as such term is defined in Section XV.A herein; provided, however, that when the amount of the progress payments reaches fifty percent (50%) of the Contract Sum, and all of the requirements of the
Contract, including its satisfactory progress, have been complied with, no additional percentage will be retained on succeeding payments during the continuation of such satisfactory performance of the Work. Progress payments will be the amount of the payment as thus reduced less the sum of all previous payments. When the Contract is fifty percent (50%) completed, one-half of the amount retained by PhilaPort shall be returned to the Contractor; provided, that the Engineer approves the application for payment; and provided further, that the Contractor is making satisfactory progress and there is no specific cause for greater withholding. The sum or sums withheld by PhilaPort from the Contractor after the Contract is fifty percent (50%) completed shall not exceed five percent (5%) of the value of completed Work based on monthly progress payment requests; provided, however, that in the event a dispute arises between PhilaPort and any contractor, which dispute is based upon increased costs claimed by one contractor occasioned by delays or other actions of another contractor, additional retainage in the sum of one and one-half (1½) times the amount of any possible liability may be withheld until such time as a final resolution is agreed to by all parties directly or indirectly involved, unless the Contractor causing the additional claim furnishes a bond satisfactory to PhilaPort to indemnify PhilaPort against the claim. However, all such monies retained by PhilaPort may be withheld from the Contractor until Substantial Completion of the Contract.

6. Progress payments on contracts for furnishing and/or installing electrical, mechanical, plumbing, heating, and other equipment subject to test, will include an allowance of fifty percent (50%) of the price bid for the units especially fabricated therefor (or the apportioned value thereof), when such equipment is delivered on the Site or on PhilaPort property. A further allowance of twenty-five percent (25%) will be made when the equipment is installed and ready for test.

7. This Section XIV.E shall apply unless otherwise provided in the Contract Documents.

F. Failure of Payment:

If PhilaPort or the Commonwealth should fail to make payment to the Contractor as provided in Section XV.E herein within sixty (60) days after receipt of an application for payment that was approved by PhilaPort for payment, such failure shall afford the Contractor the right to an immediate Claim Settlement Conference before a Dispute Designee as provided in Section X.A herein. The Contractor shall not be entitled to stop Work in any event unless PhilaPort exercises its right to suspend the Work as provided in Sections XIII.A and B herein. Under this Section XV.F, after a decision has been rendered by the Dispute Designee, the Contractor may file a claim with the Board of Claims as provided in Section X.A herein.

G. Substantial Completion Inspection:

1. When the Contractor requests a substantial completion inspection of the Work or a designated portion thereof, the Engineer and PhilaPort shall make a substantial completion inspection within thirty (30) calendar days of the request. At any time during the progress of the Work, however, PhilaPort may schedule a substantial completion
inspections. During the substantial completion inspection, a punch list will be compiled by the Engineer listing the items to be completed or corrected to achieve Final Completion. The failure to include any items on such list shall not alter the responsibility of the Contractor to complete all Work in accordance with the Contract Documents. If the Engineer and PhilaPort, on the basis of a substantial completion inspection, determine that the Work is Substantially Complete, then the Engineer will issue a certificate of substantial completion, which shall establish the date of Substantial Completion, shall state the responsibilities of the Contractor for maintenance, heat and utilities and other items, if applicable, and shall fix the time within which the Contractor shall complete the items listed therein, said time to be before the Date of Completion or any extension thereof. The substantial completion certificate of completion shall be submitted by the Engineer to PhilaPort and the Contractor for their written acceptance of the responsibilities assigned to them in such certificate.

2. Following the substantial completion inspection, if there are items to be completed and/or corrected, PhilaPort and the Engineer will determine the dollar value to be withheld by PhilaPort. The Contractor shall complete all items to be corrected and/or completed within thirty (30) days after the date of substantial completion inspection or show just cause to the satisfaction of the Engineer and PhilaPort why they cannot be completed. If the Contractor does not complete the items to be corrected and/or completed within thirty (30) days, or show just cause to the satisfaction of the Engineer and PhilaPort why they cannot be completed, PhilaPort will have the right to correct those items at the Contractor’s expense.

3. At no time after the date of substantial completion inspection shall the Contractor be permitted to file any claim, arising under the Contract, against PhilaPort; provided, however, that this shall not preclude the Contractor from filing claims against PhilaPort which arise subsequent to the date of substantial completion inspection and prior to acceptance by the Contractor of final payment.

**H. Final Payment:**

1. Final payment, constituting the entire unpaid balance of the Contract Sum, shall be paid to the Contractor as provided in Section XV herein forty-five (45) days after the issuance of the certificate of final completion and the final application for payment; provided that the Work has then been fully completed and accepted by PhilaPort, and Final Completion has occurred.

2. If, after Substantial Completion of the Work, Final Completion is materially delayed through no fault of the Contractor, and the Engineer and PhilaPort so confirm, then upon certification by the Engineer, and without terminating the Contract, payment of the balance due for that portion of the Work fully completed and accepted shall be made to the Contractor as provided in Section XV herein. If the remaining balance of the Work not fully completed or corrected is less than the retainage stipulated in Section XIV herein, and if the appropriate bonds have been furnished, 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 the Contractor to PhilaPort prior to certification of such payment. Such payment shall be made under the terms and conditions governing final payment, except that it shall not constitute a waiver of any of the claims of PhilaPort against the Contractor.

3. The making of final payment shall constitute a waiver of all claims by PhilaPort except those arising from:
   a. unsettled claims;
   b. faulty or defective Work;
   c. failure of the Work to comply with the requirements of the Contract Documents; or
   d. terms of any special guarantees required by the Contract Documents.

4. Acceptance of the Final Payment shall constitute a waiver of all claims by the Contractor.

I. Interest on Final Payment:

In accordance with Pa. Stat. Ann. tit. 62, § 3941(b), the final payment due the Contractor after Substantial Completion of the Contract shall bear interest at a rate of ten percent (10%) per annum, such interest to begin after the date that such payment shall become due and payable to the Contractor; provided, that where PhilaPort has issued bonds to finance the Project, interest shall be payable to the Contractor at the rate of interest of the bond issue or at the rate of ten percent (10%) per annum, whichever is less. The acceptance of the final payment shall constitute a waiver of all claims and liens by the Contractor not filed prior to such acceptance.

XVI. Completion:

A. Substantial Completion:

The date of Substantial Completion of the Work, or designated portion thereof, is the date on which the Engineer certifies, and PhilaPort approves, that the Work is sufficiently complete, in accordance with the Contract Documents, so that the Work, or designated portion thereof, is available for the use for which it is intended, excepting only minor punch list items in non-completion of which does not interfere with the Work’s intended use. Upon Substantial Completion, PhilaPort shall accept the Work or designated portion thereof, which acceptance shall not unreasonably be withheld. Upon substantial completion, Contractor will provide all documents referenced in Sections V.E and K.

B. Final Completion:

1. The date of Final Completion of the Work is the date when all of the items set forth
below are achieved:

a. All of the Work has been completed and accepted by PhilaPort, including but not limited to all items on the punch list;

b. The Contract is fully performed as provided in the Contract Documents; and

c. The following have been provided to PhilaPort;

   i. an affidavit that all payrolls, bills for materials and equipment, and other indebtedness connected with the Work for which PhilaPort might in any way be responsible, have been paid or otherwise satisfied;

   ii. statements of the surety and the Contractor which are satisfactory to PhilaPort as to the Contractor’s payment of all claims for labor and materials; and

   iii. if required by PhilaPort, other data establishing payment or satisfaction of all such obligations, such as receipts, releases and waivers of liens arising out of the Contract, to the extent and in such form as may be designated by PhilaPort. Such information includes, but is not limited to, proof of actual MBE/WBE Participation.

   iv. all documentation referenced in Sections V.E and K.

2. If any Subcontractor refuses to furnish a release or waiver required by PhilaPort, the Contractor may furnish a bond satisfactory to PhilaPort to indemnify PhilaPort against any such potential or actual lien. If any such lien remains unsatisfied after all payments are made, the Contractor shall refund to PhilaPort all moneys that the latter may be compelled to pay in discharging such lien, including all costs and reasonable attorney’s fees.

3. Neither the final payment nor any remaining retained percentage shall become due until the Contractor submits to PhilaPort the items set forth in Section XVI.B.1.c above.

XVII. Warranty:

A. Maintenance After Completion and the Contractor’s Guarantee:

1. The Contractor shall guarantee the Work against defects of material and workmanship for a period of one (1) year from the date of final acceptance by PhilaPort, unless another period is specified in the Contract Documents, and shall guarantee all equipment to perform the duty specified. PhilaPort shall have the benefit of all guaranties and warranties, including all equipment and material guaranties and warranties. When individual items of the Contract are accepted and used by PhilaPort prior to the Date of Completion, the period of guarantee for said items shall begin from the date of
acceptance of such items. If, within the said period of guarantee, any of the Work shall prove to be defective either in material or workmanship, or if damage occurs by settlement of any backfill placed under the Contract, or if any part or parts of equipment furnished shall prove to be inadequate, insufficient, or defective either in design, material, or workmanship, the Contractor shall, immediately upon demand from the Engineer (whose decision as to such inadequacy, insufficiency, or defectiveness shall be binding and conclusive upon the parties hereto), repair and replace the same, and shall repair and replace any consequential damage to other parts or structures, at the Contractor’s own cost and expense, without cost or expense to PhilaPort, and to the approval and satisfaction of the Engineer.

2. Should the Contractor or the Contractor’s sureties fail to comply with the orders of the Engineer to replace or repair defective material, workmanship, or equipment within ten (10) days from the date of such notice, PhilaPort shall have the right to declare the Contractor and/or the Contractor’s surety in default, and to proceed with the correction of the defect in accordance with the provisions of these General Conditions.

XVIII. Work Site Conditions:

A. Performance of the Work:

The method of procedure shall be subject to approval as best adapted for the safe, efficient, and expeditious performance of the Work, with a minimum of interference with public traffic or convenience, or the movement of vehicular traffic or cargo on the Site. The Work shall be performed at such times and at such places as may be ordered or approved by the Engineer.

B. Maintenance of Traffic and Access to Property:

Traffic of all kinds shall be maintained continuously and access to buildings shall be provided for at all times, except where otherwise specifically permitted by the Contract Documents, or where temporary interference is authorized by the Engineer, in which case it shall be interrupted only for such time as is necessary to provide temporary substitutes for surfaces disturbed by the Work and to restore street and sidewalk surfaces after the completion of the Work. Where partial occupation of the street is allowed, materials and equipment shall be so placed as to insure a minimum of interference with traffic. No materials shall be placed on the sidewalk within one (1) foot of the curb line, and a clear sidewalk passage not less than four (4) feet in width shall be maintained at all times. The flow in gutters and inlets shall be maintained.

C. Temporary Buildings:

Buildings, fences, and equipment erected by the Contractor shall be neat in appearance, shall be approved by the Engineer, and shall be painted a medium blue or other color as designated by the Engineer. No advertising matter, other than Contract information and the name and address of the Contractor, shall be displayed on the Work.
D. Temporary Ventilation:

The Contractor shall provide temporary ventilation to remove from the structure any excessive humidity in enclosed portions of the Work resulting from the Work so that the Work may be performed without interruption and under correct conditions including required dryness for installation of the various materials. Any dangerous or noxious fumes or particles suspended in the air shall be the responsibility of the contractor whose work caused those conditions to exist. Temporary equipment used shall produce no hazard to the Work or to any person in or near the Work. The Contractor shall furnish all such equipment, pay all costs for it and for its operation, including fuel and power supplies during operation both in and out of normal working hours, and the Contractor shall remove it when no longer required.

E. Detour Signs:

When permission is given to close a highway during Contract operations and to divert the traffic therefrom, the Contractor, at the Contractor’s own expense, shall erect and maintain highway barricades. Detour signs shall be placed by the Department of Streets of the City and/or the Pennsylvania Department of Transportation, as applicable. The Contractor will be required to notify PhilaPort seven (7) Working Days prior to the date of starting the Work and one (1) Working Day prior to the Date of Completion. Copies of these notices shall be sent to the Traffic Engineer of the Department of Streets and the Pennsylvania Department of Transportation.

F. Contract Identification Signs:

When so directed by the Engineer in writing, the Contractor shall, at the Contractor’s own expense, erect and maintain in a prominent position upon the Work a suitable sign, plainly lettered with the name and address of the Contractor, the character of the Work and the name of PhilaPort. No advertising matter other than the signs above noted shall be displayed on the Work.

G. Storage Space:

Buildings, yards, or sidings that may be required for the delivery or storage of materials shall be provided by and at the cost of the Contractor. The use of streets for storing materials will not be permitted, unless specifically authorized in writing by the Engineer.

H. Night Work:

Work during the night shall be carried on with due regard to the comfort of nearby residents, and the method of performance shall be subject to the approval of the Engineer, who may, if conditions so require, order that no night work be done in specific localities. Workers shall refrain from loud noises, calls, or whistles; and the operation of air compressors, rock drills, and blasting is prohibited between the hours of 7:00 p.m. and 7:00 a.m. unless specifically
permitted by the Engineer.

I. Power and Light:

The Contractor shall use either electric, compressed air or internal combustion engine power, unless conditions are such that use of steam power is not objectionable and its use is approved by the Engineer. When compressed air or internal combustion engines are used the exhaust shall be muffled. Only electric lights shall be used in or under buildings or anywhere on the Site below the surface of the street.

J. Use of Water:

The Contractor shall make all necessary arrangements and obtain all permits for the use of water from the City or otherwise, and Contractor shall pay for all water used and permits required.

K. Prevention of Dust and Smoke:

The Contractor shall keep the surface of the sidewalks and streets affected by the Work, including, but without limitation, decking and temporary paving, in a clean and neat condition. The Contractor shall sprinkle with water or otherwise treat the surface sufficiently to keep the dust laid during the progress of the Work. Piles of dirt or other material shall not be left on the surface. The above mentioned requirements are not intended to take the place of the usual duties of the Department of Streets or the Pennsylvania Department of Transportation, as applicable, but to supplement them. No fires of any kind or burning of debris on the Site or adjacent to it will be permitted; debris shall not be disposed of on the Site.

L. Explosives:

If any blasting is involved in the performance of the Contract, the Contractor must obtain a blasting permit from the Department of Licenses and Inspections of the City and all such other licenses or permits as shall be required. Permits will be issued only upon approval of the appropriate governmental agency or official, and posting of a bond or delivery of a certificate of insurance covering personal injuries and property damage. Blasting may be done only by licensed blasters duly licensed by the City. The Contractor must also obtain all necessary licenses or permits for the storage of explosives and the transportation of explosives to the Site, which are issued by the Department of Licenses and Inspections of the City subject to prior approval of the appropriate governmental agency or official.

M. Work in Freezing Weather:

Masonry of all kinds, pointing, grouting, plastering, and other Work subject to the action of frost shall not be done when exposed to freezing weather, except under conditions where the Engineer may specifically direct or permit such Work, subject to the heating of materials, the
protection of finished Work, and such other measures as may be deemed necessary. The Contractor’s work should take into account the possibility of normal weather conditions and the Engineer is not required to authorize additional time or money for the completion of the Work. If operations are suspended on account of freezing weather, the Work shall be properly protected until the resumption of Work is permitted. If a suspension of the Work on account of freezing weather or from any other cause is necessary, the Site shall be cleaned up and left in good order during the period of such suspension.

N. Cooperation with Public Utility Companies:

Notice shall be given by the Contractor to all individuals, companies, and the proper City officials owning or having charge of structures along any part of the Work, of the Contractor’s intention to commence operations along such part of the route, at least seven (7) days in advance, and a copy of such notice shall be filed with the Engineer. The Contractor shall cooperate with other contractors and with the employees, officers, and agents of the City, Commonwealth and Federal departments and of the various companies which own, operate, or have supervision over the structures encountered, and shall conform to the reasonable requirements of the owners of such structures with regard to their safe maintenance. The Contractor shall give to authorized representatives of said departments and companies free access at all times to the excavation and to the Site to inspect the condition and support of their structures. Suitable arrangements shall be provided to facilitate access to valves and manholes. Ventilation openings shall be provided where gas is likely to accumulate. Where structures are to be constructed under the facilities of any public utility company, the Contractor shall arrange with the public utility company for the removal or support and maintenance of such facilities.

O. Gas Pipes:

The performance of any necessary alterations to the gas mains and gas service pipes, including temporary or permanent relocations thereof, are the responsibility of the Contractor and shall be performed by the Contractor or the Philadelphia Gas Works. The mains and services that have been removed may be replaced in their permanent position after the backfilling has been sufficiently compacted.
P. Traffic Control Apparatus:

The Contractor shall support and maintain in their present locations, or in approved temporary locations, any existing traffic signs or traffic control masts, signals, signs, apparatuses, and their connecting cables, in the proper condition to permit the uninterrupted functioning of the signals during the progress of the Work, on temporary poles if necessary, and in a manner satisfactory to the City’s Department of Streets and/or the Pennsylvania Department of Transportation, as applicable. If the existing signal apparatus is supported on poles and these poles are moved to a temporary location during the progress of the Work, the Contractor shall either erect temporary signal poles in the approximate locations of the original poles and erect the signals thereon, or shall extend the electrical connection to the poles as relocated, as may be ordered by the Engineer. Upon the restoration of surface conditions, the Contractor shall restore the equipment, including cables and electrical connections, to its original position and condition. The Contractor’s obligations under this Section XVII (P) shall be done without additional compensation.

Q. Interruption of Existing Services:

Whenever it becomes necessary to interrupt existing services in use, such as sewer, water, gas and steam lines, and electric service, the Work shall continue on a twenty-four (24) hour basis until it is completed and the service restored, or at such alternate time required by PhilaPort.

R. Support and Protection:

All structures unless specifically designated by the Engineer to be abandoned or relocated, shall be supported and protected at all times from injury, including damage from freezing, and maintained continuously in service. Should any injury occur while the Work is in progress and the structures are under the protection of the Contractor, the Contractor shall fully restore such structures to as good a condition as existed before the injury was done. The above, including also such changes of structures as are for the Contractor’s own convenience in executing the Work, shall be done without additional compensation, unless otherwise specifically provided for in the Contract Documents.

S. Structures Interfering with Construction:

If, in the course of the Work, it is found that any of the existing structures occupy space required by any other structure or appurtenances thereto to be constructed under the Contract, or that they are so situated as to render it impracticable, in the opinion of the Engineer, to do the Work called for under the Contract in the manner specified, the Contractor shall excavate and uncover the portions of the structures within the pavement lines for excavating under the Contract and shall maintain such structures in service and shall notify the Engineer, who will arrange for the relocation, changing, or removal of the interfering pipes or structures within a reasonable time. The Contractor shall not move nor disturb the structures in any way without consultation with the owners and the approval of the Engineer. Structures belonging to public utility companies, which are ordered by the Engineer to be removed or relocated, will
be so removed or relocated and permanent supports placed. The Contractor, however, shall support and protect them up to the time of their removal, shall cooperate with their owners during the process of relocation, and shall maintain and protect them if and when they are relocated within the zone of influence of the Work. This Work shall be done by the Contractor without additional compensation from PhilaPort. Sewers, water pipes, electrical conduits, and other structures shall be constructed, relocated, or reconstructed as shown on the Plans or as may be ordered in the course of the Work. Payment for this Work will be made at the applicable prices in the Contract Documents unless otherwise specifically provided. If approval is given by the Engineer to a request by the Contractor to effect a temporary or permanent relocation of structures, for the Contractor’s own convenience, and satisfactory arrangements can be made with the owners thereof, this Work will be done at the expense of the Contractor.

T. Abandonment of Structures:

In the case of structures, the service of which is permanently abandoned, the Engineer will designate which of the materials are to be salvaged and which are to be abandoned in the trench or otherwise disposed of. The Contractor shall remove and deliver to a designated point of storage materials ordered to be salvaged, and payment therefore will be made at the appropriate prices of the Contract, unless otherwise specifically provided. The Contractor shall allow owners of privately owned structures reasonable facilities for salvaging their property.

U. Insulation for Construction Projects:

All Insulation incorporated into the Project must contain the minimum percentage of postconsumer recovered paper or recovered material a shown below for the applicant product.

<table>
<thead>
<tr>
<th>Material Type:</th>
<th>Percent by Weight:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cellulose loose – fill and spray on</td>
<td>75% postconsumer recovered paper</td>
</tr>
<tr>
<td>Perlite Composite Board</td>
<td>23% postconsumer recovered paper</td>
</tr>
<tr>
<td>Plastic rigid foam, polyisocyanurate/polyurethane</td>
<td></td>
</tr>
<tr>
<td>Rigid Foam</td>
<td>9% recovered material</td>
</tr>
<tr>
<td>Foam-in-Place</td>
<td>5% recovered material</td>
</tr>
<tr>
<td>Glass Rigid Foam</td>
<td>6% recovered material</td>
</tr>
<tr>
<td>Phenolic Rigid Foam</td>
<td>5% recovered material</td>
</tr>
<tr>
<td>Rock Wool</td>
<td>50% recovered material</td>
</tr>
</tbody>
</table>

Postconsumer recovered paper is defined as “Any paper, paperboard and fibrous wastes from retail stores, office buildings, homes and so forth, after they have been passed through their end-usage as a consumer item including; used corrugated boxes, old newspapers, old magazines, mixed waste paper, tabulating cards and used cordage, as well as all paper, paperboard, and fibrous wastes that enter and are collected from municipal solid waste.”
Recovered materials are defined as “waste material and byproducts which have been recovered or diverted from solid waste, but such term does not include those materials and byproducts generated from, and commonly reused within, an original manufacturing process.”

The Contractor may be required to provide PhilaPort with documentary evidence that the insulation provided for the Project was produced with the required minimum percentage of postconsumer recovered paper or recovered material.
DIVERSITY AND INCLUSION
DIVERSITY AND INCLUSION POLICY MINIMUM PARTICIPATION LEVELS

PHILAPORT has established the following minimum participation levels (MPLs) for Historically Underutilized Business Enterprises in accordance with a policy on diversity inclusion, set forth in Part X of the Contracting, Procurement, and Leasing Policies and Procedures, revised as of November 2015, the provisions of which are incorporated as though fully set forth herein.

All contracts awarded for construction will have a minimum HUB participation level set by the Director of Procurement, but in no event shall it be less than 20% of the contract value. The participation for each award must include at least 2 of the categories that are identified as HUB (below) with no less than 5% participation for every category being included.

Historically Underutilized Business Enterprise (HUB)
A Business Enterprise that is:

1. an MBE
2. a WBE
3. a Veteran or Service-Disabled Veteran Business Enterprise
4. an LGBT Business Enterprise

***Use forms included to submit HUB solicitation and commitments at time of bidding.
ACCEPTED CERTIFICATIONS

PhilaPort accepts approved third-party certifications from any of the following entities as long as they fit into the categories of inclusion accepted by PhilaPort:

- Woman’s Business Enterprise National Council (WBENC)
- National Minority Supplier Development Council (NMSDC)
- United States Small Business Administration (SBA) 8(a) Program *
- Vets First Verification Program at vetbiz.gov
- US Business Leadership Network (USBLN)
- National Gay & Lesbian Chamber of Commerce (NGLCC)
PHILADELPHIA REGIONAL PORT AUTHORITY

Diversity Inclusion Plan
(Construction)
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## EXHIBITS

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II. POLICY STATEMENT

The Board of the Philadelphia Regional Port Authority, an independent agency of the Commonwealth of Pennsylvania, pursuant to Sections 697.4 and 697.6(c)(5) of the Philadelphia Regional Port Authority Act, has adopted a policy on diversity inclusion, set forth in Part X of the Contracting, Procurement, and Leasing Policies and Procedures, revised as of November 2015 (the “Diversity Inclusion Policy” or the “Policy”).

It is the policy of the Philadelphia Regional Port Authority (“PHILAPORT”) to promote opportunities for full participation by Minority-owned, Women-owned, Veteran-owned or Service-Disabled-Veteran-owned and LGBT-owned small businesses, hereafter collectively referred to as disadvantaged business enterprises (“HUBs”) in all project-related construction contracts to the greatest extent feasible and to do so by insuring that all Prime Contractors do not discriminate in the solicitation, award and administration of construction subcontracts on PHILAPORT’s projects.

Further, PHILAPORT’s policy is to extend the applicability of the Diversity Inclusion Policy to other professional and non-professional services for which PHILAPORT contracts.

III. DIVERSITY INCLUSION PLAN

A. HUB Requirements

PHILAPORT shall take all necessary and appropriate steps to assure that its Prime Contractors do not discriminate and use HUBs in accordance with this Diversity Inclusion Plan (the “Diversity Inclusion Plan” or the “Plan”) for all project-related construction contract awards that exceed the bidding threshold established annually for authorities in Pennsylvania.1

IV. DEFINITIONS

A. Bidder Responsiveness - Actions taken by a Prime Bidder to seek participation by Subcontractors as defined below who are HUBs, and documented in the bid. Responsiveness includes submission at the time of the bid of the HUB Solicitation and Commitment Statement (similar in content to Exhibit 1), and, if needed, documentation providing an explanation for failure to achieve minimum levels of participation (MPLs). This documentation must demonstrate that the bidder has not engaged in discriminatory practices and may include a description of any barriers or impediments encountered despite the actions taken.

B. Bidder Responsibility – Demonstration of non-discrimination in the selection of Subcontractors. Bidders are presumed to meet these responsibilities if minimum participation levels established for the project on the pertinent subcontract are

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1 Although the Plan is termed the “Diversity Inclusion Plan,” the intent of the Plan is to achieve both Diversity and Inclusion, as two distinct characteristics, with respect to its construction contracts.
achieved. Non-discrimination can also be demonstrated by submitting supplemental evidence that failure to achieve the MPLs was not motivated by consideration of race, gender or other impermissible criterion; that HUBs were not treated less favorably than others; and that solicitation and commitment decisions were not based upon policies which disparately affect HUBs.

C. **Business Enterprise** - Any legal entity that is organized in any form other than as a joint venture (e.g., sole proprietorship, partnership, corporation, etc.) to engage in lawful commercial transactions.

D. **Contractor** - An entity that contracts with the PHILAPORT to perform work in connection with a construction project.

E. **Control** - The exclusive, ultimate and sole control of a business including, but not limited to, capital investment and all other financial, property acquisition, contract negotiation, and legal matters, officer-director-employee selection and comprehensive hiring, operating responsibility, cost-control matters, income and dividend matters, financial transactions, and rights of other shareholders or partners. Control shall be real, substantial, and continuing, not merely pro forma. Control shall include the power to direct or cause the direction of the management and policies of the business and to make the day-to-day as well as major decisions in matters of policy, management, and operations. Control shall be exemplified by possession of the requisite knowledge and expertise to operate the particular business. Control shall not be vested in majority or absentee ownership. Control by a HUB defined herein shall not be deemed to exist in any case where any majority owner or employee of the business is disproportionately responsible for the operation of the firm.

F. **Disadvantaged Business Enterprise (HUB)**

A Business Enterprise that is:

1. an MBE
2. a WBE
3. a Veteran or Service-Disabled Veteran Business Enterprise
4. an LGBT Business Enterprise

G. **LGBT Business Enterprise**

A Business Enterprise that is:

1. a sole proprietorship, owned and controlled by a LGBT Person; or
2. a partnership or joint venture of Business Enterprises controlled by LGBT Persons in which 51% of the beneficial ownership interest is held by LGBT Persons; or

3. a corporation or other entity controlled by LGBT Persons in which at least 51% of the voting interest and 51% of the beneficial ownership interest are held by LGBT Persons.

H. LGBT Person

Persons who identify as lesbian, gay, bisexual, or transgender.

I. Minority Business Enterprise (MBE)

A Business Enterprise that is:

1. a sole proprietorship, owned and controlled by a Minority Person; or

2. a partnership or joint venture of Business Enterprises controlled by Minority Persons in which 51% of the beneficial ownership interest is held by Minority Persons; or

3. a corporation or other entity controlled by Minority Persons in which at least 51% of the voting interest and 51% of the beneficial ownership interest are held by Minority Persons.

J. Minority Person

Persons who are citizens of the United States and who are Black Americans, Hispanic Americans, Native Americans, Asian-Indian Americans, or Asian-Pacific Americans.

1. Black (African) Americans - Persons having origins from any of the Black groups of Africa. The term includes persons having origins in any of the original peoples of the Cape Verdes Islands.

2. Hispanic Americans - Persons having their origins from one or more of the Spanish-speaking peoples of Mexico, Puerto Rico, Cuba, Central or South America or the Caribbean Islands.

3. Native Americans - Persons having origins from one or more of the original peoples of North America and who are recognized as an Indian by a tribe or tribal organization.

4. Asian-Indian – Persons having origins from one or more countries in south Asia, including India and Pakistan.
5. Asian-Pacific Americans - Persons having origins from one or more of the original peoples of the Far East, Southeast Asia or the Pacific Islands, including China, Japan, Korea, Samoa, and the Philippine Islands.

K. **Owner** – PHILAPORT

L. **Prime Bidder and Prime Contractor**

For HUB purposes, the term, “Prime Bidder” means a Business Enterprise that submits a bid to PHILAPORT (e.g., general contractors, plumbing contractors). A Prime Contractor is a Prime Bidder that has received an award from PHILAPORT.

M. **Service-Disabled Veteran Business Enterprise.** A Business Enterprise that is:

1. a sole proprietorship, owned and controlled by a Service-Disabled Veteran; or

2. a partnership or joint venture of Business Enterprises controlled by Service-Disabled Veterans in which 51% of the beneficial ownership interest is held by Service-Disabled Veterans; or

3. a corporation or other entity controlled by Service-Disabled Veterans in which at least 51% of the voting interest and 51% of the beneficial ownership interest are held by Service-Disabled Veterans.

N. **Service-Disabled Veteran.**

Persons who are Veterans and either (1) are “disabled veterans” as defined in 5 USC 2108(2) (i.e. “individuals who have served on active duty in the armed forces, have been separated therefrom under honorable conditions, and have established the present existence of a service-connected disability or are receiving compensation, disability retirement benefits, or pension because of a public statute administered by the Department of Veterans Affairs or military department”) or (2) have a disability as defined in the Social Security regulations, 42 USC 423 (i.e. “an inability to engage in any substantial gainful activity by reason of any medically determinable physical or mental impairment which can be expected to result in death, or which has lasted, or can be expected to last for a continuous period of not less than 12 months”) and have a present determination of a disability by the Social Security Administration or Veterans Administration.

O. **Subcontractor.** A Business Enterprise that has a contract with a Prime Contractor to supply labor, equipment, materials or supplies for a project as a manufacturer, vendor, supplier or subcontractor.

P. **Veteran.** Persons who served in honorably in the United States military.

Q. **Veteran Business Enterprise.**
1. a sole proprietorship, owned and controlled by a Veteran; or
2. a partnership or joint venture of Business Enterprises controlled by Veterans in which 51% of the beneficial ownership interest is held by Veterans; or
3. a corporation or other entity controlled by Veterans in which at least 51% of the voting interest and 51% of the beneficial ownership interest are held by Veterans.

R. Women’s Business Enterprise (WBE). A Business Enterprise that is:
1. a sole proprietorship, owned and controlled by a Woman; or
2. a partnership or joint venture of Business Enterprises controlled by Women in which 51% of the beneficial ownership interest is held by Women; or
3. a corporation or other entity controlled by Women in which at least 51% of the voting interest and 51% of the beneficial ownership interest are held by Women.

S. Women. United States citizens who are of the female gender.

V. CONTRACTOR COMPLIANCE GENERALLY

A. Minimum Participation Levels (MPLs)

PHILAPORT will establish minimum participation levels (MPLs) for the HUBs on a project-by-project basis. The MPLs will be established for each prime bid to be used solely as a guide in determining Prime Bidder responsibility. MPLs are applied to each bid category. The MPLs will vary based on the market availability of subcontracting opportunities for HUB’s, on a project-by-project basis.

PHILAPORT shall endeavor to establish MPLs on the basis of actual market availability that matches the scope of work included in the project and available HUB firms, on a project-by-project basis with separate participation levels for the HUB categories.

B. Bidder’s Submissions at Time of Bid

The Prime Bidder shall submit the HUB Solicitation and Commitment Statement attached as Exhibit 1 with its bid, showing efforts made to solicit HUB Subcontractors, and written confirmations of the intent to use the identified Subcontractors if awarded the prime contract. Prime Contractor’s HUB Contact/Solicitation and Commitment Statement shall include the names of all companies and individuals contacted or solicited for participation in the project,
the type of work, material, supplies or equipment involved in the solicitation, the total dollar amount of each quote received, the time of solicitation, and, where applicable, the total dollar amount of each subcontract that would be awarded.

C. Safe Harbor and Compliance at Time of Bidding

In the absence of evidence to the contrary, compliance with the requirements under this Plan to demonstrate both bidder responsiveness and responsibility is presumed if MPLs are achieved.

If MPLs are not met, the Prime Bidder shall document why it was not feasible to meet the numerical levels by submitting evidence that failure to achieve MPLs was not motivated by consideration of race or gender, or other disadvantaged status; that HUBs were not treated less favorably than others; that solicitation and commitment decisions were not based upon policies which disparately affect HUBs. Justification for not meeting the MPLs may include impediments encountered despite actions taken.

D. Compliance Responsibilities – PHILAPORT and Prime Contractor

PHILAPORT has the responsibility to comply with the requirements under this Plan and ensure non-discrimination in the selection of Subcontractors, and in the administration of the project.

Prime Contractor has the responsibility to meet its commitments made during bidding by utilizing each Subcontractor it selected to the full extent of the subcontract value. The failure to meet minimum participation levels at the completion of two projects shall warrant Prime Contractor’s disqualification from contracting with PHILAPORT for a period of six months and the imposition of liquidated damages in the amount of 10% of the dollar amount of the shortfall in the commitment to compensate PHILAPORT for the administrative costs of addressing the deficiency and not as a penalty.
E. Prime Contractor’s Submissions during Project Administration

Prime Contractor shall submit monthly reports as specified in this Plan and in the Contract Documents. Specifically, Prime Contractor shall submit the Prime Contractor’s HUB Monthly Reporting Form Summarizing Payments Made (similar in content to Exhibit 2) for each project as well as proof of payment in the form of invoices from subcontractors. Both form and proof of payment to subcontractors should be submitted to the Finance Department along with the Prime Contractor’s monthly invoicing. PhilaPort reserves the right to withhold payment to Prime Contractor until the HUB monthly reporting is up-to-date and in accordance with the MPLs submitted with the bid.

VI. PROCEDURES – CLAUSES INCLUDED IN BIDDING AND CONTRACT DOCUMENTS

PHILAPORT shall insert the following in the appropriate contract document, establishing requirements applicable to the Prime Bidder:

A. Advertisement / Invitation for Bid (IFB)

All advertisements for IFB will include the following statement:

“The bidder must submit documentary evidence of solicitations from HUBs, which have been contacted and to which commitments have been made. Documentation of contract solicitations and commitments shall be submitted concurrently with the bid.”

B. Instructions to Bidders (ITB)

The following statements will be placed in the bid documents, establishing requirements applicable to the Prime Bidder:

1. Participation Level
   
a. PHILAPORT has established the following minimum participation levels (MPLs) for Disadvantaged Business Enterprises in accordance with a policy on diversity inclusion, set forth in Part X of the Contracting, Procurement, and Leasing Policies and Procedures, revised as of November 2015, the provisions of which are incorporated as though fully set forth herein.

      • MBEs ____% of the total dollar amount of the ______ contract
      • WBEs ____% of the total dollar amount of the ______ contract
      • Veteran or Service-Disabled Veteran Business Enterprise
% of the total dollar amount of the ______ contract

- LGBT Business Enterprise ____% of the total dollar amount of the ______ contract

All contracts awarded for construction will have a minimum HUB participation level set by the Director of Procurement, but in no event shall it be less than 20% of the contract value. The participation for each award must include at least 2 of the categories that are identified as HUB with no less than 5% participation for every category being included.

MPLs are established for this project to be used solely as a threshold in determining Prime Bidder responsibility. Prime Bidders are presumed to meet their responsibilities under the Policy if the dollar commitments to the HUBs reflect these participation levels. A Prime Bidder will not be rejected as non-responsible solely because it fails to reach the MPLs. To determine the participation level that has been reached, a Prime Bidder shall divide the total dollar amount of the commitments for the project by the total dollar amount of the Prime Bidder’s contract award.

b. HUB subcontracts will be credited toward the MPLs at 100%. HUB stocking suppliers and manufacturers are credited at 100%. HUB non-stocking suppliers, which are commonly and ordinarily the custom in the industry and a part of the industry’s trade practices, are credited at 100%. Non-stocking suppliers, which are not commonly and ordinarily the custom in the industry nor a part of the industry’s trade practice, are not credited.

c. A prospective Subcontractor that qualifies in one, two, three or all four categories, will only receive credit toward MPLs as one but not more than one. Prime Bidders must indicate on the HUB Solicitation and Commitment Statement (similar in content to Exhibit 1) how the prospective Subcontractor should be credited.

d. A HUB which is the Prime Bidder on a project with a contract valued at $100,000 or less will receive full MPL credit for its own work effort for services provided. Such a business bidding as Prime Contractor should nonetheless attempt to hire and solicit other, certified HUBs for participation in subcontracts.

e. HUB Subcontractors providing labor must perform at least seventy-five percent (75%) of the cost of the subcontract, not including the cost of materials, with its own employees.

C. General Conditions
PHILAPORT will include the following provisions in construction contracts, establishing requirements applicable to Prime Contractor.

1. Reporting Requirements After Award

   a. Prime contractors must provide PHILAPORT directly with the Prime Contractor's HUB Monthly Reporting Form Summarizing Payments Made (similar in content to Exhibit 2) for each project that is underway and for which payment applications are being submitted. The report shall include the names of and the total dollar amount paid to all HUB Subcontractors utilized under this contract. PHILAPORT reserves the right to verify payments to subcontractors at any time.

2. Joint Ventures and Subcontracting

   a. Joint Venture. Project-related contracts that involve a joint venture with a HUB firm must include the following clause:

   If the joint venture relationship identified as the __________________________ is dissolved, on otherwise discontinued, (________________________), Name of Replacement Prime Contractor

   Replacement Prime Contractor, as the successor on the contract, shall continue this commitment by entering into contractual agreements with other appropriate firms to perform work on this contract. Replacement Prime Contractor must submit all requests for change orders to PHILAPORT for approval.

   b. Subcontracting. Subcontracts with HUB firms must include the following clause:

   If the subcontracting commitment made to the __________________________ Name of Subcontractor is terminated or materially reduced, __________________________ Name of Prime Contractor

   agrees that the termination or material reduction is subject to the approval of PHILAPORT, which approval shall not be withheld unreasonably.

VII. PROCEDURE TO SOLICIT PARTICIPATION

A. HUB Certification
1. Prime Bidders will only be given credit for HUBs that are certified or accepted as certified HUBs by programs approved by, and in accordance with additional requirements set forth by, Board resolution.

2. Under the State Act of December 21, 1984, No. 230, P.L. 210, 18 PA. C.S.A. § 4107.2 a person commits a felony of the third degree if, in the course of business, he/she engages in deception relating to HUB certification.

3. To be credited, the certification relied upon must be for the category of labor, equipment, materials or supplies that would be used by Prime Contractor in the proposed subcontract with the Subcontractor. For example, a certification as a masonry contractor does not qualify as a certification to supply electrical equipment.

B. Notification to HUBs

The procedure for Prime Contractor to notify HUBs of contract shall be as follows:

1. **Notice of ITBs**

   The Prime Bidder shall utilize available information regarding certified HUB firms capable of performing in the project’s area. PHILAPORT shall provide reasonable assistance to the Prime Bidder. The Prime Bidder shall provide notice of the project to HUB firms so identified and to other qualified HUB firms and shall otherwise provide the same level of communication and interaction with prospective HUB Subcontractors as it would to other companies with which the Prime Bidder routinely contracts.

2. **Other Notices** - Notices of the HUB subcontracting opportunities will be sent by PHILAPORT to appropriate organizations, such as:

   a. local minority churches and civic organizations;

   b. appropriate (1) minority business technical assistance organizations and schools, (2) minority, women, veteran, LGBT and small business contractor associations and appropriate trade organizations; and,

   c. other business assistance agencies, community organizations, and media organizations such as trade association papers and newsletters, community television networks, local newsletters, and radio advertising.

3. **Plans and Specifications** - Plans and specifications and all bidding documents on all projects will be made available to potential
Subcontractors, and HUB contractor associations, and trade organizations, through Penn Bid and similar web-based databases, and otherwise as may be appropriate.

4. **List of Plan holders** - The names of Prime Bidders requesting bid documents will be made available upon request by PHILAPORT to HUB firms which provide labor, equipment, materials or supplies that appropriate to the scope of project work being solicited.

5. **Lists of HUB’s Businesses** - PHILAPORT will provide each Prime Bidder obtaining plans and specifications for a project with any available lists of HUB firms.

VIII. PROCEDURE TO EVALUATE BIDS

A. Responsiveness

1. The Prime Bidder must complete and submit the HUB Solicitation and Commitment Statement (similar in content to Exhibit 1) with the bid. Failure to submit a completed form with the bid will result in the bid being rejected as nonresponsive.

2. The Prime Bidder should only solicit HUB Subcontractors whose labor, equipment, materials or supplies are within the scope of work and which the Prime Bidder reasonably believes it could choose to subcontract with or purchase from.

3. Prime Bidders failing to meet the MPLs must submit concurrently with the bid, an explanation of why the MPLs have not been met. This explanation must demonstrate that the Prime Bidder has not engaged in discriminatory practices in the solicitation and utilization of HUBs to perform as Subcontractors on the project. The evidence submitted by the Prime Bidder must demonstrate the following:

   a. indicate whether HUB firms were solicited for each type of work the Prime Bidder expects to subcontract for and for all materials which the Prime Bidder expects to procure and, if not, the reason(s) why no such solicitation was made;

   b. indicate the reason why commitments were not made to HUB firms for a type of subcontract labor, equipment, materials or supplies in any areas where quotes were received from such firms; and

   c. in any case where no quotations are received from, nor commitments made to HUB firms, indicate on Exhibit 1 that no quotes were received, and if there is another reason for no commitments being made, the reason for the lack of commitments.
4. If the Prime Bidder fails to submit such evidence, the bid submission shall be considered non-responsive and the bid shall be rejected.

5. Information related to the above shall be submitted on Exhibit 1 with the bid and on such additional materials as the Prime Bidder wishes to attach.

B. Responsibility

1. The submittals of each Prime Bidder are subject to review by PHILAPORT to determine whether the Prime Bidder has discriminated in the selection of Subcontractors.

Where the MPLs are not met, PHILAPORT will determine whether discrimination has occurred. If, after investigation including a review of Exhibit 1, other materials submitted by the Prime Bidder, and such additional documents and information as PHILAPORT has secured, it is determined that discrimination has occurred, the Prime Bidder shall be deemed to be not responsible and the bid will be rejected.

2. Documentation submitted by the Prime Bidder should meet the following standards for review:

   a. the Prime Bidder whose actions resulted in a limited or no commitment to HUB firms was not motivated by consideration of race or gender;

   b. HUB firms were not treated less favorably than other businesses in the hiring and/or contract solicitation and commitment processes; and

   c. solicitation and commitment decisions were not based upon policies that disparately affect HUB firms.

3. Commitments to HUB firms at the time of bidding must be maintained throughout the project unless a change in commitment is approved in advance by PHILAPORT. Such approval shall not unreasonably be withheld.

C. Access to Information

PHILAPORT may obtain documents and information from any Prime Bidder and any Subcontractor as may be required to ascertain Prime Bidder’s contractor responsibility. Failure to provide requested information may result in the Prime Bidder’s bid being declared non-responsive, the Prime Bidder being declared not responsible, or both.

IX. PROCEDURES – RECORDS AND REPORTS
A. Records and Reports

1. PHILAPORT will review all reports received to determine if the commitments made by Prime Contractors in their bids are being met. This review is to be done contemporaneously with the receipt of payment applications, and in any event prior to final payment being made to Prime Contractor.

2. PHILAPORT will keep such records as are necessary to determine compliance with its HUB requirements. These records must be in sufficient detail to indicate the prime contract work performed, and the percentages of project-related work that is being performed by HUBs.

3. Prime Contractor must retain HUB records related to the construction period for a period of four years after final completion of the project. If any litigation, claim, negotiation, audit, or other action has been commenced before the previously mentioned record retention periods, the records must be retained until the completion of the action and resolution of all issues which arise from it or until the end of the previously referenced record retention period, whichever is later.
Exhibit 1

DBE Solicitation and Commitment Statement
Project owners and all prime bidders will complete this form to document all businesses solicited and all businesses that provided solicited or unsolicited quotes for project-related contracts.

1. Provide your company name, address, telephone number.

2. Provide the project name, project number, bid opening date, contract award date, and a contact person’s name.

3. For each business solicited and each quote/bid received, enter the firm name, Employer Identification Number (EIN) or Social Security Number (SSN) for a sole proprietorship, telephone number with area code, and e-mail address. Only the company’s name is a mandatory item.

4. Indicate whether or not the firm is an MBE, a WBE, Veteran or Service-Disabled Veteran Business Enterprise, or LGBT Business Enterprise. Place a check mark in only one of the appropriate MBE, WBE, Veteran or Service-Disabled Veteran Business Enterprise or LGBT Business Enterprise, add the identity of the certifying entity and the DBE’s certification number.

5. Indicate the type of work to be performed and/or material to be supplied.

6. Enter the total dollar amount of the quote received.

7. Enter the total dollar ($) amount of the commitment which you have made to the MBE, WBE, Veteran or Service-Disabled Veteran Business Enterprise or LGBT Business Enterprise. If no amount is provided in this space, it will be presumed that your firm made no commitment to the MBE, WBE, Veteran or Service-Disabled Veteran Business Enterprise or LGBT Business Enterprise.

8. NOTE: You must include information on both solicited and unsolicited quotes. Failure to include a firm providing solicited or unsolicited quotes may result in the rejection of the bid or a determination that you are not a responsible contractor. Adequate time equivalent to that provided to other Subcontractor proposers must be provided for DBE Subcontractors and suppliers to respond to bids.

9. Indicate the name, telephone number and e-mail address of the person(s) who prepared the form.
### Exhibit 1

**DBE SOLICITATION AND COMMITMENT STATEMENT**

<table>
<thead>
<tr>
<th>OWNER / PRIME BIDDER'S FIRM NAME (1)</th>
<th>PROJECT NAME (2)</th>
</tr>
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<tbody>
<tr>
<td>ADDRESS</td>
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<td>TELEPHONE NUMBER</td>
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<tr>
<td>COMPANY NAME</td>
<td>DATE OF SOLICITATION</td>
<td>MBE</td>
<td>WBE</td>
<td>Veteran or Service-Disabled Veteran Business Enterprise</td>
<td>LGBT Business Enterprise</td>
<td>Certification Program and Number</td>
<td>TYPE OF WORK TO BE PERFORMED AND/OR MATERIAL TO BE SUPPLIED</td>
<td>TOTAL DOLLAR AMOUNT OF QUOTE RECEIVED</td>
<td>TOTAL COMMITMENT DOLLAR AMOUNT</td>
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</table>

(8) Note: List those certified DBE Subcontractors from which you solicited quotes or which contacted you and gave you quotes in regard to this invitation to bid. Contact with DBE Subcontractors should be at least equivalent to the notice given to other subcontractor proposers.

(9) PREPARED BY (please print)          TELEPHONE NUMBER | E-MAIL

*Use additional sheets, if necessary.*
Exhibit 2

Prime Contractor’s DBE Monthly Reporting Form Summarizing Payments Made
EXHIBIT 2
Prime Contractor’s Monthly DBE Payment Report

<table>
<thead>
<tr>
<th>Name of Project</th>
<th>Prime Original Contract Value:</th>
<th>Change Orders (Overall Add/Deduct):</th>
<th>Total Contract Amount to Date:</th>
<th>Total Payments Issued from to (date)</th>
<th>Contract No.:</th>
<th>Report for the Month of:</th>
<th>Notice to Proceed Date:</th>
<th>Project Mgr. Name:</th>
<th>Assigned DBE Goal %:</th>
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<table>
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<tr>
<th>Name of DBE Subcontractor</th>
<th>Work Task Performed</th>
<th>Original Contract Amount ($)</th>
<th>Change Order Amount $ (+/-)</th>
<th>Amount of Invoice Received this Month</th>
<th>Date of Invoice Received in this Month</th>
<th>Payments Made to DBE in this Month ($)</th>
<th>Date(s) Payments Made this Month</th>
<th>Total DBE Payments Made to Date in $</th>
<th>% Overall Work Finished</th>
<th>Final Payment (Y/N)</th>
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**Itemize payments/invoices and dates if paid/received more than one payment/invoice between the 1st and 31st of this Month.**

**Prime Contractor Information:**

Prime Firm Name:__________________________  Project Director Name:__________________________

Address:__________________________  Project Director Signature:__________________________

Telephone No.:__________  Date:__________  EIN # / TIN #:__________________________

**Prime's Past Due Invoice Information:** List any invoice more than _____ days past due from the date submitted to _____ at the time you complete this form.

<table>
<thead>
<tr>
<th>Invoice #</th>
<th>Invoice Date</th>
<th>Invoice Amount ($)</th>
<th>No. of Days Past Due</th>
<th>Comments</th>
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</table>
1. Have all DBE Subcontractors with executed subcontracts been paid amounts due from previous progress payments?

☐ If Yes, skip the next section and go to Number 3.

☐ If No, please complete fields in box below (use additional paper, if necessary)

<table>
<thead>
<tr>
<th>Subcontractor Name</th>
<th>Amount Withheld from Invoice ($)</th>
<th>Total of Invoice Amount ($)</th>
<th>Invoice No.</th>
<th>Invoice Date</th>
<th>Specific Reason for Withholding</th>
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2. Have you notified the DBE Subcontractor(s) that you are withholding payment and the reason(s) why?

☐ If Yes, provide a copy of written notification to the DBE Subcontractor with this form, indicating the date of notification.

☐ If No, lack of prior written notification to the DBE(s) that you are withholding payment may violate the prompt payment clause guidelines. Please contact the DBE immediately, and provide a copy of written notification to the Subcontractor with this form.

3. By signing this form, I certify that all of the above represent true and accurate information.

___________________________________________  ___________________________________________  _____/_____/_______
Project Director Name (Print)  Project Director (Signature)  Date

Additional Reasons/Comments for Withholding Payment:

___________________________________________  ___________________________________________  _____/_____/_______

DO NOT WRITE BELOW

Please forward to: ____________________________________________

☐ Approved

☐ Denied

This Form is Due on the _____ of each Month.
PART 4

(attachments)
SPECIFICATIONS

PLEASE NOTE: Whenever an item is defined in the Bidding or Contract Documents by trade name and catalogue number of a manufacturer or vendor, the term “or approved equal,” if not inserted therewith shall be implied. Any reference to a particular manufacturer’s product either by trade name or by limited description is solely for the purpose of more clearly indicating the minimum standard of quality desired, except where a “no substitute” is requested. When a “no substitute” is requested, PhilaPort will consider bids for the referenced product only. The term “or approved equal” is defined as meaning any other make which, in the sole opinion of the Engineer, is of such character, quality, and performance equivalence as to meet the standard of quality of products specified for which it is to be used equally as well as that specified. (Part 1, Instructions to Bidders, Section 4, D)
HEATING SYSTEM RENOVATION
AT PORT ADMINISTRATION BUILDING
3460 NORTH DELAWARE AVENUE
PHILADELPHIA, PA  19134

PREPARED FOR:  Philadelphia Regional Port Authority
3460 NORTH DELAWARE AVENUE
PHILADELPHIA, PA  19134

PREPARED BY:  KITCHEN & ASSOCIATES SERVICES, INC.
Kitchen & Associates  Architecture • Engineering • Planning • Interiors

SUBMITTED:  MAY 17, 2019
REVISED:  MAY 30, 2019
K&A #17082.003
PAB #19-048.2
SECTION 000002

PROJECT DIRECTORY

ARCHITECT:

Kitchen and Associates Services, Inc.
756 Haddon Avenue
Collingswood, NJ 08108
Tel: (856) 854-1880 / (215) 985-0111
FAX: (856) 854-3842
Eugene Schiavo, AIA, PP, LEED® AP

MECHANICAL, PLUMBING AND ELECTRICAL ENGINEER

Mark Ulrick Engineers, Inc.
622 Cooper Street, Suite 200
Camden, NJ 08102
Phone: 856-320-8100
Fax: 856-320-8106
Mark Washington, PE, Principal

END OF SECTION
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<td>05/17/19</td>
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NOT USED

### DIVISION 2: SITE WORK
NOT USED

### DIVISION 3: CONCRETE
NOT USED

### DIVISION 4: MASONRY
NOT USED

### DIVISION 5: METALS
NOT USED

### DIVISION 6: WOOD AND PLASTICS
NOT USED

### DIVISION 7: THERMAL AND MOISTURE PROTECTION
NOT USED

### DIVISION 8: DOORS AND WINDOWS
NOT USED

### DIVISION 9: FINISHES
NOT USED

### DIVISION 10: SPECIALTIES
NOT USED

### DIVISION 11: EQUIPMENT
NOT USED

### DIVISION 12: FURNISHINGS
NOT USED

### DIVISION 13: SPECIAL CONSTRUCTION
NOT USED

### DIVISION 14: CONVEYING SYSTEMS
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DIVISION 21: FIRE SUPPRESSION
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DIVISION 22: PLUMBING
22 34 10 Natural Gas Piping

DIVISION 23: HVAC
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23 05 13 Electrical Requirements for HVAC Equipment
23 05 19 Meters and Gages for HVAC Piping
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NOT USED

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NOT USED

DIVISION 32: EXTERIOR IMPROVEMENTS
NOT USED

DIVISION 33: UTILITIES
NOT USED

END OF SECTION
SECTION 223410

NATURAL GAS PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Pipes, tubes, and fittings.
2. Piping specialties.
3. Piping and tubing joining materials.
4. Valves.
5. Pressure regulators.

1.2 PERFORMANCE REQUIREMENTS

A. Minimum Operating-Pressure Ratings:

1. Piping and Valves: 100 psig (690 kPa) minimum unless otherwise indicated.
2. Service Regulators: 65 psig (450 kPa) minimum unless otherwise indicated.

B. Natural-Gas System Pressures within Buildings: 0.5 psig or less.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

PART 2 - PRODUCTS

2.1 PIPES, TUBES, AND FITTINGS

A. Steel Pipe: ASTM A 53/A 53M, black steel, Schedule 40, Type E or S, Grade B.

2.2 PIPING SPECIALTIES

A. Appliance Flexible Connectors:
   2. Operating-Pressure Rating: 0.5 psig (3.45 kPa).
   5. Maximum Length: 72 inches (1830 mm).

B. 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.
   3. Strainer Screen: 40-mesh startup strainer, and perforated stainless-steel basket with 50 percent free area.
   4. CWP Rating: 125 psig (862 kPa).

C. Weatherproof Vent Cap: Cast- or malleable-iron increaser fitting with corrosion-resistant wire screen, with free area at least equal to cross-sectional area of connecting pipe and threaded-end connection.

2.3 JOINING MATERIALS

A. Joint Compound and Tape: Suitable for natural gas.


2.4 MANUAL GAS SHUTOFF VALVES

A. See "Aboveground Manual Gas Shutoff Valve Schedule" Articles for where each valve type is applied in various services.

B. General Requirements for Metallic Valves, NPS 2 (DN 50) and Smaller: Comply with ASME B16.33.
   1. CWP Rating: 125 psig (862 kPa).
   3. Dryseal Threads on Flare Ends: Comply with ASME B1.20.3.
   5. Listing: Listed and labeled by an NRTL acceptable to authorities having jurisdiction for valves 1 inch (25 mm) and smaller.
   6. Service Mark: Valves 1-1/4 inches (32 mm) to NPS 2 (DN 50) shall have initials "WOG" permanently marked on valve body.

A. One-Piece, Bronze Ball Valve with Bronze Trim: MSS SP-110.
1. **Manufacturers:** Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   
   a. BrassCraft Manufacturing Company; a Masco company.
   c. Lyall, R. W. & Company, Inc.
   e. Perfection Corporation; a subsidiary of American Meter Company.

3. Ball: Chrome-plated brass.
4. Stem: Bronze; blowout proof.
5. Seats: Reinforced TFE; blowout proof.
6. Packing: Separate packnut with adjustable-stem packing threaded ends.
8. CWP Rating: 600 psig.
9. Listing: Valves NPS 1 and smaller shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction.
10. Service: Suitable for natural-gas service with "WOG" indicated on valve body.

B. **Two-Piece, Full-Port, Bronze Ball Valves with Bronze Trim:** MSS SP-110.

1. **Manufacturers:** Subject to compliance with requirements available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   
   a. BrassCraft Manufacturing Company; a Masco company.
   c. Lyall, R. W. & Company, Inc.
   e. Perfection Corporation; a subsidiary of American Meter Company.

3. Ball: Chrome-plated bronze.
4. Stem: Bronze; blowout proof.
5. Seats: Reinforced TFE; blowout proof.
6. Packing: Threaded-body packnut design with adjustable-stem packing.
8. CWP Rating: 600 psig (4140 kPa).
9. Listing: Valves NPS 1 (DN 25) and smaller shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction.
10. Service: Suitable for natural-gas service with "WOG" indicated on valve body.

C. **Bronze Plug Valves:** MSS SP-78.
1. 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:

   a. Lee Brass Company.

5. Operator: Square head or lug type with tamperproof feature where indicated.
6. Pressure Class: 125 psig (862 kPa).
7. Listing: Valves NPS 1 (DN 25) and smaller shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction.
8. Service: Suitable for natural-gas service with "WOG" indicated on valve body.

2.5 PRESSURE REGULATORS

A. General Requirements:

   1. Single stage and suitable for natural gas.
   2. Steel jacket and corrosion-resistant components.
   3. Elevation compensator.
   4. End Connections: Threaded for regulators NPS 2 (DN 50) and smaller; flanged for regulators NPS 2-1/2 and larger.


   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. Canadian Meter Company Inc.
      b. Eaton Corporation; Controls Div.
      c. Harper Wyman Co.
      d. Maxitrol Company.
      e. SCP, Inc.

   5. Seat Disc: Nitrile rubber.

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. Bryan Donkin USA

2. Body: Cast iron.
7. Pilot Regulator Diaphragm: Molded nitrile rubber with nylon reinforcing.
8. Single-port, self-contained regulator with orifice no larger than required at maximum pressure inlet, and no pressure sensing piping external to the regulator.
9. Pressure regulator shall maintain discharge pressure setting downstream, and not exceed 150 percent of design discharge pressure at shutoff.
11. Atmospheric Vent: Factory- or field-installed, stainless-steel screen in opening if not connected to vent piping.

2.6 DIELECTRIC UNIONS

A. 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:
   b. Central Plastics Company.
   d. Jomar International Ltd.
   e. Matco-Norca, Inc.
   g. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
   h. Wilkins; a Zurn company.

2. Description:
   b. Pressure Rating: 125 psig (860 kPa) minimum at 180 deg F (82 deg C).
   c. End Connections: Solder-joint copper alloy and threaded ferrous.
PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine roughing-in for natural-gas piping system to verify actual locations of piping connections before equipment installation.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Close equipment shutoff valves before turning off natural gas to premises or piping section.

B. Inspect natural-gas piping according to the International Fuel Gas Code (with Philadelphia Amendments) to determine that natural-gas utilization devices are turned off in piping section affected.

C. Comply with the International Fuel Gas Code (with Philadelphia Amendments) requirements for prevention of accidental ignition.

3.3 OUTDOOR PIPING INSTALLATION

A. Comply with the International Fuel Gas Code for installation and purging of natural-gas piping.

B. Steel Piping with Protective Coating:
   1. Apply joint cover kits to pipe after joining to cover, seal, and protect joints.
   2. Repair damage to PE coating on pipe as recommended in writing by protective coating manufacturer.
   3. Replace pipe having damaged PE coating with new pipe.

C. Install fittings for changes in direction and branch connections.

D. Install pressure gage upstream and downstream from each service regulator.

3.4 INDOOR PIPING INSTALLATION

A. Comply with the International Fuel Gas Code for installation and purging of natural-gas piping.

B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements are used to size pipe and calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.

C. Arrange for pipe spaces, chases, slots, sleeves, and openings in building structure during progress of construction, to allow for mechanical installations.
D. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.

E. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

F. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

G. Locate valves for easy access.

H. Install natural-gas piping at uniform grade of 2 percent down toward drip and sediment traps.

I. Install piping free of sags and bends.

J. Install fittings for changes in direction and branch connections.

K. Verify final equipment locations for roughing-in.

L. Comply with requirements in Sections specifying gas-fired appliances and equipment for roughing-in requirements.

M. Drips and Sediment Traps: Install drips at points where condensate may collect, including service-meter outlets. Locate where accessible to permit cleaning and emptying. Do not install where condensate is subject to freezing.

1. Construct drips and sediment traps using tee fitting with bottom outlet plugged or capped. Use nipple a minimum length of 3 pipe diameters, but not less than 3 inches long and same size as connected pipe. Install with space below bottom of drip to remove plug or cap.

N. Extend relief vent connections for service regulators, line regulators, and overpressure protection devices to outdoors and terminate with weatherproof vent cap.

O. Conceal pipe installations in walls, pipe spaces, utility spaces, above ceilings, below grade or floors, and in floor channels unless indicated to be exposed to view.

P. Use eccentric reducer fittings to make reductions in pipe sizes. Install fittings with level side down.

Q. Connect branch piping from top or side of horizontal piping.

R. Install unions in pipes NPS 2 and smaller, adjacent to each valve, at final connection to each piece of equipment. Unions are not required at flanged connections.

S. Do not use natural-gas piping as grounding electrode.

T. Install strainer on inlet of each line-pressure regulator and automatic or electrically operated valve.

U. Install pressure gage upstream and downstream from each line regulator.
V. Install sleeves for piping penetrations of walls, ceilings, and floors.

W. Install sleeve seals for piping penetrations of concrete walls and slabs.

X. Install escutcheons for piping penetrations of walls, ceilings, and floors.

3.5 VALVE INSTALLATION

A. Install manual gas shutoff valve for each gas appliance.

B. Install regulators and overpressure protection devices with maintenance access space adequate for servicing and testing.

3.6 PIPING JOINT CONSTRUCTION

A. Ream ends of pipes and tubes and remove burrs.

B. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

C. Threaded Joints:
   1. Thread pipe with tapered pipe threads complying with ASME B1.20.1.
   2. Cut threads full and clean using sharp dies.
   3. Ream threaded pipe ends to remove burrs and restore full inside diameter of pipe.
   4. Apply appropriate tape or thread compound to external pipe threads unless dryseal threading is specified.
   5. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

D. Welded Joints:
   2. Bevel plain ends of steel pipe.
   3. Patch factory-applied protective coating as recommended by manufacturer at field welds and where damage to coating occurs during construction.

E. Flanged Joints: Install gasket material, size, type, and thickness appropriate for natural-gas service. Install gasket concentrically positioned.

F. Flared Joints: Cut tubing with roll cutting tool. Flare tube end with tool to result in flare dimensions complying with SAE J513. Tighten finger tight, then use wrench. Do not overtighten.

3.7 HANGER AND SUPPORT INSTALLATION

A. Comply with requirements for pipe hangers and supports specified in Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment."
B. Install hangers for horizontal steel piping with the following maximum spacing and minimum rod sizes:

1. NPS 1 (DN 25) and Smaller: Maximum span, 96 inches (2438 mm); minimum rod size, 3/8 inch (10 mm).
2. NPS 1-1/4 (DN 32): Maximum span, 108 inches (2743 mm); minimum rod size, 3/8 inch (10 mm).
3. NPS 1-1/2 and NPS 2 (DN 40 and DN 50): Maximum span, 108 inches (2743 mm); minimum rod size, 3/8 inch (10 mm).
4. NPS 4 and Larger: Maximum span, 10 feet; minimum rod size, 5/8 inch.

3.8 CONNECTIONS

A. Install natural-gas piping electrically continuous, and bonded to gas appliance equipment grounding conductor of the circuit powering the appliance according to NFPA 70.

B. Install piping adjacent to appliances to allow service and maintenance of appliances.

C. Connect piping to appliances using manual gas shutoff valves and unions. Install valve within 72 inches (1800 mm) of each gas-fired appliance and equipment. Install union between valve and appliances or equipment.

D. Sediment Traps: Install tee fitting with capped nipple in bottom to form drip, as close as practical to inlet of each appliance.

3.9 LABELING AND IDENTIFYING

A. Comply with requirements in Division 22 Section "Identification for Plumbing Piping and Equipment" for piping and valve identification.

3.10 PAINTING

A. Comply with requirements in Section 099123 "Painting" for painting exterior natural-gas piping.

B. Paint exposed, exterior metal piping, valves, service regulators, service meters and meter bars, earthquake valves, and piping specialties, except components, with factory-applied paint or protective coating.

1. Alkyd System: MPI EXT 5.1D.
   c. Topcoat: Exterior alkyd enamel (flat).
   d. Color: Yellow.

C. Damage and Touchup: Repair marred and damaged factory-applied finishes with materials and by procedures to match original factory finish.
3.11 FIELD QUALITY CONTROL
A. Test, inspect, and purge natural gas according to the International Fuel Gas Code and authorities having jurisdiction.
B. Natural-gas piping will be considered defective if it does not pass tests and inspections.
C. Prepare test and inspection reports.

3.12 OUTDOOR PIPING SCHEDULE
A. Underground natural-gas pipings shall be one of the following:
   1. Steel pipe with wrought-steel fittings and welded joints, or mechanical couplings. Coat pipe and fittings with protective coating for steel piping.
B. Aboveground natural-gas piping shall be the following:
   1. Steel pipe with wrought-steel fittings and welded joints.

3.13 INDOOR PIPING SCHEDULE FOR SYSTEM PRESSURES LESS THAN 0.5 PSIG
A. Aboveground, branch piping NPS 1 and smaller shall be the following:
   1. Steel pipe with malleable-iron fittings and threaded joints.
B. Aboveground, distribution piping shall be the following:
   1. Steel pipe with malleable-iron fittings and threaded joints.

3.14 INDOOR PIPING SCHEDULE FOR SYSTEM PRESSURES MORE THAN 0.5 PSIG AND LESS THAN 5 PSIG
A. Aboveground, branch piping NPS 1 and smaller shall be the following:
   1. Steel pipe with malleable-iron fittings and threaded joints.
B. Aboveground, distribution piping shall be the following:
   1. Steel pipe with malleable-iron fittings and threaded joints.

3.15 INDOOR PIPING SCHEDULE FOR SYSTEM PRESSURES MORE THAN 5 PSIG (34.5 kPa)
A. Aboveground Piping: Maximum operating pressure more than 5 psig.
B. Aboveground, Branch Piping: Steel pipe with steel welding fittings and welded joints.
C. Aboveground, distribution piping shall be the following:
   1. Steel pipe with steel welding fittings and welded joints.

3.16 ABOVEGROUND MANUAL GAS SHUTOFF VALVE SCHEDULE

A. Valves for pipe sizes NPS 2 and smaller at service meter shall be one of the following:
   1. One-piece, bronze ball valve with bronze trim.
   2. Two-piece, full-port, bronze ball valves with bronze trim.

B. Valves for pipe sizes NPS 2-1/2 and larger at service meter shall be one of the following:
   1. Two-piece, full-port, bronze ball valves with bronze trim.
   2. Bronze plug valve.

C. Distribution piping valves for pipe sizes NPS 2 and smaller shall be one of the following:
   1. One-piece, bronze ball valve with bronze trim.
   2. Two-piece, full-port, bronze ball valves with bronze trim.

D. Distribution piping valves for pipe sizes NPS 2-1/2 and larger shall be one of the following:
   1. Two-piece, full-port, bronze ball valves with bronze trim.
   2. Bronze plug valve.

E. Valves in branch piping for single appliance shall be one of the following:
   1. One-piece, bronze ball valve with bronze trim.
   2. Two-piece, full-port, bronze ball valves with bronze trim.

END OF SECTION
SECTION 230500
COMMON WORK RESULTS FOR HVAC

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:
   1. Piping materials and installation instructions common to most piping systems.
   2. Transition fittings.
   3. Dielectric fittings.
   4. Mechanical sleeve seals.
   5. Sleeves.
   7. Grout.
   8. HVAC demolition.
   9. Equipment installation requirements common to equipment sections.
   10. Painting and finishing.
   11. Concrete bases.
   12. Hangers, Supports and anchorages for HVAC system piping and equipment.
   13. Identification for HVAC piping and equipment.

1.2 DEFINITIONS

A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct chases, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.

B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.

C. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.

D. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and chases.

E. Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.
1.3 REFERENCES

A. Provide work in accordance with all applicable international, state and local, codes, rules, regulations and standards, including but not limited to, requirements of the following:

1. ASAME/ANSI B31: Code for Pressure Piping
2. AWS D1.1: Structural Welding Code-Steel
3. MSS SP58: Pipe Hangers and supports-Materials, Design, and Manufacturers
4. MSS SP69: Pipe Hangers and Supports-Selection and Application except spacing for hangers
5. ANSI A13.1:1: Scheme for Identification of Piping Systems
6. Application NFPA Codes and Standards
7. 2006 ICC Codes

1.4 SUBMITTALS

A. Provide Product List of factory fabricated items, in accordance with the "Product Requirements", including name of proposed manufacture, for all products specified in various sections of Division 22.

B. Provide submittals in accordance with the "Submittal Procedures" in sufficient detail to verify full compliance with the requirements of the Contract Document.

C. Product Data: Provide for each type of factory-fabricated product indicated.

1.5 QUALITY ASSURANCE

A. Steel Support Welding: Qualify processes and operators according to AWS D1.1, "Structural Welding Code--Steel."

B. Steel Pipe Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."

1. Comply with provisions in ASME B31 Series, "Code for Pressure Piping."
2. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture.
B. Store plastic pipes protected from direct sunlight. Support to prevent sagging and bending.

1.7 COORDINATION
A. Arrange for pipe spaces, chases, slots, and openings in building structure during progress of construction, to allow for HVAC installations.
B. Coordinate installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components as they are constructed.
C. Coordinate requirements for access panels and doors for HVAC items requiring access that are concealed behind finished surfaces. Access panels and doors are specified in Division 08 Section "Access Doors and Frames."

PART 2 - PRODUCTS

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

2.2 PIPE, TUBE, AND FITTINGS
A. Refer to individual Division 23 piping Sections for pipe, tube, and fitting materials and joining methods.
B. Pipe Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.
   1. ASME B16.21, nonmetallic, flat, asbestos-free, 1/8-inch (3.2-mm) maximum thickness unless thickness or specific material is indicated.
a. Full-Face Type: For flat-face, Class 125, cast-iron and cast-bronze flanges.
b. Narrow-Face Type: For raised-face, Class 250, cast-iron and steel flanges.

2. AWWA C110, rubber, flat face, 1/8 inch (3.2 mm) thick, unless otherwise indicated; and full-face or ring type, unless otherwise indicated.

C. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.

D. Plastic, Pipe-Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer, unless otherwise indicated.

E. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.

F. Brazing Filler Metals: AWS A5.8, BCuP Series, copper-phosphorus alloys for general-duty brazing, unless otherwise indicated; and AWS A5.8, BAg1, silver alloy for refrigerant piping, unless otherwise indicated.

G. Welding Filler Metals: Comply with AWS D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

H. Solvent Cements for Joining Plastic Piping:
   1. CPVC Piping: ASTM F 493.
   2. PVC Piping: ASTM D 2564. Include primer according to ASTM F 656.

I. Fiberglass Pipe Adhesive: As furnished or recommended by pipe manufacturer.

2.4 DIELECTRIC FITTINGS

A. Description: Combination fitting of copper alloy and ferrous materials with threaded, solder-joint, plain, or weld-neck end connections that match piping system materials.

B. Insulating Material: Suitable for system fluid, pressure, and temperature.

C. Dielectric Unions: Factory-fabricated, union assembly, for 250-psig minimum working pressure at 180 deg F.

   1. Manufacturers:
      a. Eclipse, Inc.
      b. Epco Sales, Inc.
      d. Zurn Industries, Inc.; Wilkins Div.

D. Dielectric Flanges: Factory-fabricated, companion-flange assembly, for 150- or 300-psig minimum working pressure as required to suit system pressures.

   1. Manufacturers:
a. Capitol Manufacturing Co.
b. Central Plastics Company.
c. Epco Sales, Inc.

E. Dielectric-Flange Kits: Companion-flange assembly for field assembly. Include flanges, full-face- or ring-type neoprene or phenolic gasket, phenolic or polyethylene bolt sleeves, phenolic washers, and steel backing washers.

1. Manufacturers:
   a. Advance Products & Systems, Inc.
   b. Calpico, Inc.
   c. Central Plastics Company.
   d. Pipeline Seal and Insulator, Inc.

2. Separate companion flanges and steel bolts and nuts shall have 150- or 300-psig minimum working pressure where required to suit system pressures.

F. Dielectric Couplings: Galvanized-steel coupling with inert and noncorrosive, thermoplastic lining; threaded ends; and 300-psig minimum working pressure at 225 deg F.

1. Manufacturers:
   a. Calpico, Inc.
   b. Lochinvar Corp.

G. Dielectric Nipples: Electroplated steel nipple with inert and noncorrosive, thermoplastic lining; plain, threaded, or grooved ends; and 300-psig minimum working pressure at 225 deg F.

1. Manufacturers:
   a. Perfection Corp.
   b. Precision Plumbing Products, Inc.
   c. Sioux Chief Manufacturing Co., Inc.
   d. Victaulic Co. of America.

2.5 MECHANICAL SLEEVE SEALS

A. Description: Modular sealing element unit, designed for field assembly, to fill annular space between pipe and sleeve.

1. Manufacturers:
   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 pipe. Include type and number required for pipe material and size of pipe.

3. Pressure Plates: **Plastic**. Include two for each sealing element.

4. 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.

2.6 SLEEVES

A. Galvanized-Steel Sheet: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.

B. Steel Pipe: ASTM A 53, Type E, Grade B, Schedule 40, galvanized, plain ends.

C. Cast Iron: Cast or fabricated "wall pipe" equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.

D. Stack Sleeve Fittings: Manufactured, cast-iron sleeve with integral clamping flange. Include clamping ring and bolts and nuts for membrane flashing.

   1. Underdeck Clamp: Clamping ring with set screws.

E. Molded PVC: Permanent, with nailing flange for attaching to wooden forms.


G. Molded PE: Reusable, PE, tapered-cup shaped, and smooth-outer surface with nailing flange for attaching to wooden forms.

2.7 ESCUTCHEONS

A. Description: Manufactured wall and ceiling escutcheons and floor plates, with an ID to closely fit around pipe, tube, and insulation of insulated piping and an OD that completely covers opening.

B. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with polished chrome-plated finish.

C. One-Piece, Cast-Brass Type: With set screw.

   1. Finish: Polished chrome-plated

D. Split-Casting, Cast-Brass Type: With concealed hinge and set screw.

   1. Finish: Polished chrome-plated.

E. One-Piece, Floor-Plate Type: Cast-iron floor plate.

F. Split-Casting, Floor-Plate Type: Cast brass with concealed hinge and set screw.
2.8 GROUT

A. Description: ASTM C 1107, Grade B, nonshrink and nonmetallic, dry hydraulic-cement grout.

2. Design Mix: 5000-psi, 28-day compressive strength.

PART 3 - EXECUTION

3.1 HVAC DEMOLITION

A. Disconnect, demolish, and remove HVAC systems, equipment, and components indicated to be removed.

1. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.
2. Piping to Be Abandoned in Place: Drain piping and cap or plug piping with same or compatible piping material.
3. Ducts to Be Removed: Remove portion of ducts indicated to be removed and plug remaining ducts with same or compatible ductwork material.
4. Ducts to Be Abandoned in Place: Cap or plug ducts with same or compatible ductwork material.
5. Equipment to Be Removed: Disconnect and cap services and remove equipment.
6. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make equipment operational.
7. Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment and deliver to Owner.

B. If pipe, insulation, or equipment to remain is damaged in appearance or is unserviceable, remove damaged or unserviceable portions and replace with new products of equal capacity and quality.

3.2 PIPING SYSTEMS - COMMON REQUIREMENTS

A. Install piping according to the following requirements and Division 23 Sections specifying piping systems.

B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.

C. Install piping in concealed locations, unless otherwise indicated and except in equipment rooms and service areas.
D. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

F. Install piping to permit valve servicing.

G. Install piping at indicated slopes.

H. Install piping free of sags and bends.

I. Install fittings for changes in direction and branch connections.

J. Install piping to allow application of insulation.

K. Select system components with pressure rating equal to or greater than system operating pressure.

L. Install escutcheons for penetrations of walls, ceilings, and floors according to the following:

1. New Piping:
   a. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep-pattern type.
   b. Chrome-Plated Piping: One-piece, cast-brass type with polished chrome-plated finish.
   c. Insulated Piping: One-piece, stamped-steel type with spring clips.
   d. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, cast-brass type with polished chrome-plated finish.
   e. Bare Piping at 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, stamped-steel type with concealed hinge and set screw or spring clips.
   i. Bare Piping in Equipment Rooms: One-piece, cast-brass type.
   j. Bare Piping in Equipment Rooms: One-piece, stamped-steel type with set screw spring clips set screw or spring clips.
   k. Bare Piping at Floor Penetrations in Equipment Rooms: One-piece, floor-plate type.

2. Existing Piping: Use the following:
   a. Chrome-Plated Piping: Split-casting, cast-brass type with chrome-plated finish.
   b. Bare Piping at Wall and Floor Penetrations in Finished Spaces: Split-casting, cast-brass type with chrome-plated finish.
c. Bare Piping at Wall and Floor Penetrations in Finished Spaces: Split-plate, stamped-steel type with concealed hinge and spring clips.
d. Bare Piping at Ceiling Penetrations in Finished Spaces: Split-casting, cast-brass type with chrome-plated finish.
e. Bare Piping at Ceiling Penetrations in Finished Spaces: Split-plate, stamped-steel type with concealed hinge and set screw.
f. Bare Piping in Unfinished Service Spaces: Split-casting, cast-brass type with polished chrome-plated finish.
g. Bare Piping in Unfinished Service Spaces: Split-plate, stamped-steel type with concealed hinge and set screw or spring clips.
h. Bare Piping in Equipment Rooms: Split-casting, cast-brass type.
i. Bare Piping in Equipment Rooms: Split-plate, stamped-steel type with set screw or spring clips.
j. Bare Piping at Floor Penetrations in Equipment Rooms: Split-casting, floor-plate type.

M. Sleeves are not required for core-drilled holes.

N. Permanent sleeves are not required for holes formed by removable PE sleeves.

O. Install sleeves for pipes passing through concrete and masonry walls and concrete floor and roof slabs.

P. Install sleeves for pipes passing through concrete and masonry walls, gypsum-board partitions, and concrete floor and roof slabs.
   1. Cut sleeves to length for mounting flush with both surfaces.
      a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches above finished floor level. Extend cast-iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified.
   2. Install sleeves in new walls and slabs as new walls and slabs are constructed.
   3. Install sleeves that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation. Use the following sleeve materials:
      a. Steel Pipe Sleeves: For pipes smaller than NPS 6.
      b. Steel Sheet Sleeves: For pipes NPS 6 and larger, penetrating gypsum-board partitions.
      c. Stack Sleeve Fittings: For pipes penetrating floors with membrane waterproofing. Secure flashing between clamping flanges. Install section of cast-iron soil pipe to extend sleeve to 2 inches above finished floor level. Refer to Division 07 Section "Sheet Metal Flashing and Trim" for flashing.
         1) Seal space outside of sleeve fittings with grout.
      4. Except for underground wall penetrations, seal annular space between sleeve and pipe or pipe insulation, using joint sealants appropriate for size, depth, and location of joint. Refer to Division 07 Section "Joint Sealants" for materials and installation.
Q. Aboveground, Exterior-Wall Pipe Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.

1. Install steel pipe for sleeves smaller than 6 inches in diameter.
2. Install cast-iron "wall pipes" for sleeves 6 inches and larger in diameter.
3. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

R. Underground, Exterior-Wall Pipe Penetrations: Install cast-iron "wall pipes" for sleeves. Seal pipe penetrations using mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.

1. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

S. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Refer to Division 07 Section "Penetration Firestopping" for materials.

T. Verify final equipment locations for roughing-in.

U. Refer to equipment specifications in other Sections of these Specifications for roughing-in requirements.

3.3 PIPING JOINT CONSTRUCTION

A. Join pipe and fittings according to the following requirements and Division 23 Sections specifying piping systems.

B. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

C. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

D. Soldered Joints: Apply ASTM B 813, water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook," using lead-free solder alloy complying with ASTM B 32.

F. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:

1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

G. Welded Joints: Construct joints according to AWS D10.12, using qualified processes and welding operators according to Part 1 "Quality Assurance" Article.

H. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.

I. Plastic Piping Solvent-Cement Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:

1. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.
2. CPVC Piping: Join according to ASTM D 2846/D 2846M Appendix.
3. PVC Pressure Piping: Join schedule number ASTM D 1785, PVC pipe and PVC socket fittings according to ASTM D 2672. Join other-than-schedule-number PVC pipe and socket fittings according to ASTM D 2855.
4. PVC Nonpressure Piping: Join according to ASTM D 2855.

J. Plastic Pressure Piping Gasketed Joints: Join according to ASTM D 3139.

K. Plastic Nonpressure Piping Gasketed Joints: Join according to ASTM D 3212.

L. PE Piping Heat-Fusion Joints: Clean and dry joining surfaces by wiping with clean cloth or paper towels. Join according to ASTM D 2657.

1. Plain-End Pipe and Fittings: Use butt fusion.
2. Plain-End Pipe and Socket Fittings: Use socket fusion.

M. Fiberglass Bonded Joints: Prepare pipe ends and fittings, apply adhesive, and join according to pipe manufacturer's written instructions.

3.4 PIPING CONNECTIONS

A. Make connections according to the following, unless otherwise indicated:

1. Install unions, in piping NPS 2 and smaller, adjacent to each valve and at final connection to each piece of equipment.
2. Install flanges, in piping NPS 2-1/2 and larger, adjacent to flanged valves and at final connection to each piece of equipment.
3. Dry Piping Systems: Install dielectric unions and flanges to connect piping materials of dissimilar metals.

3.5 EQUIPMENT INSTALLATION - COMMON REQUIREMENTS

A. Install equipment to allow maximum possible headroom unless specific mounting heights are not indicated.

B. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.

C. Install HVAC equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference to other installations. Extend grease fittings to accessible locations.

D. Install equipment to allow right of way for piping installed at required slope.

3.6 ERECTION OF METAL SUPPORTS AND ANCHORAGES

A. Refer to Division 05 Section "Metal Fabrications" for structural steel.

B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor HVAC materials and equipment.

C. Field Welding: Comply with AWS D1.1.

3.7 ERECTION OF WOOD SUPPORTS AND ANCHORAGES

A. Cut, fit, and place wood grounds, nailers, blocking, and anchorages to support, and anchor HVAC materials and equipment.

B. Select fastener sizes that will not penetrate members if opposite side will be exposed to view or will receive finish materials. Tighten connections between members. Install fasteners without splitting wood members.

C. Attach to substrates as required to support applied loads.

3.8 GROUTING

A. Mix and install grout for HVAC equipment base bearing surfaces, pump and other equipment base plates, and anchors.

B. Clean surfaces that will come into contact with grout.

C. Provide forms as required for placement of grout.

D. Avoid air entrapment during placement of grout.
E. Place grout, completely filling equipment bases.
F. Place grout on concrete bases and provide smooth bearing surface for equipment.
G. Place grout around anchors.
H. Cure placed grout.

3.9 BOILER INSTALLATION
A. Contractor to get expedited review for intent to install permits.

END OF SECTION
SECTION 230513
COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes extent of electrical equipment and electrical wiring that is the responsibility of Division 23.

B. Section includes general requirements for motors install at equipment manufacturer's factory or shipped separately by equipment manufacturer for field installation.

1.3 REFERENCE STANDARDS

A. ANSI/IEEE 112 (C50.20): Test Procedure for Single Phase Induction Motors

B. ANSI/IEEE 114 (C50.21): Test Procedure for Polyphase Induction Motors and Generators

C. NFPA 70: National Electric Code (NEC)

D. UL: Underwriters Laboratories

1.2 CORDINATION

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: Re-greasable, shielded, antifriction ball bearings suitable for radial and thrust loading.
H. Temperature Rise: Match insulation rating.
I. Insulation: Class F.
J. 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.

K. Enclosure Material: Cast iron for motor frame sizes 324T and larger, rolled steel for motor frame sizes smaller than 324T.

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:

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. Multispeed Motors: Variable-torque, permanent-split-capacitor type.

C. Bearings: Prelubricated, antifriction ball bearings or sleeve bearings suitable for radial and thrust loading.

D. Motors 1/20 HP and Smaller: Shaded-pole type.

E. 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
SECTION 230519

METERS AND GAGES FOR HVAC PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Liquid-in-glass thermometers.
   2. Thermowells.
   3. Dial-type pressure gages.
   4. Gage attachments.
   5. Test plugs.
   6. Test-plug kits.
   7. Orifice flowmeters.
   8. Pitot-tube flowmeters.

1.2 SUBMITTALS

A. Product Data: For each type of product indicated.
B. Wiring Diagrams: For power, signal, and control wiring.
C. Product Certificates: For each type of meter and gage, from manufacturer.
D. Operation and Maintenance Data: For meters and gages to include in operation and maintenance manuals.

PART 2 - PRODUCTS

2.1 LIQUID-IN-GLASS THERMOMETERS – PIPE SIZES ¾” TO 1-1/2”

A. Metal-Case, Compact-Style, Liquid-in-Glass Thermometers:
   1. Manufacturers:
      a. Trerice, H. O. Co.
   3. Case: Cast aluminum; 6-inch nominal size.
   4. Case Form: Back angle unless otherwise indicated.
   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 and deg C.
7. Window: Glass or plastic.
8. Stem: Aluminum or brass and of length to suit installation.
   b. Design for Thermowell Installation: Bare stem.
10. Accuracy: Plus or minus 1 percent of scale range or one scale division, to a maximum of
    1.5 percent of scale range.

2.2 LIQUID-IN-GLASS THERMOMETERS – PIPE SIZES 2” AND LARGER

A. Metal-Case, Industrial-Style, Liquid-in-Glass Thermometers:
1. Manufacturers:
   a. Flo Fab Inc.
   b. Trerice, H. O. Co.
   c. Weiss Instruments, Inc.
3. Case: Cast aluminum 7-inch nominal size unless otherwise indicated.
4. Case Form: Adjustable angle unless otherwise indicated.
5. Tube: Glass with magnifying lens and blue or red organic liquid.
6. Tube Background: Non-reflective aluminum with permanently etched scale markings
   graduated in deg F and deg C.
7. Window: Glass.
8. Stem: Aluminum and of length to suit installation.
   a. Design for Thermowell Installation: Bare stem.
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 THERMOWELLS

A. Thermowells:
2. Description: Pressure-tight, socket-type fitting made for insertion into piping tee fitting.
3. Material for Use with Copper Tubing: CNR.
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.

2.4 PRESSURE GAGES

A. Direct-Mounted, Metal-Case, Dial-Type Pressure Gages:
   1. Manufacturers:
      a. Flo Fab Inc.
      b. Trerice, H. O. Co.
      c. Weiss Instruments, Inc.
   3. Pressure-Element Assembly: Bourdon tube unless otherwise indicated.
   4. 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.
   5. Movement: Mechanical, with link to pressure element and connection to pointer.
   8. Window: Glass.
  10. Accuracy: Grade A, plus or minus 1 percent of middle half of Grade B, plus or minus 2 percent scale range.

2.5 GAUGE 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.

2.6 TEST PLUGS

A. Manufacturers:
   1. Trerice, H. O. Co.
   2. Watts Regulator Co.; a div. of Watts Water Technologies, Inc.
   3. Weiss Instruments, Inc.

B. Description: Test-station fitting made for insertion into piping tee fitting.

C. Body: Brass or stainless steel with core inserts and gasketed and threaded cap. Include extended stem on units to be installed in insulated piping.

D. Thread Size: NPS 1/4 or NPS 1/2, ASME B1.20.1 pipe thread.
E. Minimum Pressure and Temperature Rating: 500 psig at 200 deg F.

F. Core Inserts: Chlorosulfonated polyethylene synthetic and EPDM self-sealing rubber.

2.7 TEST-PLUG KITS

A. Manufacturers:

1. Flow Design, Inc.
2. Peterson Equipment Co., Inc.
3. Trerice, H. O. Co.
4. Weiss Instruments, Inc.

B. Furnish one test-plug kit(s) containing one thermometer(s), one pressure gage and adapter, and carrying case. Thermometer sensing elements, pressure gage, and adapter probes shall be of diameter to fit test plugs and of length to project into piping.

C. Low-Range Thermometer: Small, bimetallic insertion type with 1- to 2-inch diameter dial and tapered-end sensing element. Dial range shall be at least 25 to 125 deg F.

D. High-Range Thermometer: Small, bimetallic insertion type with 1- to 2-inch- diameter dial and tapered-end sensing element. Dial range shall be at least 0 to 220 deg F.

E. Pressure Gage: Small, Bourdon-tube insertion type with 2- to 3-inch- diameter dial and probe. Dial range shall be at least 0 to 200 psig.

F. Carrying Case: Metal or plastic, with formed instrument padding.

2.8 FLOWMETERS

A. Orifice Flowmeters:

1. Manufacturers:

   a. ABB; Instrumentation and Analytical.
   b. Bell & Gossett; ITT Industries.
   c. Preso Meters; a division of Racine Federated Inc.
   d. S. A. Armstrong Limited; Armstrong Pumps Inc.

2. Description: Flowmeter with sensor, hoses or tubing, fittings, valves, indicator, and conversion chart.

3. Flow Range: Sensor and indicator shall cover operating range of equipment or system served.


   a. Design: Differential-pressure-type measurement for water.
b. Construction: Cast-iron body, brass valves with integral check valves and caps, and calibrated nameplate.
c. Minimum Pressure Rating: 300 psig.
d. Minimum Temperature Rating: 250 deg F.

5. Permanent Indicators: Meter suitable for wall or bracket mounting, calibrated for connected sensor and having 6-inch-diameter, or equivalent, dial with fittings and copper tubing for connecting to sensor.
   a. Scale: Gallons per minute.
   b. Accuracy: Plus or minus 1 percent between 20 and 80 percent of scale range.

6. Portable Indicators: Hand-held, differential-pressure type, calibrated for connected sensor and having two 12-foot hoses, with carrying case.
   a. Scale: Gallons per minute.
   b. Accuracy: Plus or minus 2 percent between 20 and 80 percent of scale range.

7. Display: Shows rate of flow, with register to indicate total volume in gallons.
9. Operating Instructions: Include complete instructions with each flowmeter.

B. Pitot-Tube Flowmeters:
1. Manufacturers:
   a. ABB; Instrumentation and Analytical.
   b. Preso Meters; a division of Racine Federated Inc.
   c. TACO Incorporated.

2. Description: Flowmeter with sensor and indicator.
3. Flow Range: Sensor and indicator shall cover operating range of equipment or system served.
4. Sensor: Insertion type; for inserting probe into piping and measuring flow directly in gallons per minute.
   a. Design: Differential-pressure-type measurement for water.
   b. Construction: Stainless-steel probe of length to span inside of pipe, with integral transmitter and direct-reading scale.
   d. Minimum Temperature Rating: 250 deg F.

5. Indicator: Hand-held meter; either an integral part of sensor or a separate meter.
6. Integral Transformer: For low-voltage power connection.
7. Accuracy: Plus or minus 3 percent.
8. Display: Shows rate of flow, with register to indicate total volume in gallons.
9. Operating Instructions: Include complete instructions with each flowmeter.

C. Venturi Flowmeters:
1. Manufacturers:
   a. ABB; Instrumentation and Analytical.
   b. Hyspan Precision Products, Inc.
   c. Preso Meters; a division of Racine Federated Inc.
   d. S. A. Armstrong Limited; Armstrong Pumps Inc.

2. Description: Flowmeter with calibrated flow-measuring element, hoses or tubing, fittings, valves, indicator, and conversion chart.

3. Flow Range: Sensor and indicator shall cover operating range of equipment or system served.

   a. Design: Differential-pressure-type measurement for water.
   b. Construction: Bronze, brass, or factory-primed steel, with brass fittings and attached tag with flow conversion data.
   d. Minimum Temperature Rating: 250 deg F.
   e. End Connections for NPS 2 and Smaller: Threaded.
   f. End Connections for NPS 2-1/2 and Larger: Flanged or welded.
   g. Flow Range: Flow-measuring element and flowmeter shall cover operating range of equipment or system served.

5. Permanent Indicators: Meter suitable for wall or bracket mounting, calibrated for connected flowmeter element, and having 6-inch-diameter, or equivalent, dial with fittings and copper tubing for connecting to flowmeter element.
   a. Scale: Gallons per minute.
   b. Accuracy: Plus or minus 1 percent between 20 and 80 percent of scale range.

6. Portable Indicators: Hand-held, differential-pressure type, calibrated for connected flowmeter element and having two 12-foot hoses, with carrying case.
   a. Scale: Gallons per minute.
   b. Accuracy: Plus or minus 2 percent between 20 and 80 percent of scale range.

7. Display: Shows rate of flow, with register to indicate total volume in gallons.
9. Operating Instructions: Include complete instructions with each flowmeter.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install thermowells with socket extending a minimum of 2 inches into fluid, one-third of pipe diameter to center of pipe 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 direct-mounted pressure gages in piping tees with pressure gage located on pipe at the most readable position.

H. Install remote-mounted pressure gages on panel.

I. Install valve and snubber in piping for each pressure gage for fluids.

J. Install valve and syphon fitting in piping for each pressure gage for steam.

K. Install test plugs in piping tees.

L. Install flow indicators in piping systems in accessible positions for easy viewing.

M. Assemble and install connections, tubing, and accessories between flow-measuring elements and flowmeters according to manufacturer's written instructions.

N. Install flowmeter elements in accessible positions in piping systems.

O. Install wafer-orifice flowmeter elements between pipe flanges.

P. 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.

Q. Install permanent indicators on walls or brackets in accessible and readable positions.

R. Install connection fittings in accessible locations for attachment to portable indicators.

S. Install thermometers in the following locations:
   1. Inlet and outlet of each hydronic zone.
   2. Inlet and outlet of each hydronic coil in air-handling units.

T. Install pressure gages in the following locations:
   1. Inlet and outlet of each hydronic zone.
   2. Inlet and outlet of each hydronic coil in air-handling units.
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.

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, AHU coil.
   1. Compact or Industrial-style, liquid-in-glass type.
   2. Test plug with EPDM self-sealing rubber inserts.

B. 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: 0 to 250 deg F.

3.6 PRESSURE-GAUGE SCHEDULE

A. Pressure gages at inlet and outlet of each chiller chilled-water, boiler-hot water, pump-suction and discharge the following:

   1. Liquid-filled, Sealed, Solid-front, pressure-relief-mounted, metal case.
   2. Test plug with chlorosulfonated polyethylene synthetic, EPDM self-sealing rubber inserts.

3.7 PRESSURE-GAGE SCALE-RANGE SCHEDULE

A. Scale Range for Hot-Water Piping: 0 to 200 psi.

3.8 FLOWMETER SCHEDULE

A. Flowmeters for Hot-Water Piping: Pitot-tube of Venturi type.
END OF SECTION
SECTION 230523
GENERAL-DUTY VALVES FOR HVAC PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Ball valves. (3-inch and smaller)
   2. High-performance butterfly valves. (4-inch and larger)
   3. Lift check valves.
   4. Swing check valves.
   5. Swing check valves with closure control.

B. Related Sections:
   1. Division 23 HVAC piping Sections for specialty valves applicable to those Sections only.
   2. Division 23 Section "Identification for HVAC Piping and Equipment" for valve tags and schedules.

1.2 DEFINITIONS

A. CWP: Cold working pressure.

B. EPDM: Ethylene propylene copolymer rubber.

C. NBR: Acrylonitrile-butadiene, Buna-N, or nitrile rubber.

D. SWP: Steam working pressure.

1.3 SUBMITTALS

A. Product Data: For each type of valve indicated.

1.4 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.

1.5 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.
   4. Set butterfly valves closed or slightly open.
   5. 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. Gear Actuator: For quarter-turn valves NPS 8 and larger.
   2. Handwheel: For valves other than quarter-turn types.
   3. Handlever: For quarter-turn valves NPS 6 and smaller.
   4. 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.
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.

G. Manufacturers:

1. Subject to compliance with requirements, provide products by one of the following:
   a. Crane Co.
   b. Grinnell.
   c. Hammond Valve.
   d. Jamesbury; a subsidiary of Metso Automation
   e. Milwaukee Valve Company.
   f. NIBCO INC.
   g. Stockham.
   h. Victaulic

2.2 BRONZE BALL VALVES

A. Two-Piece, Regular-Port, Bronze Ball Valves with Stainless-Steel Trim:

1. Description:
   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: Stainless steel.
   i. Ball: Stainless steel, vented.
   j. Port: Regular.

2.3 IRON, SINGLE-FLANGE BUTTERFLY VALVES

A. 150 CWP, Iron, Single-Flange Butterfly Valves with EPDM Seat and Aluminum-Bronze Disc:

1. Description:
   a. Standard: MSS SP-67, Type I.
   b. CWP Rating: 150 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: EPDM.
f. Stem: One- or two-piece stainless steel.
g. Disc: Aluminum bronze.

2.4 CHAINWHEELS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Babbitt Steam Specialty Co.
   2. Roto Hammer Industries.
   3. Trumbull Industries.

B. Description: Valve actuation assembly with sprocket rim, brackets, and chain.
   1. Brackets: Type, number, size, and fasteners required to mount actuator on valve.
   2. Attachment: For connection to ball or butterfly valve stems.
   3. Sprocket Rim with Chain Guides: Ductile or cast iron of type and size required for valve. Include zinc coating.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine valve interior for cleanliness, freedom from foreign matter, and corrosion. Remove special packing materials, such as blocks, used to prevent disc movement during shipping and handling.

B. Operate valves in positions from fully open to fully closed. Examine guides and seats made accessible by such operations.

C. Examine threads on valve and mating pipe for form and cleanliness.

D. Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material. Verify that gasket is of proper size, that its material composition is suitable for service, and that it is free from defects and damage.

E. Do not attempt to repair defective valves; replace with new valves.

3.2 VALVE INSTALLATION

A. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.

B. Locate valves for easy access and provide separate support where necessary.

C. Install valves in horizontal piping with stem at or above center of pipe.
D. Install valves in position to allow full stem movement.

E. Install chainwheels on operators for ball or butterfly valves NPS 4 and larger and more than 96 inches above floor. Extend chains to 60 inches above finished floor.

F. Install chainwheels on operators for ball or butterfly valves NPS 4 and larger and more than 36 inches above ceiling. Extend chains to 12 inches above finished ceiling.

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, or butterfly valves.
   3. Throttling Service: ball, or butterfly valves.

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 3 and Smaller: Solder-joint valve-end.
   2. For Steel Piping, NPS 4 and Larger: Welded Flanged ends and joints.

3.5 CHILLED-WATER AND HEATING WATER VALVE SCHEDULE

A. Pipe NPS 3 and Smaller:
   1. Ball Valves: Two piece, full port, with stainless-steel trim.

B. Pipe NPS 4 and Larger:

   END OF SECTION
SECTION 230529

HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following hangers and supports for HVAC system piping and equipment:

1. Steel pipe hangers and supports.
2. Trapeze pipe hangers.
3. Thermal-hanger shield inserts.
4. Fastener systems.
5. Pipe stands.
6. Equipment supports.

B. Related Sections include the following:

1. Division 23 Section "Expansion Fittings and Loops for HVAC Piping" for pipe guides and anchors.
2. Division 23 Section "Vibration and Seismic Controls for HVAC Piping and Equipment" for vibration isolation devices.
3. Division 23 Section(s) Metal Ducts for duct hangers and supports.

1.2 DEFINITIONS

A. MSS: Manufacturers Standardization Society for The Valve and Fittings Industry Inc.

B. Terminology: As defined in MSS SP-90, "Guidelines on Terminology for Pipe Hangers and Supports."

1.3 PERFORMANCE REQUIREMENTS

A. Design supports for multiple pipes, including pipe stands, capable of supporting combined weight of supported systems, system contents, and test water.

B. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

1.4 SUBMITTALS

A. Product Data: For the following:
1. Steel pipe hangers and supports.

2. Thermal-hanger shield inserts.

B. Shop Drawings Show fabrication and installation details and include calculations for the following:

1. Trapeze pipe hangers. Include Product Data for components.
2. Pipe stands. Include Product Data for components.
3. Equipment supports.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.
2. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 STEEL PIPE HANGERS AND SUPPORTS

A. Description: MSS SP-58, Types 1 through 58, factory-fabricated components. Refer to Part 3 "Hanger and Support Applications" Article for where to use specific hanger and support types.

B. Manufacturers:

1. AAA Technology & Specialties Co., Inc.
2. Bergen-Power Pipe Supports.
4. Carpenter & Paterson, Inc.
5. Empire Industries, Inc.
6. ERICO/Michigan Hanger Co.
7. Globe Pipe Hanger Products, Inc.
8. Grinnell Corp.
9. GS Metals Corp.
11. PHD Manufacturing, Inc.
12. PHS Industries, Inc.
13. Piping Technology & Products, Inc.
14. Tolco Inc.
C. Nonmetallic Coatings: Plastic coating, jacket, or liner.

D. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion for support of bearing surface of piping.

2.3 TRAPEZE PIPE HANGERS

A. Description: MSS SP-69, Type 59, shop- or field-fabricated pipe-support assembly made from structural-steel shapes with MSS SP-58 hanger rods, nuts, saddles, and U-bolts.

2.4 THERMAL-HANGER SHIELD INSERTS

A. Description: 100-psig minimum, compressive-strength insulation insert encased in sheet metal shield.

B. Manufacturers:

1. Carpenter & Paterson, Inc.
2. ERICO/Michigan Hanger Co.
3. PHS Industries, Inc.
4. Pipe Shields, Inc.
5. Rilco Manufacturing Company, Inc.
6. Value Engineered Products, Inc.

C. Insulation-Insert Material for Cold Piping: ASTM C 552, Type II cellular glass with vapor barrier.

D. Insulation-Insert Material for Hot Piping: ASTM C 552, Type II cellular glass

E. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.

F. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.

G. Insert Length: Extend 2 inches beyond sheet metal shield for piping operating below ambient air temperature.

2.5 FASTENER SYSTEMS

A. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

1. Manufacturers:
B. Mechanical-Expansion Anchors: Insert-wedge-type zinc-coated steel, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

1. Manufacturers:
   b. Empire Industries, Inc.
   c. Hilti, Inc.
   d. ITW Ramset/Red Head.
   e. MKT Fastening, LLC.
   f. Powers Fasteners.

2.6 EQUIPMENT SUPPORTS

A. Description: Welded, shop- or field-fabricated equipment support made from structural-steel shapes.

2.7 MISCELLANEOUS MATERIALS

A. Structural Steel: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.

B. Grout: ASTM C 1107, factory-mixed and packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout; suitable for interior and exterior applications.

2. Design Mix: 5000-psi (34.5-MPa), 28-day compressive strength.

PART 3 - EXECUTION

3.1 HANGER AND SUPPORT APPLICATIONS

A. Specific hanger and support requirements are specified in Sections specifying piping systems and equipment.

B. Comply with MSS SP-69 for pipe hanger selections and applications that are not specified in piping system Sections.
C. Use hangers and supports with galvanized, metallic coatings for piping and equipment that will not have field-applied finish.

D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.

E. Use padded hangers for piping that is subject to scratching.

F. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated stationary pipes, NPS 1/2 to NPS 30 (DN 15 to DN 750).
2. Yoke-Type Pipe Clamps (MSS Type 2): For suspension of 120 to 450 deg F (49 to 232 deg C) pipes, NPS 4 to NPS 16 (DN 100 to DN 400), requiring up to 4 inches (100 mm) of insulation.
3. Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension of pipes, NPS 3/4 to NPS 24 (DN 20 to DN 600), requiring clamp flexibility and up to 4 inches (100 mm) of insulation.
4. Steel Pipe Clamps (MSS Type 4): For suspension of cold and hot pipes, NPS 1/2 to NPS 24 (DN 15 to DN 600), if little or no insulation is required.
5. Pipe Hangers (MSS Type 5): For suspension of pipes, NPS 1/2 to NPS 4 (DN 15 to DN 100), to allow off-center closure for hanger installation before pipe erection.
6. Adjustable, Swivel Split- or Solid-Ring Hangers (MSS Type 6): For suspension of noninsulated stationary pipes, NPS 3/4 to NPS 8 (DN 20 to DN 200).
7. Adjustable, Steel Band Hangers (MSS Type 7): For suspension of noninsulated stationary pipes, NPS 1/2 to NPS 8 (DN 15 to DN 200).
8. Adjustable Band Hangers (MSS Type 9): For suspension of noninsulated stationary pipes, NPS 1/2 to NPS 8 (DN 15 to DN 200).
9. Adjustable, Swivel-Ring Band Hangers (MSS Type 10): For suspension of noninsulated stationary pipes, NPS 1/2 to NPS 2 (DN 15 to DN 50).
10. Split Pipe-Ring with or without Turnbuckle-Adjustment Hangers (MSS Type 11): For suspension of noninsulated stationary pipes, NPS 3/8 to NPS 8 (DN 10 to DN 200).
11. Extension Hinged or 2-Bolt Split Pipe Clamps (MSS Type 12): For suspension of noninsulated stationary pipes, NPS 3/8 to NPS 3 (DN 10 to DN 80).
12. U-Bolts (MSS Type 24): For support of heavy pipes, NPS 1/2 to NPS 30 (DN 15 to DN 750).
13. Clips (MSS Type 26): For support of insulated pipes not subject to expansion or contraction.
14. Pipe Saddle Supports (MSS Type 36): For support of pipes, NPS 4 to NPS 36 (DN 100 to DN 900), with steel pipe base stanchion support and cast-iron floor flange.
15. Pipe Stanchion Saddles (MSS Type 37): For support of pipes, NPS 4 to NPS 36 (DN 100 to DN 900), with steel pipe base stanchion support and cast-iron floor flange and with U-bolt to retain pipe.
16. Adjustable, Pipe Saddle Supports (MSS Type 38): For stanchion-type support for pipes, NPS 2-1/2 to NPS 36 (DN 65 to DN 900), if vertical adjustment is required, with steel pipe base stanchion support and cast-iron floor flange.
17. Single Pipe Rolls (MSS Type 41): For suspension of pipes, NPS 1 to NPS 30 (DN 25 to DN 750), from 2 rods if longitudinal movement caused by expansion and contraction might occur.

18. Adjustable Roller Hangers (MSS Type 43): For suspension of pipes, NPS 2-1/2 to NPS 20 (DN 65 to DN 500), from single rod if horizontal movement caused by expansion and contraction might occur.

19. Complete Pipe Rolls (MSS Type 44): For support of pipes, NPS 2 to NPS 42 (DN 50 to DN 1050), if longitudinal movement caused by expansion and contraction might occur but vertical adjustment is not necessary.

20. Pipe Roll and Plate Units (MSS Type 45): For support of pipes, NPS 2 to NPS 24 (DN 50 to DN 600), if small horizontal movement caused by expansion and contraction might occur and vertical adjustment is not necessary.

21. Adjustable Pipe Roll and Base Units (MSS Type 46): For support of pipes, NPS 2 to NPS 30 (DN 50 to DN 750), if vertical and lateral adjustment during installation might be required in addition to expansion and contraction.

G. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers, NPS 3/4 to NPS 20 (DN 20 to DN 500).
2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers, NPS 3/4 to NPS 20 (DN 20 to DN 500), if longer ends are required for riser clamps.

H. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches (150 mm) for heavy loads.
2. Steel Clevises (MSS Type 14): For 120 to 450 deg F (49 to 232 deg C) piping installations.
3. Swivel Turnbuckles (MSS Type 15): For use with MSS Type 11, split pipe rings.
4. Malleable-Iron Sockets (MSS Type 16): For attaching hanger rods to various types of building attachments.
5. Steel Weldless Eye Nuts (MSS Type 17): For 120 to 450 deg F (49 to 232 deg C) piping installations.

I. 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.
4. Spring-Cushion Roll Hangers (MSS Type 49): For equipping Type 41 roll hanger with springs.
5. Spring Sway Braces (MSS Type 50): To retard sway, shock, vibration, or thermal expansion in piping systems.

6. Variable-Spring Hangers (MSS Type 51): Preset to indicated load and limit variability factor to 25 percent to absorb expansion and contraction of piping system from hanger.

7. Variable-Spring Base Supports (MSS Type 52): Preset to indicated load and limit variability factor to 25 percent to absorb expansion and contraction of piping system from base support.

8. Variable-Spring Trapeze Hangers (MSS Type 53): Preset to indicated load and limit variability factor to 25 percent to absorb expansion and contraction of piping system from trapeze support.

9. 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.

J. Comply with MSS SP-69 for trapeze pipe hanger selections and applications that are not specified in piping system Sections.

K. Comply with MFMA-102 for metal framing system selections and applications that are not specified in piping system Sections.

L. Use mechanical-expansion anchors instead of building attachments where required in concrete construction.

3.2 HANGER AND SUPPORT INSTALLATION

A. Steel Pipe Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from building structure.

B. Trapeze Pipe Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Arrange for grouping of parallel runs of horizontal piping and support together on field-fabricated trapeze pipe hangers.
   1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified above for individual pipe hangers.
   2. Field fabricate from ASTM A 36/A 36M, steel shapes selected for loads being supported. Weld steel according to AWS D1.1.

C. Fiberglass Pipe Hanger Installation: Comply with applicable portions of MSS SP-69 and MSS SP-89. Install hangers and attachments as required to properly support piping from building structure.
D. Metal Framing System Installation: Arrange for grouping of parallel runs of piping and support together on field-assembled metal framing systems.

E. Fiberglass Strut System Installation: Arrange for grouping of parallel runs of piping and support together on field-assembled fiberglass struts.

F. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.

G. Fastener System Installation:
   1. Install powder-actuated fasteners for use in lightweight concrete or concrete slabs less than 4 inches (100 mm) thick in concrete after concrete is placed and completely cured. Use operators that are licensed by powder-actuated tool manufacturer. Install fasteners according to powder-actuated tool manufacturer's operating manual.
   2. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.

H. Pipe Stand Installation:
   1. Pipe Stand Types except Curb-Mounting Type: Assemble components and mount on smooth roof surface. Do not penetrate roof membrane.
   2. Curb-Mounting-Type Pipe Stands: Assemble components or fabricate pipe stand and mount on permanent, stationary roof curb. Refer to Division 07 Section "Roof Accessories" for curbs.

I. Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers, and other accessories.


K. 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.

L. Install lateral bracing with pipe hangers and supports to prevent swaying.

M. Load Distribution: Install hangers and supports so piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

N. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and so maximum pipe deflections allowed by ASME B31.1 (for power piping) and ASME B31.9 (for building services piping) are not exceeded.

O. Insulated Piping: Comply with the following:
   1. Attach clamps and spacers to piping,
      a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.
b. Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.
c. Do not exceed pipe stress limits according to ASME B31.1 for power piping and ASME B31.9 for building services piping.

2. Install MSS SP-58, Type 39, protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.
   a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 (DN 100) and larger if pipe is installed on rollers.

3. Install MSS SP-58, Type 40, protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.
   a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 (DN 100) and larger if pipe is installed on rollers.

4. Shield Dimensions for Pipe: Not less than the following:
   a. NPS 1/4 to NPS 3-1/2 (DN 8 to DN 90): 12 inches (305 mm) long and 0.048 inch (1.22 mm) thick.
   b. NPS 4 (DN 100): 12 inches (305 mm) long and 0.06 inch (1.52 mm) thick.
   c. NPS 5 and NPS 6 (DN 125 and DN 150): 18 inches (457 mm) long and 0.06 inch (1.52 mm) thick.
   d. NPS 8 to NPS 14 (DN 200 to DN 350): 24 inches (610 mm) long and 0.075 inch (1.91 mm) thick.
   e. NPS 16 to NPS 24 (DN 400 to DN 600): 24 inches (610 mm) long and 0.105 inch (2.67 mm) thick.

5. Pipes NPS 8 (DN 200) and Larger: Include wood inserts.
6. Insert Material: Length at least as long as protective shield.
7. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

3.3 EQUIPMENT SUPPORTS
A. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor.
B. Grouting: Place grout under supports for equipment and make smooth bearing surface.
C. Provide lateral bracing, to prevent swaying, for equipment supports.

3.4 METAL FABRICATIONS
A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers and equipment supports.
B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.

C. Field Welding: Comply with AWS D1.1 procedures for shielded metal arc welding, appearance and quality of welds, and methods used in correcting welding work, and with the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. Finish welds at exposed connections so no roughness shows after finishing and contours of welded surfaces match adjacent contours.

3.5 ADJUSTING

A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.

B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches.

C. Touch Up: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.

1. Apply paint by brush or spray to provide minimum dry film thickness of 2.0 mils (0.05 mm).

D. Touch Up: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal.

E. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END OF SECTION
SECTION 230548
VIBRATION FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 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. Freestanding and restrained air-mounting system.
12. Restrained vibration isolation roof-curb rails.
13. Restraining braces and cables.
14. Steel and inertia, vibration isolation equipment bases.

1.2 DEFINITIONS


1.3 SUBMITTALS

A. Product Data: For the following:

1. Include rated load, rated deflection, and overload capacity for each vibration isolation device.

2. Interlocking Snubbers: Include ratings for horizontal, vertical, and combined loads.

B. Delegated-Design Submittal: For vibration isolation 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, required to select vibration isolators, and for designing vibration isolation bases.
   
a. Coordinate design calculations with wind load calculations required for equipment mounted outdoors.

2. Riser Supports: Include riser diagrams and calculations showing anticipated expansion and contraction at each support point, initial and final loads on building structure, spring deflection changes. Include certification that riser system has been examined for excessive stress and that none will exist.

3. 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.

C. Coordination Drawings: Show coordination of bracing for HVAC piping and equipment with other systems and equipment in the vicinity, including other supports and restraints.

D. Welding certificates.

E. Qualification Data: For professional engineer and testing agency.

F. Air-Mounting System Performance Certification: Include natural frequency, load, and damping test data performed by an independent agency.

G. Field quality-control test reports.

H. Operation and Maintenance Data: For air-mounting systems to include in 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, and that is acceptable to authorities having jurisdiction.

B. Comply with -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."
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:

B. Manufacturers:
   1. Amber/Booth Company, Inc.
   3. Mason Industries.
   4. Vibration Eliminator Co., Inc.

C. 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.

D. 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 base plate 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.

E. Restrained Mounts: All-directional mountings with 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.

F. Spring Isolators: Freestanding, laterally stable, open-spring isolators.
   1. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
   2. Minimum Additional Travel: 50 percent of the required deflection at rated load.
   3. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
4. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
5. Baseplates: Factory drilled for bolting to structure and bonded to 1/4-inch-thick, rubber isolator pad attached to baseplate underside. Baseplates shall limit floor load to 500 psig.
6. Top Plate and Adjustment Bolt: Threaded top plate with adjustment bolt and cap screw to fasten and level equipment.

G. Restrained Spring Isolators: Freestanding, steel, open-spring isolators with 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: 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.

H. Housed Spring Mounts: Housed spring isolator with integral snubbers.
   1. Housing: Ductile-iron or steel housing to provide all-directional 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.

I. 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.

J. 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.

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7. Self-centering hanger rod cap to ensure concentricity between hanger rod and support spring coil.

K. 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.

L. 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.

M. 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 AIR-MOUNTING SYSTEMS

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:
1. Firestone Industrial Products Company.
3. Mason Industries.
4. Vibration Eliminator Co., Inc.

C. Air Mounts: Freestanding, single or multiple, compressed-air bellows.

1. Assembly: Upper and lower steel sections connected by a replaceable, flexible, nylon-reinforced neoprene bellows.
2. Maximum Natural Frequency: 3 Hz.
3. Operating Pressure Range: 25 to 100 psig.
4. Burst Pressure: At least three times manufacturer's published maximum operating pressure.
5. Leveling Valves: Minimum of 3 required to maintain leveling within plus or minus 1/8 inch.

D. Restrained Air Mounts: Housed compressed-air bellows.
   1. Assembly: Upper and lower steel sections connected by a replaceable, flexible, nylon-reinforced neoprene bellows and spring, with angle-iron frame having vertical-limit stops and channel-section top with leveling adjustment and attachment screws.
   2. Maximum Natural Frequency: 3 Hz.
   3. Operating Pressure Range: 25 to 100 psig.
   4. Burst Pressure: At least three times manufacturer's published maximum operating pressure.
   5. Leveling Valves: Minimum of 3 required to maintain leveling within plus or minus 1/8 inch.

2.3 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:

B. Manufacturers:
   1. Amber/Booth Company, Inc.
   3. Mason Industries.
   4. Vibration Eliminator Co., Inc.

C. Steel Base: Factory-fabricated, welded, structural-steel bases and rails.
   1. Design Requirements: Lowest possible mounting height with not less than 1-inch clearance above the floor. Include equipment anchor bolts and auxiliary motor slide bases or rails.
      a. Include supports for suction and discharge elbows for pumps.
   2. Structural Steel: Steel shapes, plates, and bars complying with ASTM A 36/A 36M. Bases shall have shape to accommodate supported equipment.
   3. Support Brackets: Factory-welded steel brackets on frame for outrigger isolation mountings and to provide for anchor bolts and equipment support.

1. Design Requirements: Lowest possible mounting height with not less than 1-inch clearance above the floor. Include equipment anchor bolts and auxiliary motor slide bases or rails.
   a. Include supports for suction and discharge elbows for pumps.
2. Structural Steel: Steel shapes, plates, and bars complying with ASTM A 36/A 36M. Bases shall have shape to accommodate supported equipment.
3. Support Brackets: Factory-welded steel brackets on frame for outrigger isolation mountings and to provide for anchor bolts and equipment support.
4. Fabrication: Fabricate steel templates to hold equipment anchor-bolt sleeves and anchors in place during placement of concrete. Obtain anchor-bolt templates from supported equipment manufacturer.

2.4 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 wind control devices to indicate capacity range.

PART 3 - EXECUTION

3.1 EXAMINATION
   A. Examine areas and equipment to receive vibration isolation and wind 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 forces.

C. Strength of Support and Restraint Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static and loads within specified loading limits.

3.3 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 air-spring leveling mechanism.

D. Adjust active height of spring isolators.

E. Adjust restraints to permit free movement of equipment within normal mode of operation.

END OF SECTION
SECTION 230553

IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Equipment labels.
   2. Warning signs and labels.
   3. Pipe labels.
   4. Duct labels.
   5. Stencils.
   6. Valve tags.
   7. Warning tags.

1.2 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Samples: For color, letter style, and graphic representation required for each identification material and device.

C. Equipment Label Schedule: Include a listing of all equipment to be labeled with the proposed content for each label.

D. Valve numbering scheme.

E. Valve Schedules: For each piping system to include in maintenance manuals.

1.3 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.
PART 2 - PRODUCTS

2.1 EQUIPMENT LABELS

A. Plastic Labels for Equipment:
   1. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch thick, and having predrilled holes for attachment hardware.
   2. Letter Color: Black.
   4. Maximum Temperature: Able to withstand temperatures up to 160 deg F.
   5. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
   6. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
   7. Fasteners: Stainless-steel rivets or self-tapping screws.
   8. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

B. Label Content: Include equipment's Drawing designation or unique equipment number, Drawing numbers where equipment is indicated (plans, details, and schedules), plus the Specification Section number and title where equipment is specified.

C. Equipment Label Schedule: For each item of equipment to be labeled, on 8-1/2-by-11-inch 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 partially cover 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: Yellow.

D.  Maximum Temperature: Able to withstand temperatures up to 160 deg F.

E.  Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.

F.  Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.

G.  Fasteners: Stainless-steel rivets or self-tapping screws.

H.  Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

I.  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  STENCILS

A.  Stencils: Prepared with letter sizes according to ASME A13.1 for piping; minimum letter height of 1-1/4 inches (32 mm) for ducts; and minimum letter height of 3/4 inch for access panel and door labels, equipment labels, and similar operational instructions.

   2.  Stencil Paint: Exterior, gloss, alkyd enamel black unless otherwise indicated. Paint may be in pressurized spray-can form.
   3.  Identification Paint: Exterior, alkyd enamel in colors according to ASME A13.1 unless otherwise indicated.
2.5 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.

B. Valve Schedules: For each piping system, on 8-1/2-by-11-inch 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. Stenciled Pipe Label Option: Stenciled labels may be provided instead of manufactured pipe labels, at Installer's option. Install stenciled pipe labels, complying with ASME A13.1, on each piping system.

1. Identification Paint: Use for contrasting background.

C. Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:
1. Near each valve and control device.
2. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.
3. Near penetrations through walls, floors, ceilings, and inaccessible enclosures.
4. At access doors, manholes, and similar access points that permit view of concealed piping.
5. Near major equipment items and other points of origination and termination.
6. Spaced at maximum intervals of 50 feet along each run. Reduce intervals to 25 feet in areas of congested piping and equipment.

D. Pipe Label Color Schedule:
1. Heating Water Piping:
   a. Background Color: Red.

3.4 VALVE-TAG INSTALLATION
A. Install tags on valves and control devices in piping systems, except check valves; valves within factory-fabricated equipment units; shutoff valves; faucets; convenience and lawn-watering hose connections; and 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:

2. Valve-Tag Color:
   a. Hot Water: Green.

3. Letter Color:

END OF SECTION
SECTION 230593

TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1.2 DEFINITIONS

C. TAB: Testing, adjusting, and balancing.
D. TABB: Testing, Adjusting, and Balancing Bureau.
E. TAB Specialist: An entity engaged to perform TAB Work.

1.3 SUBMITTALS

A. LEED Submittal:

B. 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.


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.

1.4 QUALITY ASSURANCE

A. TAB Contractor Qualifications: Engage a TAB entity certified by NEBB or TABB.

1. TAB Field Supervisor: Employee of the TAB contractor and certified by NEBB or TABB.
2. TAB Technician: Employee of the TAB contractor and who is certified by NEBB or TABB as a TAB technician.

B. TAB Conference: Meet with Architect Owner Construction Manager or commissioning Authority on approval of the TAB strategies and procedures plan to develop a mutual understanding of the details. Require the participation of the TAB field supervisor and technicians. Provide seven days' advance notice of scheduled meeting time and location.

1. Agenda Items:
   b. The TAB plan.
   c. Coordination and cooperation of trades and subcontractors.
   d. Coordination of documentation and communication flow.

C. 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.

D. TAB Report Forms: Use standard TAB contractor's forms approved by Construction Manager Commissioning Authority.

E. Instrumentation Type, Quantity, Accuracy, and Calibration: As described in ASHRAE 111, Section 5, "Instrumentation."
1.5 PROJECT CONDITIONS

A. Full Owner Occupancy: Owner will occupy the site and existing building during entire TAB period. Cooperate with Owner during TAB operations to minimize conflicts with Owner's operations.

1.6 COORDINATION

A. Notice: Provide seven days' advance notice for each test. Include scheduled test dates and times.

B. Perform TAB after leakage and pressure tests on air and water distribution systems have been satisfactorily completed.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine the Contract Documents to become familiar with Project requirements and to discover conditions in systems' designs that may preclude proper TAB of systems and equipment.

B. Examine systems for installed balancing devices, such as test ports, gage cocks, thermometer wells, flow-control devices, balancing valves and fittings, and 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 ceiling plenums and used for supply, return, or relief air to verify that they meet the leakage class of connected ducts as specified in Division 23 Section "Metal Ducts Nonmetal Ducts" and are properly separated from adjacent areas. Verify that penetrations in plenum walls are sealed and fire-stopped if required.

F. Examine equipment performance data including fan and pump 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.

G. Examine system and equipment installations and verify that field quality-control testing, cleaning, and adjusting specified in individual Sections have been performed.

H. Examine test reports specified in individual system and equipment Sections.

I. 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.

J. Examine terminal units, such as variable-air-volume boxes, and verify that they are accessible and their controls are connected and functioning.

K. Examine three-way valves for proper installation for their intended function of diverting or mixing fluid flows.

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.

3.2 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, smoke, and fire dampers are open.
6. Isolating and balancing valves are open and control valves are operational.
7. Ceilings are installed in critical areas where air-pattern adjustments are required and access to balancing devices is provided.
8. Windows and doors can be closed so indicated conditions for system operations can be met.
3.3 GENERAL PROCEDURES FOR TESTING AND BALANCING

A. Perform testing and balancing procedures on each system according to the procedures contained in AABC's "National Standards for Total System Balance" ASHRAE 111 NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems" SMACNA's "HVAC Systems - Testing, Adjusting, and Balancing" and in this Section.


B. Cut insulation, ducts, pipes, and equipment cabinets for installation of test probes to the minimum extent necessary for TAB procedures.

1. After testing and balancing, patch probe holes in ducts with same material and thickness as used to construct ducts.
2. After testing and balancing, install test ports and duct access doors that comply with requirements in Division 23 Section "Air Duct Accessories."
3. 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, valve position indicators, 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.

3.4 GENERAL PROCEDURES FOR BALANCING AIR SYSTEMS

A. Prepare test reports for both fans and outlets. Obtain manufacturer's outlet factors and recommended testing procedures. Crosscheck the summation of required outlet volumes with required fan volumes.

B. Prepare schematic diagrams of systems' "as-built" duct layouts.

C. For variable-air-volume systems, develop a plan to simulate diversity.

D. Determine the best locations in main and branch ducts for accurate duct-airflow measurements.

E. Check airflow patterns from the outdoor-air louvers and dampers and the return- and exhaust-air dampers through the supply-fan discharge and mixing dampers.

F. Locate start-stop and disconnect switches, electrical interlocks, and motor starters.

G. Verify that motor starters are equipped with properly sized thermal protection.

H. Check dampers for proper position to achieve desired airflow path.

I. Check for airflow blockages.
J. Check condensate drains for proper connections and functioning.

K. Check for proper sealing of air-handling-unit components.

L. Verify that air duct system is sealed as specified in Division 23 Section "Metal Ducts."

3.5 DETAILED PROCEDURES FOR 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.
   d. Measure inlet static pressure of double-inlet fans through the wall of the plenum that houses the fan.

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. Measure static pressures entering and leaving other devices, such as sound traps, heat-recovery equipment, and air washers, under final balanced conditions.

5. 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.

6. Obtain approval from Commissioning Authority 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.

7. 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, submain ducts, and major branch ducts to indicated airflows within specified tolerances.

1. Measure airflow of submain 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 submain and branch duct after all have been adjusted. Continue to adjust submain 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.

3.6 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.

3.7 DETAILED PROCEDURES FOR HYDRONIC SYSTEMS

A. Measure water flow at pumps. Use the following procedures except for positive-displacement pumps:

1. Verify impeller size by operating the pump with the discharge valve closed. Read pressure differential across the pump. Convert pressure to head and correct for differences in gage heights. Note the point on manufacturer's pump curve at zero flow and verify that the pump has the intended impeller size.
   a. If impeller sizes must be adjusted to achieve pump performance, obtain approval from Commissioning Authority and comply with requirements in Division 23 Section "Hydronic Pumps."

2. Check system resistance. With all valves open, read pressure differential across the pump and mark pump manufacturer's head-capacity curve. Adjust pump discharge valve until indicated water flow is achieved.
   a. Monitor motor performance during procedures and do not operate motors in overload conditions.

3. Verify pump-motor brake horsepower. Calculate the intended brake horsepower for the system based on pump manufacturer's performance data. Compare calculated brake horsepower with nameplate data on the pump motor. Report conditions where actual amperage exceeds motor nameplate amperage.

4. Report flow rates that are not within plus or minus 10 percent of design.

B. Measure flow at all automatic flow control valves to verify that valves are functioning as designed.

C. Measure flow at all pressure-independent characterized control valves, with valves in fully open position, to verify that valves are functioning as designed.

D. Set calibrated balancing valves, if installed, at calculated presetting.

E. Measure flow at all stations and adjust, where necessary, to obtain first balance.
   1. System components that have Cv rating or an accurately cataloged flow-pressure-drop relationship may be used as a flow-indicating device.

F. Measure flow at main balancing station and set main balancing device to achieve flow that is 5 percent greater than indicated flow.
G. Adjust balancing stations to within specified tolerances of indicated flow rate as follows:
   1. Determine the balancing station with the highest percentage over indicated flow.
   2. Adjust each station in turn, beginning with the station with the highest percentage over indicated flow and proceeding to the station with the lowest percentage over indicated flow.
   3. Record settings and mark balancing devices.

H. Measure pump flow rate and make final measurements of pump amperage, voltage, rpm, pump heads, and systems' pressures and temperatures including outdoor-air temperature.

I. Measure the differential-pressure-control-valve settings existing at the conclusion of balancing.

J. Check settings and operation of each safety valve. Record settings.

K. PROCEDURES FOR MOTORS

L. 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.
   4. Efficiency rating.
   5. Nameplate and measured voltage, each phase.
   6. Nameplate and measured amperage, each phase.
   7. Starter thermal-protection-element rating.

M. 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.

3.8 TOLERANCES

A. Set HVAC system's air flow rates and water flow rates within the following 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.

3.9 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.

B. Status Reports: Prepare monthly progress reports to describe completed procedures, procedures in progress, and scheduled procedures. Include a list of deficiencies and problems found in systems being tested and balanced. Prepare a separate report for each system and each building floor for systems serving multiple floors.

3.10 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. Manufacturers' test data.
3. Field test reports prepared by system and equipment installers.
4. 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.
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. System Diagrams: Include schematic layouts of air and hydronic distribution systems. Present each system with single-line diagram and include the following:
   1. Quantities of outdoor, supply, return, and exhaust airflows.
   2. Water flow rates.
   3. Duct, outlet, and inlet sizes.
   4. Pipe and valve sizes and locations.
   5. Terminal units.

E. 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. Preheat-coil static-pressure differential in inches wg.
   g. Cooling-coil static-pressure differential in inches wg.
   h. Heating-coil static-pressure differential in inches wg.
   i. Outdoor airflow in cfm.
   j. Return airflow in cfm.
   k. Outdoor-air damper position.
   l. Return-air damper position.
   m. Vortex damper position.

F. 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.
   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.
   o. Inlet steam pressure in psig.
3. Unit Data:
   a. System identification.
   b. Location.
   c. Make and type.
   d. Model number and unit size.
   e. Manufacturer's serial number.
   f. Fuel type in input data.
   g. Output capacity in Btu/h.
   h. Ignition type.
   i. Burner-control types.
   j. Motor horsepower and rpm.
   k. Motor volts, phase, and hertz.
   l. Motor full-load amperage and service factor.
   m. Sheave make, size in inches, and bore.
   n. Center-to-center dimensions of sheave, and amount of adjustments in inches.

4. Test Data (Indicated and Actual Values):
   a. Total air flow rate in cfm.
   b. Entering-air temperature in deg F.
   c. Leaving-air temperature in deg F.
   d. Air temperature differential in deg F.
   e. Entering-air static pressure in inches wg.
   f. Leaving-air static pressure in inches wg.
   g. Air static-pressure differential in inches wg.
   h. Low-fire fuel input in Btu/h.
   i. High-fire fuel input in Btu/h.
   j. Manifold pressure in psig.
   k. High-temperature-limit setting in deg F.
   l. Operating set point in Btu/h.
   m. Motor voltage at each connection.
   n. Motor amperage for each phase.
   o. Heating value of fuel in Btu/h.

G. Fan Test Reports: For supply, return, and exhaust fans, include the following:

1. Fan Data:
   a. System identification.
   b. Location.
   c. Make and type.
   d. Model number and size.
   e. Manufacturer's serial number.
   f. Arrangement and class.
   g. Sheave make, size in inches, and bore.
   h. Center-to-center dimensions of sheave, and amount of adjustments in inches.
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.
   g. Number, make, and size of belts.

3. Test Data (Indicated and Actual Values):
   a. Total airflow rate in cfm.
   b. Total system static pressure in inches wg.
   c. Fan rpm.
   d. Discharge static pressure in inches wg.
   e. Suction static pressure in inches wg.

H. Round, Flat-Oval, 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.

I. Air-Terminal-Device Reports:

1. Unit Data:
   a. System and air-handling unit identification.
   b. Location and zone.
   c. Apparatus used for test.
   d. Area served.
   e. Make.
   f. Number from system diagram.
   g. Type and model number.
   h. Size.
   i. Effective area in sq. ft.
2. Test Data (Indicated and Actual Values):
   
   a. Air flow rate in cfm.
   b. Air velocity in fpm.
   c. Preliminary air flow rate as needed in cfm.
   d. Preliminary velocity as needed in fpm.
   e. Final air flow rate in cfm.
   f. Final velocity in fpm.
   g. Space temperature in deg F.

J. System-Coil Reports: For reheat coils and water coils of terminal units, include the following:

   1. Unit Data:
      
      a. System and air-handling-unit identification.
      b. Location and zone.
      c. Room or riser served.
      d. Coil make and size.
      e. Flowmeter type.

   2. Test Data (Indicated and Actual Values):
      
      a. Air flow rate in cfm.
      b. Entering-water temperature in deg F.
      c. Leaving-water temperature in deg F.
      d. Water pressure drop in feet of head or psig.
      e. Entering-air temperature in deg F.
      f. Leaving-air temperature in deg F.

K. Instrument Calibration Reports:

   1. Report Data:
      
      a. Instrument type and make.
      b. Serial number.
      c. Application.
      d. Dates of use.
      e. Dates of calibration.

3.11 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 water flow of at least 5 percent of terminals.
   c. Measure room temperature at each thermostat/temperature sensor. Compare the reading to the set point.
   d. Verify that balancing devices are marked with final balance position.
   e. 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 Commissioning Authority.
   2. The TAB contractor's test and balance engineer shall conduct the inspection in the presence of Commissioning Authority.
   3. Commissioning Authority 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
SECTION 230700
HVAC INSULATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Insulation Materials:
   a. Fiberglass or Mineral fiber.
2. Insulating cements.
3. Adhesives.
5. Lagging adhesives.
7. Factory-applied jackets.
8. Field-applied jackets.
10. Securements.
11. Corner angles.

B. Related Sections:

1. Division 23 Section "Metal Ducts" for duct liners.

1.2 SUBMITTALS

A. Product Data: For each type of product indicated. Include thermal conductivity, thickness, and jackets (both factory and field applied, if any).

B. LEED Submittal:

1. Product Data for Credit EQ 4.1: For adhesives and sealants, including printed statement of VOC content.

C. Shop Drawings:

1. Detail application of protective shields, saddles, and inserts at hangers for each type of insulation and hanger.
2. Detail attachment and covering of heat tracing inside insulation.
3. Detail insulation application at pipe expansion joints for each type of insulation.
4. Detail insulation application at elbows, fittings, flanges, valves, and specialties for each type of insulation.
5. Detail removable insulation at piping specialties, equipment connections, and access panels.
6. Detail application of field-applied jackets.
7. Detail application at linkages of control devices.
8. Detail field application for each equipment type.

D. Samples: For each type of insulation and jacket indicated. Identify each Sample, describing product and intended use.

1. Sample Sizes:
   b. Sheet Form Insulation Materials: 12 inches square.
   d. Sheet Jacket Materials: 12 inches square.
   e. Manufacturer's Color Charts: For products where color is specified, show the full range of colors available for each type of finish material.

E. Qualification Data: For qualified Installer.

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.

G. Field quality-control reports.

1.3 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.

1.4 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.
1.5 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, duct Installer for duct insulation application, and equipment Installer for equipment insulation application. Before preparing piping and ductwork Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.

C. Coordinate installation and testing of heat tracing.

1.6 SCHEDULING

A. Schedule insulation application after pressure testing systems and, where required, after installing and testing heat tracing. 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. 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. Fiberglass or 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, II with factory-applied vinyl jacket. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

   1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

      a. CertainTeed Corp.; Duct Wrap.
      b. Johns Manville; Microlite.
c. Knauf Insulation; Duct Wrap.
d. Manson Insulation Inc.; Alley Wrap.
e. Owens Corning; All-Service Duct Wrap.
f. Johns Manville; HTB 23 Spin-Glas.
g. Owens Corning; High Temperature Flexible Batt Insulations.

F. Fiberglass or Mineral-Fiber, Preformed Pipe Insulation:

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. 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 with factory-applied ASJ-SSL. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

G. Fiberglass or 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, provide one of the following

   a. Knauf Insulation; Permawick Pipe Insulation.
   b. Owens Corning; VaporWick Pipe Insulation.
   c. Pipe and tank insulation is used for large-diameter piping and vessels. ASJ is commonly used.

H. Fiberglass or Mineral-Fiber, Pipe and Tank Insulation: Mineral or glass fibers bonded with a thermosetting resin. Semirigid board material with factory-applied ASJ 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, provide one of the following 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.
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. Calcium Silicate Adhesive: Fibrous, sodium-silicate-based adhesive with a service temperature range of 50 to 800 deg F.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following

   a. Childers Products, Division of ITW; CP-97.
   d. Vimasco Corporation; 760.

2. For indoor applications, use adhesive that has a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

C. Fiberglass or Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.

1. Products: Subject to compliance with requirements, provide one of the following available products that may be incorporated into the Work include, but are not limited to, the following:

   a. Childers Products, Division of ITW; CP-82.
   c. ITW TACC, Division of Illinois Tool Works; S-90/80.
   d. Marathon Industries, Inc.; 225.
   e. Mon-Eco Industries, Inc.; 22-25.
   f. Retain subparagraph below if low-emitting materials are required
   g. for LEED-NC Credit EQ 4.1.

2. For indoor applications, use adhesive that has a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).


1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following

   a. Childers Products, Division of ITW; CP-82.

2. Childers Products, Division of ITW; CP-82.
   b. ITW TACC, Division of Illinois Tool Works; S-90/80.
   c. Marathon Industries, Inc.; 225.
d. Mon-Eco Industries, Inc.; 22-25.

3. For indoor applications, use adhesive that has a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

E. PVC Jacket Adhesive: Compatible with PVC jacket.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
   a. Dow Chemical Company (The); 739, Dow Silicone.
   d. Speedline Corporation; Speedline Vinyl Adhesive.

2. For indoor applications, use adhesive that has a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.3 MASTICS

A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-C-19565C, Type II.

1. For indoor applications, use mastics that have a VOC content of 5 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 and outdoor use on below ambient services.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
   a. Childers Products, Division of ITW; CP-35.
   b. Foster Products Corporation, H. B. Fuller Company; 30-90.
   c. ITW TACC, Division of Illinois Tool Works; CB-50.
   d. Marathon Industries, Inc.; 590.
   e. Mon-Eco Industries, Inc.; 55-40.
   f. Vimasco Corporation; 749.

2. Water-Vapor Permeance: ASTM E 96, Procedure B, 0.013 perm at 43-mil dry film thickness.
3. Service Temperature Range: Minus 20 to plus 180 deg F.

C. Vapor-Barrier Mastic: Solvent 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. Childers Products, Division of ITW; CP-30.
b. Foster Products Corporation, H. B. Fuller Company; 30-35.
c. ITW TACC, Division of Illinois Tool Works; CB-25.
e. Mon-Eco Industries, Inc.; 55-10.
f. Water-Vapor Permeance: ASTM F 1249, 0.05 perm at 35-mil dry film thickness.

2. Service Temperature Range: 0 to 180 deg F.


D. 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 Products, Division of ITW; Encacel.
   b. Foster Products Corporation, H. B. Fuller Company; 60-95/60-96.
   c. Marathon Industries, Inc.; 570.
   d. Mon-Eco Industries, Inc.; 55-70.

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.


E. Breather Mastic: Water based; suitable for indoor and outdoor use on above ambient services.

1. Products: Subject to compliance with requirements, Available products that may be incorporated into the Work include, but are not limited to, the following:

   a. Childers Products, Division of ITW; C-10.
   b. Foster Products Corporation, H. B. Fuller Company; 35-00.
   c. ITW TACC, Division of Illinois Tool Works; CB-05/15.
   e. Mon-Eco Industries, Inc.; 55-50.
   f. Vimasco Corporation; WC-1/WC-5.

2. Water-Vapor Permeance: ASTM F 1249, 3 perms at 0.0625-inch dry film thickness.

3. Service Temperature Range: Minus 20 to plus 200 deg F.

4. Solids Content: 63 percent by volume and 73 percent by weight.


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 10 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 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.

2.5 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 Products, Division of ITW; CP-76. Foster Products Corporation, H. B. Fuller Company; 30-45.
      b. Marathon Industries, Inc.; 405.
      c. Mon-Eco Industries, Inc.; 44-05.
      d. Pittsburgh Corning Corporation; Pittseal 444.
      e. Vimasco Corporation; 750.
   2. Joint Sealants for Polystyrene Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
      a. Childers Products, Division of ITW; CP-70.
      c. Marathon Industries, Inc.; 405.
      d. Mon-Eco Industries, Inc.; 44-05.
      e. Vimasco Corporation; 750.
   3. Materials shall be compatible with insulation materials, jackets, and substrates.
   4. Permanently flexible, elastomeric sealant.
   5. Service Temperature Range: Minus 100 to plus 300 deg F.
   6. Color: White or gray.
   7. For indoor applications, use sealants that have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

B. Metal Jacket Flashing Sealants:
1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
   a. Childers Products, Division of ITW; CP-76-8.
   b. Foster Products Corporation, H. B. Fuller Company; 95-44.
   c. Marathon Industries, Inc.; 405.
   d. Mon-Eco Industries, Inc.; 44-05.
   e. Vimasco Corporation; 750.

2. Materials shall be compatible with insulation materials, jackets, and substrates.
3. Fire- and water-resistant, flexible, elastomeric sealant.
4. Service Temperature Range: Minus 40 to plus 250 deg F.
5. Color: Aluminum.
6. For indoor applications, use sealants that have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.6 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.
   c. Proto PVC Corporation; LoSmoke.
   d. Speedline Corporation; SmokeSafe.

2. Adhesive: As recommended by jacket material manufacturer.
3. Color: White Color-code jackets based on system. Color as selected by Architect 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.

4. Factory-fabricated tank heads and tank side panels.

C. Metal Jacket:

1. Products: Subject to compliance with products that may be incorporated into the Work include, but are not limited to,
   a. Childers Products, Division of ITW; Metal Jacketing Systems.
   b. PABCO Metals Corporation; Surefit.
2.7 TAPES

A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
   a. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0835.
   b. Compac Corp.; 104 and 105.
   c. Ideal Tape Co., Inc., an American Biltrite Company; 428 AWF ASJ.
   d. Venture Tape; 1540 CW Plus, 1542 CW Plus, and 1542 CW Plus/SQ.

B. PVC Tape: White vapor-retarder tape matching field-applied PVC jacket with acrylic adhesive. Suitable for indoor and outdoor applications.

1. Products:
   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.
5. Elongation: 500 percent.
6. Tensile Strength: 18 lb/inch in width.

C. Aluminum-Foil Tape: Vapor-retarder tape with acrylic adhesive.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
   a. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0800.
   b. Compac Corp.; 120.
   c. Ideal Tape Co., Inc., an American Biltrite Company; 488 AWF.
   d. Venture Tape; 3520 CW.

2. Width: 2 inches.
3. Thickness: 3.7 mils.
5. Elongation: 5 percent.
6. Tensile Strength: 34 lb/inch in width.
2.8 SECUREMENTS

A. Bands:

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
   
a. Childers Products; 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 thick, 1/2 inch wide with wing seal.


B. 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. Metal, Adhesively Attached, Perforated-Base Insulation Hangers: Baseplate welded to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place. Comply with the following requirements:

   a. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

      1) AGM Industries, Inc.; Tactoo Insul-Hangers, Series T.
      2) GEMCO; Perforated Base.
      3) Midwest Fasteners, Inc.; Spindle.

   b. Baseplate: Perforated, galvanized carbon-steel sheet, 0.030 inch thick by 2 inches square.

   c. Spindle: Aluminum, fully annealed, 0.106-inch- diameter shank, length to suit depth of insulation indicated.

   d. Adhesive: Recommended by hanger manufacturer. Product with demonstrated capability to bond insulation hanger securely to substrates indicated without damaging insulation, hangers, and substrates.
3. Nonmetal, Adhesively Attached, Perforated-Base Insulation Hangers: Baseplate fastened to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place. Comply with the following requirements:

   a. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

      1) GEMCO; Nylon Hangers.
      2) Midwest Fasteners, Inc.; Nylon Insulation Hangers.

   b. Baseplate: Perforated, nylon sheet, 0.030 inch thick by 1-1/2 inches in diameter.
   c. Spindle: Nylon, 0.106-inch- diameter shank, length to suit depth of insulation indicated, up to 2-1/2 inches.
   d. Adhesive: Recommended by hanger manufacturer. Product with demonstrated capability to bond insulation hanger securely to substrates indicated without damaging insulation, hangers, and substrates.

4. Self-Sticking-Base Insulation Hangers: Baseplate welded to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place. Comply with the following requirements:

   a. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

      1) AGM Industries, Inc.; Tactoo Insul-Hangers, Series TSA.
      2) GEMCO; Press and Peel.
      3) Midwest Fasteners, Inc.; Self Stick.

   b. Baseplate: Galvanized carbon-steel sheet, 0.030 inch thick by 2 inches square.
   c. Spindle: Aluminum fully annealed, 0.106-inch- diameter shank, length to suit depth of insulation indicated.
   d. Adhesive-backed base with a peel-off protective cover.

5. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch- thick, galvanized-steel sheet, with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches in diameter.

   a. Products:

      1) AGM Industries, Inc.; RC-150.
      2) GEMCO; R-150.
      3) Midwest Fasteners, Inc.; WA-150.
      4) Nelson Stud Welding; Speed Clips.

   b. Protect ends with capped self-locking washers incorporating a spring steel insert to ensure permanent retention of cap in exposed locations.
6. Nonmetal Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch-thick nylon sheet, with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches in diameter.

   a. Products: Subject to compliance with requirements, [provide the following] [provide one of the following] [available products that may be incorporated into the Work include, but are not limited to, the following):

      1) GEMCO.
      2) Midwest Fasteners, Inc.

C. Staples: Outward-clinching insulation staples, nominal 3/4-inch wide, stainless steel or Monel.

D. Wire: 0.080-inch nickel-copper alloy.

   1. Manufacturers:

      b. Childers Products.
      c. PABCO Metals Corporation.
      d. RPR Products, Inc.

2.9 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.

C. Stainless-Steel Corner Angles: 0.024 inch thick, minimum 1 by 1 inch, stainless steel according to ASTM A 167 or ASTM A 240/A 240M, Type 304.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions for compliance with requirements for installation and other conditions affecting performance of insulation application.

   1. Verify that systems and equipment to be insulated have been tested and are free of defects.
   2. Verify that surfaces to be insulated are clean and dry.
   3. Proceed with installation only after unsatisfactory conditions have been corrected.
3.2 PREPARATION

A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

B. Surface Preparation: Clean and prepare surfaces to be insulated. Before insulating, apply a corrosion coating to insulated surfaces as follows:

1. Stainless Steel: Coat 300 series stainless steel with an epoxy primer 5 mils thick and an epoxy finish 5 mils thick if operating in a temperature range between 140 and 300 deg F. Consult coating manufacturer for appropriate coating materials and application methods for operating temperature range.
2. Carbon Steel: Coat carbon steel operating at a service temperature between 32 and 300 deg F with an epoxy coating. Consult coating manufacturer for appropriate coating materials and application methods for operating temperature range.

C. Coordinate insulation installation with the trade installing heat tracing. Comply with requirements for heat tracing that apply to insulation.

D. 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 equipment, ducts and fittings, and piping including fittings, valves, and specialties.

B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of equipment, duct system, and pipe system as specified in insulation system schedules.

C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.

D. Install insulation with longitudinal seams at top and bottom of horizontal runs.

E. Install multiple layers of insulation with longitudinal and end seams staggered.

F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.

G. Keep insulation materials dry during application and finishing.

H. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.
I. Install insulation with least number of joints practical.

J. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.
   1. Install insulation continuously through hangers and around anchor attachments.
   2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
   3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
   4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.

K. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.

L. Install insulation with factory-applied jackets as follows:
   1. Draw jacket tight and smooth.
   2. Cover circumferential joints with 3-inch- wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches o.c.
   3. Overlap jacket longitudinal seams at least 1-1/2 inches. Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 2 inches
      a. For below ambient services, apply vapor-barrier mastic over staples.
   4. Cover joints and seams with tape as recommended by insulation material manufacturer to maintain vapor seal.
   5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to duct and pipe flanges and fittings.

M. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.

N. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.

O. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.

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.
5. Handholes.
6. Cleanouts.

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. For services not specified to receive a field-applied jacket except for flexible elastomeric and polyolefin, install fitted PVC cover over elbows, tees, strainers, valves, flanges, and unions. Terminate ends with PVC end caps. Tape PVC covers to adjoining insulation facing using PVC tape.

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, 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.

D. Install removable insulation covers at locations indicated. Installation shall conform to the following:

1. Make removable flange and union insulation from sectional pipe insulation of same thickness as that on adjoining pipe. Install same insulation jacket as adjoining pipe insulation.
2. When flange and union covers are made from sectional pipe insulation, extend insulation from flanges or union long at least two times the insulation thickness over adjacent pipe insulation on each side of flange or union. Secure flange 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.

E. Insulation Installation on Straight Pipes and Tubes:

1. Secure single-layer insulation with stainless-steel bands at 12-inch intervals and tighten bands without deforming insulation materials.
2. Install 2-layer insulation with joints tightly butted and staggered at least 3 inches. Secure inner layer with wire spaced at 12-inch intervals. Secure outer layer with stainless-steel bands at 12-inch intervals.
3. Apply a skim coat of mineral-fiber, hydraulic-setting cement to insulation surface. When cement is dry, apply flood coat of lagging adhesive and press on one layer of glass cloth or tape. Overlap edges at least 1 inch. Apply finish coat of lagging adhesive over glass cloth or tape. Thin finish coat to achieve smooth, uniform finish.

F. 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 cut sections of block insulation of same material and thickness as pipe insulation.
4. Finish flange insulation same as pipe insulation.

G. 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 insulation sections of insulation are not available, install mitered sections of calcium silicate insulation. Secure insulation materials with wire or bands.
3. Finish fittings insulation same as pipe insulation.

H. Insulation Installation on Valves and Pipe Specialties:

1. Install mitered segments of calcium silicate insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
2. Install insulation to flanges as specified for flange insulation application.
3. Finish valve and specialty insulation same as pipe insulation.

3.5 FIBERGLASS AND MINERAL-FIBER INSULATION INSTALLATION

A. Insulation Installation on Straight Pipes and Tubes:

1. Secure each layer of preformed pipe insulation to pipe with wire or bands and tighten bands without deforming insulation materials.
2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
3. For insulation with factory-applied jackets on above ambient surfaces, secure laps with outward clinched staples at 6 inches o.c.
4. For insulation with factory-applied jackets on below ambient surfaces, do not staple longitudinal tabs but secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.

B. Insulation Installation on Pipe Flanges:

1. Install preformed pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with mineral-fiber blanket insulation.
4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch, and seal joints with flashing sealant.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install preformed sections of same material as straight segments of pipe insulation when available.
2. When preformed insulation elbows and fittings are not available, install mitered sections of pipe insulation, to a thickness equal to adjoining pipe insulation. Secure insulation materials with wire or bands.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed sections of same material as straight segments of pipe insulation when available.
2. When preformed sections are not available, install mitered sections of pipe insulation to valve body.
3. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
4. Install insulation to flanges as specified for flange insulation application.

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 FIRE-RATED INSULATION SYSTEM INSTALLATION

A. Where fire-rated insulation system is indicated, secure system to ducts and duct hangers and supports to maintain a continuous fire rating.

B. Insulate duct access panels and doors to achieve same fire rating as duct.

C. Install firestopping at penetrations through fire-rated assemblies. Fire-stop systems are specified in Division 07 Section "Penetration Firestopping."

3.8 FINISHES

A. Duct, Equipment, and Pipe Insulation with ASJ, Glass-Cloth, or Other Paintable Jacket Material: Paint jacket with paint system identified below and as specified in Division 09 painting Sections.
   1. 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.
B. Flexible Elastomeric Thermal Insulation: After adhesive has fully cured, apply two coats of insulation manufacturer's recommended protective coating.

C. Color: Final color as selected by Architect. Vary first and second coats to allow visual inspection of the completed Work.

D. Do not field paint aluminum or stainless-steel jackets.

3.9 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 field-insulated equipment, randomly selected by Architect, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection shall be limited to one location(s) for each type of equipment defined in the "Equipment Insulation Schedule" Article. For large equipment, remove only a portion adequate to determine compliance.
   2. 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.

3.10 EQUIPMENT INSULATION SCHEDULE

A. Insulation materials and thicknesses are identified below. If more than one material is listed for a type of equipment, selection from materials listed is Contractor's option.

B. Insulate indoor and outdoor equipment in paragraphs below that is not factory insulated.

C. Heating-hot-water expansion/compression tank insulation shall be the following:
   1. Fiberglass or Mineral-Fiber Blanket: 1-1/2 inches thick.

D. Heating-hot-water air-separator insulation shall be the following:
   1. Fiberglass or Mineral-Fiber Blanket: 3 inches thick.
3.11 PIPING INSULATION SCHEDULE, GENERAL

A. Acceptable preformed pipe and tubular insulation materials and thicknesses are identified for each piping system and pipe size range. If more than one material is listed for a piping system, selection from materials listed is Contractor's option.

B. Heating-Hot-Water Supply and Return:

1. NPS 1-1/4 inch and Smaller: Insulation shall be the following:
   a. Fiberglass or Mineral-Fiber Blanket, Preformed Pipe, Type I: 1-1/2 inch thick.

2. NPS 1-1/2 inch and Larger: Insulation shall be the following:
   a. Fiberglass or Mineral-Fiber Blanket, Preformed Pipe, Type I: 2 inch thick.

END OF SECTION
SECTION 232113
HYDRONIC PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes pipe and fitting materials, joining methods, special-duty valves, and specialties for the following:

1. Hot water heating piping.
2. Condensate-drain piping.
3. Air-vent piping.

B. Related Sections include the following:

1. Division 23 Section "Hydronic Pumps" for pumps, motors, and accessories for hydronic piping.

1.2 DEFINITIONS

A. PTFE: Polytetrafluoroethylene.

B. RTRF: Reinforced thermosetting resin (fiberglass) fittings.

C. RTRP: Reinforced thermosetting resin (fiberglass) pipe.

1.3 PERFORMANCE REQUIREMENTS

A. Hydronic piping components and installation shall be capable of withstanding the following minimum working pressure and temperature:

1. Hot and Chilled Water Heating Piping: 125 psig at 200 deg F
2. Condensate-Drain Piping: 150 deg F
3. Safety-Valve-Inlet and -Outlet Piping: Equal to the pressure of the piping system to which it is attached.

1.4 SUBMITTALS

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

1. Pressure-seal fittings.
2. Valves. Include flow and pressure drop curves based on manufacturer's testing for calibrated-orifice balancing valves and automatic flow-control valves.

3. Air control devices.


5. Hydronic specialties.

B. Shop Drawings: Detail, at 1/4 scale, the piping layout, fabrication of pipe anchors, hangers, supports for multiple pipes, alignment guides, expansion joints and loops, and attachments of the same to the building structure. Detail location of anchors, alignment guides, and expansion joints and loops.

C. Welding certificates.

D. Qualification Data: For Installer.

E. Field quality-control test reports.

F. Operation and Maintenance Data: For air control devices, hydronic specialties, and special-duty valves to include in emergency, operation, and maintenance manuals.

G. Water Analysis: Submit a copy of the water analysis to illustrate water quality available at Project site.

1.5 QUALITY ASSURANCE

A. Installer Qualifications:

1. Installers of Pressure-Sealed Joints: Installers shall be certified by the pressure-seal joint manufacturer as having been trained and qualified to join piping with pressure-seal pipe couplings and fittings.

B. Steel Support Welding: Qualify processes and operators according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

C. Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX.

   1. Comply with provisions in ASME B31 Series, "Code for Pressure Piping."
   2. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.

D. ASME Compliance: Comply with ASME B31.9, "Building Services Piping," for materials, products, and installation. 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 01.
1.6 EXTRA MATERIALS

A. Water-Treatment Chemicals: Furnish enough chemicals for initial system startup and for preventive maintenance for one year from date of Substantial Completion.

B. Differential Pressure Meter: For each type of balancing valve and automatic flow control valve, include flowmeter, probes, hoses, flow charts, and carrying case.

PART 2 - PRODUCTS

2.1 COPPER TUBE AND FITTINGS

A. Drawn-Temper Copper Tubing: ASTM B 88, Type L.

B. DWV Copper Tubing: ASTM B 306, Type DWV.

C. Wrought-Copper Fittings: ASME B16.22.

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
3. Basis-of-Design Product: comparable product by one of the following:
   a. Anvil International, Inc.
   b. S. P. Fittings; a division of Star Pipe Products.

4. Grooved-End Copper Fittings: ASTM B 75, copper tube or ASTM B 584, bronze casting.
5. Grooved-End-Tube Couplings: Rigid pattern, unless otherwise indicated; gasketed fitting. Ductile-iron housing with keys matching pipe and fitting grooves, prelubricated EPDM gasket rated for minimum 230 deg F for use with housing, and steel bolts and nuts.

D. Copper or Bronze Pressure-Seal Fittings:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
3. Basis-of-Design Product: or a comparable product by one of the following:
   a. Stadler-Viega.

4. Housing: Copper.
5. O-Rings and Pipe Stops: EPDM.
6. Tools: Manufacturer's special tools.
7. Minimum 200-psig working-pressure rating at 250 deg F.

E. Copper, Mechanically Formed Tee Option: For forming T-branch on copper water tube.

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:
3. Basis-of-Design Product: or a comparable product by one of the following:
   a. T-DRILL Industries Inc.

F. Wrought-Copper Unions: ASME B16.22.

2.2 STEEL PIPE AND FITTINGS

A. Steel Pipe: ASTM A 53/A 53M, black steel with plain ends; type, grade, and wall thickness as indicated in Part 3 "Piping Applications" Article.

B. Cast-Iron Threaded Fittings: ASME B16.4; Classes 125 and 250 as indicated in Part 3 "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 Part 3 "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:
   2. End Connections: Butt welding.
   3. Facings: Raised face.

H. Steel Pressure-Seal Fittings:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
3. Basis-of-Design Product: a comparable product by one of the following:
   a. Victaulic Company of America.

4. Housing: Steel.
5. O-Rings and Pipe Stop: EPDM.
6. Tools: Manufacturer's special tool.
7. Minimum 300-psig working-pressure rating at 230 deg F.

I. Steel Pipe Nipples: ASTM A 733, made of same materials and wall thicknesses as pipe in which they are installed.

2.3 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 thickness or specific material is indicated.
      a. Full-Face Type: For flat-face, Class 125, cast-iron and cast-bronze flanges.
      b. Narrow-Face Type: For raised-face, Class 250, cast-iron and steel flanges.

B. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.

C. Plastic, Pipe-Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer, unless otherwise indicated.

D. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.

E. Brazing Filler Metals: AWS A5.8, BCuP Series, copper-phosphorus alloys for joining copper with copper; or BAg-1, silver alloy for joining copper with bronze or steel.


2.4 TRANSITION FITTINGS

A. Plastic-to-Metal Transition Fittings:
   1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
b. IPEX Inc.
c. KBi.

3. CPVC and PVC one-piece fitting with one threaded brass or copper insert and one Schedule 80 solvent-cement-joint end.

B. Plastic-to-Metal Transition Unions:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   b. IPEX Inc.
   c. KBi.
   d. NIBCO INC.

3. MSS SP-107, CPVC and PVC union. Include brass or copper end, Schedule 80 solvent-cement-joint end, rubber gasket, and threaded union.

2.5 DIELECTRIC FITTINGS

A. Description: Combination fitting of copper-alloy and ferrous materials with threaded, solder-joint, plain, or weld-neck end connections that match piping system materials.

B. Insulating Material: Suitable for system fluid, pressure, and temperature.

C. Dielectric Unions:

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:
   b. Central Plastics Company.
   d. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
   e. Zurn Plumbing Products Group; AquaSpec Commercial Products Division.

3. Factory-fabricated union assembly, for 250-psig minimum working pressure at 180 deg F

D. Dielectric Flanges:
1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   b. Central Plastics Company.
   c. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

3. Factory-fabricated companion-flange assembly, for 150- or 300-psig minimum working pressure as required to suit system pressures.

E. Dielectric-Flange Kits:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Advance Products & Systems, Inc.
   b. Calpico, Inc.
   c. Central Plastics Company.
   d. Pipeline Seal and Insulator, Inc.

3. Companion-flange assembly for field assembly. Include flanges, full-face- or ring-type neoprene or phenolic gasket, phenolic or polyethylene bolt sleeves, phenolic washers, and steel backing washers.

4. Separate companion flanges and steel bolts and nuts shall have 150- or 300-psig minimum working pressure where required to suit system pressures.

F. Dielectric Couplings:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Calpico, Inc.
   b. Lochinvar Corporation.

3. Galvanized-steel coupling with inert and noncorrosive thermoplastic lining; threaded ends; and 300-psig minimum working pressure at 225 deg F.

G. Dielectric Nipples:
1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Perfection Corporation; a subsidiary of American Meter Company.
   b. Precision Plumbing Products, Inc.
   c. Sioux Chief Manufacturing Company, Inc.
   d. Victaulic Company of America.

3. Electroplated steel nipple with inert and noncorrosive, thermoplastic lining; plain, threaded, or grooved ends; and 300-psig minimum working pressure at 225 deg F.

2.6 VALVES

A. Gate, Globe, Check, Ball, and Butterfly Valves: Comply with requirements specified in Division 23 Section "General-Duty Valves for HVAC Piping."

B. Automatic Temperature-Control Valves, Actuators, and Sensors: Comply with requirements specified in Division 23 Section "Instrumentation and Control for HVAC."
   a. Hayward Industrial Products, Inc.
   b. NIBCO INC.
   c. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

2. Body: PVC or CPVC to match piping wafer type for installation between flanges.
4. Seats: PTFE.
5. Handle Style: Locking lever.
6. CWP Rating: Equal to piping service.
7. Maximum Operating Temperature: Equal to piping service.
8. One-, two-, or three-piece PVC or CPVC to match piping.
9. Ends: Socket or flanged.
10. Seats: PTFE.
11. Check Style: Swing or ball type.
12. CWP Rating: Equal to piping service.

C. Bronze, Calibrated-Orifice, Balancing Valves:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

3. Basis-of-Design Product: a comparable product by one of the following:
   a. Armstrong Pumps, Inc.
b. Bell & Gossett Domestic Pump; a division of ITT Industries.
c. Flow Design Inc.
d. Griswold Controls.
e. Taco.

4. Body: Bronze, ball or plug type with calibrated orifice or venturi.
5. Ball: Brass or stainless steel.
6. Plug: Resin.
7. Seat: PTFE.
8. End Connections: Threaded or socket.
10. Handle Style: Lever, with memory stop to retain set position.
12. Maximum Operating Temperature: 250 deg F.

D. Cast-Iron or Steel, Calibrated-Orifice, Balancing Valves:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
3. Basis-of-Design Product: or a comparable product by one of the following:
   a. Armstrong Pumps, Inc.
   b. Bell & Gossett Domestic Pump; a division of ITT Industries.
   c. Flow Design Inc.
   d. Griswold Controls.
   e. Taco.
4. Body: Cast-iron or steel body, ball, plug, or globe pattern with calibrated orifice or venturi.
5. Ball: Brass or stainless steel.
7. Disc: Glass and carbon-filled PTFE.
8. Seat: PTFE.
11. Handle Style: Lever, with memory stop to retain set position.
13. Maximum Operating Temperature: 250 deg F.

E. Diaphragm-Operated, Pressure-Reducing Valves:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
3. Basis-of-Design Product: a comparable product by one of the following:
   a. Amtrol, Inc.
   b. Armstrong Pumps, Inc.
   c. Bell & Gossett Domestic Pump; a division of ITT Industries.
   d. Spence Engineering Company, Inc.
   e. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

4. Body: Bronze or brass.
5. Disc: Glass and carbon-filled PTFE.
7. Stem Seals: EPDM O-rings.
8. Diaphragm: EPT.
9. Low inlet-pressure check valve.
10. Inlet Strainer: removable without system shutdown.
12. Valve Size, Capacity, and Operating Pressure: Selected to suit system in which installed, with operating pressure and capacity factory set and field adjustable.

F. Diaphragm-Operated Safety Valves:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
3. Basis-of-Design Product: a comparable product by one of the following:
   a. Amtrol, Inc.
   b. Armstrong Pumps, Inc.
   c. Bell & Gossett Domestic Pump; a division of ITT Industries.
   d. Spence Engineering Company, Inc.
   e. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

4. Body: Bronze or brass.
5. Disc: Glass and carbon-filled PTFE.
7. Stem Seals: EPDM O-rings.
8. Diaphragm: EPT.
10. Inlet Strainer: removable without system shutdown.
12. Valve Size, Capacity, and Operating Pressure: Comply with ASME Boiler and Pressure Vessel Code: Section IV, and selected to suit system in which installed, with operating pressure and capacity factory set and field adjustable.

G. Automatic Flow-Control Valves:
1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

3. Basis-of-Design Product: a comparable product by one of the following:
   a. Flow Design Inc.
   b. Griswold Controls.

4. Body: Brass or ferrous metal.
5. Piston and Spring Assembly: corrosion resistant tamper proof, self cleaning, and removable.
6. Combination Assemblies: Include bronze or brass-alloy ball valve.
7. Identification Tag: Marked with zone identification, valve number, and flow rate.
8. Size: Same as pipe in which installed.
9. Performance: Maintain constant flow, plus or minus 5 percent over system pressure fluctuations.

11. Maximum Operating Temperature: 200 deg F.

2.7 AIR CONTROL 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:

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Amtrol, Inc.
2. Armstrong Pumps, Inc.
3. Bell & Gossett Domestic Pump; a division of ITT Industries.
4. Taco.

C. Manual Air Vents:

1. Body: Bronze.
2. Internal Parts: Nonferrous.
3. Operator: Screwdriver or thumbscrew.
4. Inlet Connection: NPS 1/2.
7. Maximum Operating Temperature: 225 deg F.

D. Automatic Air Vents:

1. Body: Bronze or cast iron.
2. Internal Parts: Nonferrous.
4. Inlet Connection: NPS 1/2.
7. Maximum Operating Temperature: 240 deg F.

E. Diaphragm-Type Expansion Tanks:
   1. Tank: Welded steel, rated for 125-psig working pressure and 375 deg F maximum operating temperature. Factory test with taps fabricated and supports installed and labeled according to ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.
   2. Diaphragm: Securely sealed into tank to separate air charge from system water to maintain required expansion capacity.

F. Tangential-Type Air Separators:
   1. Tank: Welded steel; ASME constructed and labeled for 125-psig minimum working pressure and 375 deg F maximum operating temperature.
   2. Air Collector Tube: Perforated stainless steel, constructed to direct released air into expansion tank.
   3. Tangential Inlet and Outlet Connections: Threaded for NPS 2 and smaller; flanged connections for NPS 2-1/2 and larger.
   5. Size: Match system flow capacity.

G. Air Purgers:
   1. Body: Cast iron with internal baffles that slow the water velocity to separate the air from solution and divert it to the vent for quick removal.
   3. Maximum Operating Temperature: 250 deg F.

2.8 CHEMICAL TREATMENT
A. Bypass Chemical Feeder: Welded steel construction; 125-psig working pressure; 5-gal. capacity; with fill funnel and inlet, outlet, and drain valves.
   1. Chemicals: Specially formulated, based on analysis of makeup water, to prevent accumulation of scale and corrosion in piping and connected equipment.
B. Ethylene and Propylene Glycol: Industrial grade with corrosion inhibitors and environmental-stabilizer additives for mixing with water in systems indicated to contain antifreeze or glycol solutions.

2.9 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 and smaller; flanged ends for NPS 2-1/2 and larger.
3. **Strainer Screen**: 40 60-mesh startup strainer, and perforated stainless-steel basket with 50 percent free area. **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. T-Pattern Strainers:**

1. **Body**: Ductile or malleable iron with removable access coupling and end cap for strainer maintenance.
2. **End Connections**: Grooved ends.
3. **Strainer Screen**: 40-mesh startup strainer, and perforated stainless-steel basket with 57 percent free area.
4. **CWP Rating**: 750 psig.

**D. Stainless-Steel Bellow, Flexible Connectors:**

1. **Body**: Stainless-steel bellows with woven, flexible, bronze, wire-reinforcing protective jacket.
2. **End Connections**: Threaded or flanged to match equipment connected.
3. **Performance**: Capable of 3/4-inch misalignment.
4. **CWP Rating**: 150 psig.
5. **Maximum Operating Temperature**: 250 deg F.

**E. 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.

**F. Expansion fittings are specified in Division 23 Section "Expansion Fittings and Loops for HVAC Piping."**
PART 3 - EXECUTION

3.1 PIPING APPLICATIONS

A. Hot-water heating and chilled water piping, aboveground, NPS 2 and smaller, the following:
   1. Type L, drawn-temper copper tubing, wrought-copper fittings, and soldered joints.

B. Hot-water heating and chilled piping, aboveground, NPS 2-1/2 and larger, range shall be the following:
   1. Type L drawn-temper copper tubing, wrought-copper fittings, and soldered joints.
   2. Schedule 40 steel pipe, wrought-steel fittings and wrought-cast or forged-steel flanges and flange fittings, and welded and flanged joints.

C. Hot-water heating piping installed belowground and within slabs shall be:
   1. Type K, annealed-temper copper tubing, wrought-copper fittings, and soldered joints. Use the fewest possible joints.

D. Makeup-water piping installed aboveground shall be the following:
   1. Type L drawn-temper copper tubing, wrought-copper fittings, and soldered joints.

E. Condensate-Drain Piping: Type M, drawn-temper copper tubing, wrought-copper fittings, and soldered joints.

F. Air-Vent Piping:
   1. Inlet: Same as service where installed with metal-to-plastic transition fittings for plastic piping systems according to the piping manufacturer's written instructions.
   2. Outlet: Type K, annealed-temper copper tubing with soldered or flared joints.

G. 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 the piping manufacturer's written instructions.

3.2 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 throttling-duty 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; and 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.

3.3 PIPING INSTALLATIONS

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicate piping locations and arrangements if such were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.

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 Division 23 Section "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 strainers on inlet side of each control valve, pressure-reducing valve, solenoid valve, in-line pump, and elsewhere as indicated. Install NPS 3/4 nipple and ball valve in blowdown connection of strainers NPS 2 and larger. Match size of strainer blowoff connection for strainers smaller than NPS 2.

T. Install expansion loops, expansion joints, anchors, and pipe alignment guides as specified in Division 23 Section "Expansion Fittings and Loops for HVAC Piping."

U. Identify piping as specified in Division 23 Section "Identification for HVAC Piping and Equipment."

3.4 HANGERS AND SUPPORTS

A. Hanger, support, and anchor devices are specified in Division 23 Section "Hangers and Supports for HVAC Piping and Equipment." Comply with the following requirements for maximum spacing of supports.

B. Install the following pipe attachments:

1. Adjustable steel clevis hangers for individual horizontal piping less than 20 feet 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.

C. Install hangers for steel piping with the following maximum spacing and minimum rod sizes:

1. NPS ¾ - 1-1/2: Maximum span, 7 feet; minimum rod size, 3/8 inch.
2. NPS 2: Maximum span, 10 feet; minimum rod size, 3/8 inch.
3. NPS 2-1/2: Maximum span, 11 feet; minimum rod size, 1/2 inch.
4. NPS 3: Maximum span, 12 feet; minimum rod size, 1/2 inch.
5. NPS 3-1/2: Maximum span, 13 feet; minimum rod size, 1/2 inch.
6. NPS 4: Maximum span, 14 feet; minimum rod size, 5/8 inch.
7. NPS 5: Maximum span, 16 feet; minimum rod size, 5/8 inch.
8. NPS 6: Maximum span, 17 feet; minimum rod size, 3/4 inch.

D. Install hangers for drawn-temper copper tubing with the following maximum spacing and minimum rod sizes:

1. NPS 3/4: Maximum span, 5 feet; minimum rod size, 3/8 inch.
2. NPS 1: Maximum span, 6 feet; minimum rod size, 3/8 inch.
3. NPS 1-1/4: Maximum 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, 1/2 inch.
7. NPS 3: Maximum span, 10 feet; minimum rod size, 1/2 inch.

E. Support vertical runs at roof, at each floor, and at 10-foot intervals between floors.

3.5 PIPE JOINT CONSTRUCTION

A. Join pipe and fittings according to the following requirements and Division 23 Sections specifying piping systems.

B. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

C. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

D. Soldered Joints: Apply ASTM B 813, water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook," using lead-free solder alloy complying with ASTM B 32.


F. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:

1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.


H. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.
I. Plastic Piping Solvent-Cemented Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:

1. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.
2. CPVC Piping: Join according to ASTM D 2846/D 2846M Appendix.
3. PVC Pressure Piping: Join ASTM D 1785 schedule number, PVC pipe and PVC socket fittings according to ASTM D 2672. Join other-than-schedule number PVC pipe and socket fittings according to ASTM D 2855.
4. PVC Nonpressure Piping: Join according to ASTM D 2855.

J. Fiberglass Bonded Joints: Prepare pipe ends and fittings, apply adhesive, and join according to pipe manufacturer's written instructions.

K. Grooved Joints: Assemble joints with coupling and gasket, lubricant, and bolts. Cut or roll grooves in ends of pipe based on pipe and coupling manufacturer's written instructions for pipe wall thickness. Use grooved-end fittings and rigid, grooved-end-pipe couplings.

L. Mechanically Formed, Copper-Tube-Outlet Joints: Use manufacturer-recommended tool and procedure, and brazed joints.

M. Pressure-Sealed Joints: Use manufacturer-recommended tool and procedure. Leave insertion marks on pipe after assembly.

3.6 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. Manual vents at heat-transfer coils and elsewhere as required for air venting.

C. Install tangential air separator in pump suction. Install blowdown piping with gate or full-port ball valve; extend full size to nearest floor drain.

D. Install bypass chemical feeders in each hydronic system where indicated, in upright position with top of funnel not more than 48 inches above the floor. Install feeder in minimum NPS 3/4 bypass line, from main with full-size, full-port, ball valve in the main between bypass connections. Install NPS 3/4 pipe from chemical feeder drain, to nearest equipment drain and include a full-size, full-port, ball valve.

3.7 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 according to Division 23 Section "Meters and Gages for HVAC Piping."

3.8 CHEMICAL TREATMENT

A. Perform an analysis of makeup water to determine type and quantities of chemical treatment needed to keep system free of scale, corrosion, and fouling, and to sustain the following water characteristics:

1. pH: 9.0 to 10.5 Insert pH.
2. "P" Alkalinity: 100 to 500 ppm.
3. Boron: 100 to 200 ppm.
4. Chemical Oxygen Demand: Maximum 100 ppm one of first five subparagraphs below.
   a. Sodium Nitrate: 1000 to 1500 ppm
   b. Molybdate: 100 to 300 ppm
   c. Chromate: 200 to 300 ppm.
   d. Sodium Nitrate Plus Molybdate: 100 to 200 ppm each.
   e. Chromate Plus Molybdate: 50 to 100 ppm each.
5. Total Suspended Solids: Maximum 10 ppm
6. Free Caustic Alkalinity: Maximum 20 ppm

B. Fill system with fresh water and add liquid alkaline compound with emulsifying agents and detergents to remove grease and petroleum products from piping. Circulate solution for a minimum of 24 hours, drain, clean strainer screens, and refill with fresh water.

C. Add initial chemical treatment and maintain water quality in ranges noted above for the first year of operation.

3.9 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 "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
SECTION 233000
METAL DUCTWORK

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Single-wall ducts and fittings.
   2. Sheet metal materials
   3. Sealants and gaskets.
   4. Hangers and supports.

B. Related Sections:
   1. Division 23 Section "Testing, Adjusting, and Balancing for HVAC" for testing, adjusting, and balancing requirements for metal ducts.
   2. Division 23 Section "Nonmetal Ducts" for fibrous-glass ducts, thermoset fiber-reinforced plastic ducts, thermoplastic ducts, PVC ducts, and concrete ducts.
   3. Division 23 Section "HVAC Casings" for factory- and field-fabricated casings for mechanical equipment.
   4. Division 23 Section "Air Duct Accessories" for dampers, sound-control devices, duct-mounting access doors and panels, turning vanes, and flexible ducts.

1.2 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. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1-2010.

1.3 SUBMITTALS

A. Product Data: For each type of the following products:
   1. Liners and adhesives.
   2. Sealants and gaskets.

B. LEED Submittals (NOT REQUIRED):
C. 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.

D. 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. Sprinklers.
   e. Access panels.
   f. Perimeter moldings.

E. Field quality-control reports.

1.4 QUALITY ASSURANCE

A. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1-2010, Section 5 - "Systems and Equipment" and Section 7 - "Construction and System Start-Up."

B. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1-2010, Section 6.4.4 - "HVAC System Construction and Insulation."
PART 2 - PRODUCTS

2.1 SINGLE-WALL RECTANGULAR DUCTS AND FITTINGS

A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" based on indicated static-pressure class unless otherwise indicated.

B. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 1-4, "Transverse (Girth) Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

C. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 1-5, "Longitudinal Seams - Rectangular Ducts," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

D. Elbows, Transitions, Offsets, Branch Connections, and Other Duct Construction: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 2, "Fittings and Other Construction," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

2.2 SHEET METAL MATERIALS

A. General Material Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.

B. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.
   1. Galvanized Coating Designation: G60.
   2. Finishes for Surfaces Exposed to View: Mill phosphatized.

C. PVC-Coated, Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.
   1. Galvanized Coating Designation: G60.
   2. Minimum Thickness for Factory-Applied PVC Coating: 4 mils thick on sheet metal surface of ducts and fittings exposed to corrosive conditions, and minimum 1 mil thick on opposite surface.
   3. Coating Materials: Acceptable to authorities having jurisdiction for use on ducts listed and labeled by an NRTL for compliance with UL 181, Class 1.

D. Carbon-Steel Sheets: Comply with ASTM A 1008/A 1008M, with oiled, matte finish for exposed ducts.
E. Stainless-Steel Sheets: Comply with ASTM A 480/A 480M, Type 304 or 316, as indicated in the "Duct Schedule" Article; cold rolled, annealed, sheet. Exposed surface finish shall be No. 2B, No. 2D, No. 3, or No. 4 as indicated in the "Duct Schedule" Article.

F. Aluminum Sheets: Comply with ASTM B 209 Alloy 3003, H14 temper; with mill finish for concealed ducts, and standard, one-side bright finish for duct surfaces exposed to view.

G. Factory- or Shop-Applied Antimicrobial Coating:
   1. Apply to the surface of sheet metal that will form the interior surface of the duct. An untreated clear coating shall be applied to the exterior surface.
   2. Antimicrobial compound shall be tested for efficacy by an NRTL and registered by the EPA for use in HVAC systems.
   3. Coating containing the antimicrobial compound shall have a hardness of 2H, minimum, when tested according to ASTM D 3363.
   4. Surface-Burning Characteristics: Maximum flame-spread index of 25 and maximum smoke-developed index of 50 when tested according to UL 723; certified by an NRTL.
   5. Shop-Applied Coating Color: Black.
   6. Antimicrobial coating on sheet metal is not required for duct containing liner treated with antimicrobial coating.

H. Reinforcement Shapes and Plates: ASTM A 36/A 36M, 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.

I. 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.

2.3 SEALANT AND GASKETS
A. General Sealant and Gasket Requirements: Surface-burning characteristics for sealants and gaskets shall be a maximum flame-spread index of 25 and a maximum smoke-developed index of 50 when tested according to UL 723; certified by an NRTL.

B. Two-Part Tape Sealing System:
   1. Tape: Woven cotton fiber impregnated with mineral gypsum and modified acrylic/silicone activator to react exothermically with tape to form hard, durable, airtight seal.
   2. Tape Width: 3 inches.
   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, use sealant that has a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

C. Water-Based Joint and Seam Sealant:

1. Application Method: Brush on.
2. Solids Content: Minimum 65 percent.
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. Solvent-Based Joint and Seam Sealant:

1. Application Method: Brush on.
2. Base: Synthetic rubber resin.
4. Solids Content: Minimum 60 percent.
5. Shore A Hardness: Minimum 60.
7. Mold and mildew resistant.
8. For indoor applications, use sealant that has a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
9. VOC: Maximum 395 g/L.
10. Maximum Static-Pressure Class: 10-inch wg, positive or negative.
11. Service: Indoor or outdoor.
12. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum sheets.

E. Flanged Joint Sealant: Comply with ASTM C 920.

2. Type: S.
3. Grade: NS.
5. Use: O.
6. For indoor applications, use sealant that has a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

F. Flange Gaskets: Butyl rubber, neoprene, or EPDM polymer with polyisobutylene plasticizer.

G. 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.
3. Double-lipped, EPDM O-ring seal, mechanically fastened to factory-fabricated couplings and fitting spigots.

2.4 HANGERS AND SUPPORTS

A. Hanger Rods for Noncorrosive Environments: Cadmium-plated steel rods and nuts.
B. Hanger Rods for Corrosive Environments: Electrogalvanized, all-thread rods or galvanized rods with threads painted with zinc-chromate primer after installation.
C. Strap and Rod Sizes: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 4-1, "Rectangular Duct Hangers Minimum Size," and Table 4-2, "Minimum Hanger Sizes for Round Duct."
D. Steel Cables for Galvanized-Steel Ducts: Galvanized steel complying with ASTM A 603.
E. Steel Cables for Stainless-Steel Ducts: Stainless steel complying with ASTM A 492.
F. 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.
G. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.
H. Trapeze and Riser Supports:
   3. Supports for Aluminum Ducts: Aluminum or galvanized steel coated with zinc chromate.

PART 3 - EXECUTION

3.1 DUCT INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of duct system. Indicated duct locations, configurations, and arrangements were used to size ducts and calculate friction loss for air-handling equipment sizing and for other design considerations. Install duct systems as indicated unless deviations to layout are approved on Shop Drawings and Coordination Drawings.
B. Install ducts according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" unless otherwise indicated.
C. Install 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 Division 23 Section "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 "Duct Cleanliness for New Construction Guidelines."

3.2 DUCT SEALING

A. Seal ducts for duct static-pressure, seal classes, and leakage classes specified in "Duct Schedule" Article according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

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. Outdoor, Return-Air Ducts: Seal Class C.
5. Unconditioned Space, Supply-Air Ducts in Pressure Classes 2-Inch wg and Lower: Seal Class B.
6. Unconditioned Space, Supply-Air Ducts in Pressure Classes Higher Than2-Inch wg: Seal Class A.
7. Unconditioned Space, Exhaust Ducts: Seal Class C.
8. Unconditioned Space, Return-Air Ducts: Seal Class B.
9. Conditioned Space, Supply-Air Ducts in Pressure Classes 2-Inch wg and Lower: Seal Class C.
10. Conditioned Space, Supply-Air Ducts in Pressure Classes Higher Than 2-Inch wg: Seal Class B.
11. Conditioned Space, Exhaust Ducts: Seal Class B.
12. Conditioned Space, Return-Air Ducts: Seal Class C.

3.3 HANGER AND SUPPORT INSTALLATION

A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 4, "Hangers and Supports."

B. Building Attachments: Concrete inserts, powder-actuated fasteners, or structural-steel fasteners appropriate for construction materials to which hangers are being attached.

1. Where practical, install concrete inserts before placing concrete.
2. Install powder-actuated concrete fasteners after concrete is placed and completely cured.
3. Use powder-actuated concrete fasteners for standard-weight aggregate concretes or for slabs more than 4 inches 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 4-1, "Rectangular Duct Hangers Minimum Size," and Table 4-2, "Minimum Hanger Sizes for Round Duct," for maximum hanger spacing; install hangers and supports within 24 inches 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.

3.4 CONNECTIONS

A. Make connections to equipment with flexible connectors complying with Division 23 Section "Air Duct Accessories."

B. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for branch, outlet and inlet, and terminal unit connections.
3.5  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 Division 09 painting Sections.

3.6  FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Leakage Tests:

2. Test the following systems:
   a. Ducts with a Pressure Class of 2-Inch wg or Higher: 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.

3.7  DUCT CLEANING

A. Clean new 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 Division 23 Section "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.
5. Return-air ducts, dampers, actuators, and turning vanes except in ceiling plenums and mechanical equipment rooms.
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.
3.8 START UP

A. Air Balance: Comply with requirements in Division 23 Section "Testing, Adjusting, and Balancing for HVAC."

3.9 DUCT SCHEDULE

A. Fabricate ducts with galvanized sheet steel except as otherwise indicated and as follows:

B. Ducts:

1. Pressure requirements:
   a. Pressure Class: Positive 3-inch w.g., Negative 2-inch w.g.
   b. Minimum SMACNA Seal Class: A.
   c. SMACNA Leakage Class for Rectangular: 6.
   d. SMACNA Leakage Class for Round and Flat Oval: 6.

C. Intermediate Reinforcement:

2. PVC-Coated Ducts:
   a. Exposed to Airstream: Match duct material.
   b. Not Exposed to Airstream: Match duct material.

D. Elbow Configuration:

1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-2, "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 2-3, "Vanes and Vane Runners," and Figure 2-4, "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 2-3, "Vaness and Vane Runners," and Figure 2-4, "Vane Support in Elbows."

2. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-2, "Rectangular Elbows."
   a. Radius Type RE 1 with minimum 1.5 radius-to-diameter ratio.
   b. 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 2-3, "Vaness and Vane Runners," and Figure 2-4, "Vane Support in Elbows."

3. Round Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-3, "Round Duct Elbows."
   a. Minimum Radius-to-Diameter Ratio and Elbow Segments: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 3-1, "Mitered Elbows." Elbows with less than 90-degree change of direction have proportionately fewer segments.
      1) 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.
   b. Round Elbows, 12 Inches and Smaller in Diameter: Stamped or pleated.
   c. Round Elbows, 14 Inches and Larger in Diameter: Standing seam.

E. Branch Configuration:

1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-6, "Branch Connections."
   a. Rectangular Main to Rectangular Branch: 45-degree entry.
   b. Rectangular Main to Round Branch: Spin in.

2. Round: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-4, "90 Degree Tees and Laterals," and Figure 3-5, "Conical Tees." 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.
SECTION 235218
CONDENSING BOILERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS
A. Drawings and general provisions of the Contract apply to this Section, including General and Supplementary Conditions and Division 01 Specification Sections.

1.2 SUMMARY
A. This Section includes packaged, factory-fabricated and assembled, gas-fired, fire-tube condensing boilers, trim and accessories for generating hot water.

1.3 SUBMITTALS
A. Product Data: Include performance data, operating characteristics, furnished specialties and accessories.
   1. Prior to flue vent installation, engineered calculations and drawings must be submitted to Architect/Engineer to thoroughly demonstrate that size and configuration conform to recommended size, length and footprint for each submitted boiler.
B. Efficiency Curves: At a minimum, submit efficiency curves for 100%, 50% and 7% input firing rates at incoming water temperatures ranging from 80°F to 160°F.
C. Pressure Drop Curve. Submit pressure drop curve for the following flow ranges per designated capacities below
   1. 850 MBH: 25-150 GPM
   2. If submitted material is different from that of the design basis, boiler manufacture shall incur all costs associated with reselection of necessary pumps. Possible differences include, but are not limited to, the pump type, pump pad size, electrical characteristics and piping changes.
D. Shop Drawings: For boilers, boiler trim and accessories include:
   1. Plans, elevations, sections, details and attachments to other work
   2. Wiring Diagrams for power, signal and control wiring
E. Source Quality Control Test Reports: Reports shall be included in submittals.
F. Field Quality Control Test Reports: Reports shall be included in submittals.
G. Operation and Maintenance Data: Data to be included in boiler emergency, operation and maintenance manuals.

H. Warranty: Standard warranty specified in this Section

I. Other Informational Submittals:
   1. ASME Stamp Certification and Report: Submit "H" stamp certificate of authorization, as required by authorities having jurisdiction, and document hydrostatic testing of piping external to boiler.

1.4 QUALITY ASSURANCE

A. Electrical Components, Devices and Accessories: Boilers must be 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. I=B=R Performance Compliance: Condensing boilers must be rated in accordance with applicable federal testing methods and verified by AHRI as capable of achieving the energy efficiency and performance ratings as tested within prescribed tolerances.

C. ASME Compliance: Condensing boilers must be constructed in accordance with ASME Boiler and Pressure Vessel Code, Section IV “Heating Boilers”.

D. ASHRAE/IESNA 90.1 Compliance: Boilers shall have minimum efficiency according to "Gas and Oil Fired Boilers - Minimum Efficiency Requirements."


F. UL Compliance: Boilers must be tested for compliance with UL 795, "Commercial-Industrial Gas Heating Equipment." Boilers shall be listed and labeled by a testing agency acceptable to authorities having jurisdiction.

1.5 COORDINATION

A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement and formwork requirements are specified in Division 03.

1.6 WARRANTY

A. Standard Warranty: Boilers shall include manufacturer's standard form in which manufacturer agrees to repair or replace components of boilers that fail in materials or workmanship within specified warranty period.
1. Warranty Period for Fire-Tube Condensing Boilers
   a. The pressure vessel/heat exchanger shall carry a 15-year from shipment, non-prorated, limited warranty against any failure due to condensate corrosion, thermal stress, mechanical defects or workmanship.
   b. The burner shall be conditionally guaranteed against any failure for (5) five years from shipment.
   c. Manufacturer labeled control panels are conditionally warranted against failure for (3) three years from shipment.
   d. All other components, with the exception of the igniter, flame detector and \( \text{O}_2 \) sensor, are conditionally guaranteed against any failure for (2) two years from shipment.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. This specification is based on the boilers as manufactured by Lockinvar. AERCO Benchmark 1000 is an acceptable equivalent. Other equivalent units and manufacturers must meet all performance criteria and will be considered upon prior approval.

B. The BOILER shall be a LOCHINVAR FTXL Model FTX850-N having a modulating input rating of 850,000 Btu/Hr, an output of 824,500 Btu/hr and shall be operated on natural gas. The BOILER shall be capable of following performance. Maximum unit dimensions shall be: 33 inches Length, 26-1/4 inches Width and 53-1/2 inches Height. Maximum operating (wet) unit weight shall be no more than 570 pounds.

   1. Turndown ratio: 7:1
   2. Maximum input = 850.0 MBH
   3. Minimum input = 121.5 MBH

C. The BOILER shall bear the ASME "H" stamp for 160 psi working pressure and shall be National Board listed. The BOILER shall have a fully welded, stainless steel, fire tube heat exchanger. Multiple pressure vessels in a single enclosure are not acceptable. There shall be no banding material, bolts, gaskets or "O" rings in the pressure vessel construction. The heat exchanger shall be designed for a single-pass water flow to limit the water side pressure drop. Pressure drop shall be no greater than 2.2 psi at 75 GPM. The condensate collection basin shall be constructed of welded stainless steel. The complete heat exchanger assembly shall carry a ten (10) year limited warranty. The heat exchanger shall have a volume of no less than 15.9 gallons.

D. The BOILER shall be certified and listed by C.S.A. International under the latest edition of the harmonized ANSI Z21.13 test standard for the U.S. and Canada. The BOILER shall comply with the energy efficiency requirements of the latest edition of ASHRAE 90.1 and the minimum efficiency requirements of the latest edition of the AHRI BTS-2000 Standard as defined by the Department of Energy in 10 CFR Part 431. The BOILER shall operate at a minimum of 97% Combustion and Thermal Efficiency at full fire as registered with AHRI. The BOILER shall be certified for indoor installation.
E. The BOILER shall be constructed with a heavy gauge steel jacket assembly, primed and pre-painted on both sides. The combustion chamber shall be sealed and completely enclosed, independent of the outer jacket assembly, so that integrity of the outer jacket does not affect a proper seal. A burner/flame observation port shall be provided for observing the burner flame and combustion chamber. The burner shall be a premix design constructed of high temperature stainless steel with a woven Fecralloy outer covering to provide smooth operation at all modulating firing rates. The BOILER shall be supplied with a negative pressure regulation gas valve and be equipped with a pulse width modulation blower system to precisely control the fuel/air mixture to the burner. The BOILER shall operate in a safe condition with gas supply pressures as low as 4 inches of water column. The burner flame shall be ignited by direct spark ignition with flame monitoring via a flame sensor.

F. The BOILER shall utilize a 24 VAC control circuit and components. The control system shall have a factory installed display for boiler set-up, boiler status, and boiler diagnostics. All components shall be easily accessed and serviceable from the front and top of the jacket. The BOILER shall be equipped with a temperature/pressure gauge; high limit temperature control with manual reset; ASME certified pressure relief valve set for 50 psi (standard); outlet water temperature sensor with a dual thermistor to verify accuracy; system supply water temperature sensor; outdoor air sensor, flue temperature sensor with dual thermistor to verify accuracy; low water cut off with manual reset, blocked drain switch and a condensate trap for the heat exchanger condensate drain.

G. The BOILER shall feature the “SMART SYSTEM™” control which is standard and factory installed with 128 x 128 resolution display, password security, outdoor air reset, pump delay with freeze protection, pump exercise, ramp delay featuring six steps, domestic hot water prioritization with limiting capabilities, USB drive for simple uploading of parameters and a PC port connection for connection to a local computer for programming and trending. A secondary operating control that is field mounted outside or inside the appliance is not acceptable. The BOILER shall have alarm contacts for any failure, runtime contacts and data logging of runtime at given modulation rates, ignition attempts and ignition failures. The BOILER shall have a built-in “Cascade” with leader redundancy to sequence and rotate while maintaining modulation of up to eight boilers of different Btu inputs without utilization of an external controller. The internal “Cascade” function shall be capable of lead-lag, efficiency optimization, front-end loading, and rotation of lead boiler every 24 hours. The BOILER shall be capable of remote communication via optional CON-X-US™ Remote Connectivity with the capability of historical trending and sending text message or email alerts to notify the caretaker of a boiler alarm and remote programming of onboard boiler control. The BOILER shall be capable of controlling an isolation valve (offered by manufacturer) during heating operation and rotation of open valves in standby operation for full flow applications. The control must have optional capability to communicate via Modbus protocol with a minimum of 46 readable points. The BOILER shall have an optional gateway device which will allow integration with LON or BacNet protocols.

H. The “SMART SYSTEM™” control shall increase fan speed to boost flame signal when a weak flame signal is detected during normal operation. A 0-10 VDC output signal shall control a variable speed boiler pump (offered by manufacturer) to keep a fixed Delta T across the boiler regardless of the modulation rate. The BOILER shall have the capability to receive a 0-10 VDC input signal from a variable speed system pump to anticipate changes in system heat load in order to prevent flow related issues such as erratic temperature cycling.

I. The BOILER shall be equipped with two terminal strips for electrical connection. A low voltage connection board with 46 connection points for safety and operating controls, i.e., Alarm Contacts, Runtime Contacts, Louver Proving Switch, Tank Thermostat, Domestic Hot Water Building Recirculation Pump Contacts, Domestic Hot Water Building Recirculation Temperature Sensor Contacts, Remote Enable/Disable, System Supply Temperature Sensor, Outdoor Temperature Sensor, Tank Temperature Sensor, Modbus Building Management System Signal and Cascade Control Circuit. A high voltage terminal strip shall be provided for Supply voltage. Supply voltage shall be 120 volt / 60 hertz / single
phase on all models. The high voltage terminal strip plus integral relays are provided for independent pump control of the System pump, the Boiler pump and the Domestic Hot Water pump.

J. The BOILER shall be installed and vented with a Vent system with Vertical rooftop Exhaust and Horizontal sidewall Air Intake with the combustion air intake in a different pressure zone. The flue shall be Category IV approved material constructed of PVC, CPVC, Polypropylene or Stainless Steel. A separate pipe shall supply combustion air directly to the boiler from the outside in a different pressure zone from that of the exhaust vent. The boiler’s total combined air intake length shall not exceed 100 equivalent feet. The boiler’s total combined exhaust venting length shall not exceed 100 equivalent feet.

K. The BOILER shall have an independent laboratory rating for Oxides of Nitrogen (NOx) to meet the requirements of South Coast Air Quality Management District in Southern California and the requirements of Texas Commission on Environmental Quality. The manufacturer shall verify proper operation of the burner, all controls and the integrity of the heat exchanger by connection to water and venting for a factory fire test prior to shipping.

L. The BOILER shall operate at altitudes up to 4,500 feet above sea level without additional parts or adjustments. The BOILER shall be certified for operation at elevations of 4,500 feet, and above, by a 3rd party organization.

M. The BOILER shall be suitable for use with polypropylene glycol up to a 50% concentration. The de-rate associated with the glycol will vary per glycol manufacturer.

2.2 CONTROLS

A. Provide a Lynxspring Edge 534 controller. The controller shall be native Niagara 4 framework with thirty (34) I/O connections onboard. The boilers shall be integrated via BACnet. The pumps shall be integrated via modbus and enabled by digital output.

B. The Niagara controller shall have a graphical interface that can be accessed over the web with a standard browser. The Niagara 4 framework shall be based on HTML5 and shall be accessible through a cell phone, tablet, etc. Graphics provided are modern, active graphics. The system shall provide trending and email/text alarms on critical functions.

C. Sequence of Operations:
1. Provide graphical user interface to include system overview homepage and animated graphics pages for central plant components and zone pumps. User interface shall be accessible through a standard Web browser.
2. **Heating:** The system will be indexed to Heating mode based on outside air temperature or manually through the BMS graphical user interface. The system Warm Weather shut down mode shall be active when the outside air temperature sensor reflects an outside air temperature above 65F.
3. During Heating mode, the controller shall index the boilers to the Enabled state via the Master boiler in the local Smart System Controls boiler cascade. Boiler staging, Lead-Lag alternation, combustion control, and outdoor reset control is to be provided by the manufacturer onboard Smart System controls. Boiler Primary pumps are to be powered and energized by the boiler manufacturer onboard Smart System controls.
4. Outdoor Reset Control: Outdoor reset shall be managed via local settings at the Master boiler. Outdoor reset setpoints shall be accessible through the boiler BACnet interface at the customer graphical user interface. Outdoor reset parameters are to be set according to the following:
a. OAT = 25F - HWS TEMP = 190F
b. OAT = 65F - HWS TEMP = 120F

5. Boilers are to be networked to the central plant control using the BACnet MSTP protocol. Boiler alarms, status and setpoints shall be accessible via the BACnet interface to the central plant controller.

6. Zone Pumps Control: If zone demand is present, individual zone circulator pumps shall be enabled when outside air temperature is below the (configurable) warm weather shut down setpoint. Specified circulator pumps provide onboard dry contact relay for running status. Where the circulator pump does not provide a status relay onboard, a standard Current Transformer shall be provided. The circulator pump status shall be communicated to the central plant controller. On a failure of a zone pump to engage on a call for heat, an alarm shall be generated at the central plant controller interface.
7. **POINTS LIST**

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**TOTALS**

|               | 3 | 13 | 6 |
D. Control system supplier shall be by B. J. Terroni Co., Inc., 3190 Tucker Road, Bensalem, PA 19020, 215-636-3600. Other equivalent control suppliers, installers and manufacturers must meet all performance criteria and will be considered upon prior approval.

2.3 ELECTRICAL POWER
A. Controllers, Electrical Devices and Wiring: Electrical devices and connections are specified in Division 26 sections.
B. Single-Point Field Power Connection: Factory-installed and factory-wired switches, motor controllers, transformers and other electrical devices shall provide a single-point field power connection to the boiler.
C. Electrical Characteristics: See schedule sheet on drawings.

2.4 VENTING
A. The exhaust vent must be UL Listed for use with Category II, III and IV appliances and compatible with operating temperatures up to 230°F, condensing flue gas service. UL-listed vents of Polypropylene, CPVC and Al 29-4C stainless steel must be used with boilers.
B. The minimum exhaust vent duct size for each boiler is six-inch diameter.
C. Combustion-Air Intake: Boilers shall be capable of drawing combustion air from the outdoors via a metal or CPVC duct connected between the boiler and the outdoors.
D. The minimum ducted combustion air duct size for each boiler is 4-inch diameter.
E. Common vent and common combustion air must be an available option for boiler installation. Consult manufacturer for common vent and combustion air sizing.
F. Follow guidelines specified in manufacturer’s venting guide.

2.5 SOURCE QUALITY CONTROL
A. Burner and Hydrostatic Test: Factory adjust burner to eliminate excess oxygen, carbon dioxide, oxides of nitrogen emissions and carbon monoxide in flue gas, and to achieve combustion efficiency. Perform hydrostatic testing.
B. Test and inspect factory-assembled boilers, before shipping, according to ASME Boiler and Pressure Vessel Code.
   1. If boilers are not factory assembled and fire-tested, the local vendor is responsible for all field assembly and testing.
C. Allow Owner access to source quality-control testing of boilers. Notify Architect fourteen days in advance of testing.
PART 3 - EXECUTION

3.1  EXAMINATION

A. Before boiler installation examine roughing-in for concrete equipment bases, anchor-bolt sizes and locations and piping and electrical connections to verify actual locations, sizes and other conditions affecting boiler performance, maintenance and operations.

   1. Final boiler locations indicated on Drawings are approximate. Determine exact locations before roughing-in for piping and electrical connections.

B. Examine mechanical spaces for suitable conditions where boilers will be installed.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2  BOILER INSTALLATION

A. Install boilers level on concrete bases. See drawings for more detail.

B. Install gas-fired boilers according to NFPA 54.

C. Assemble and install boiler trim.

D. Install electrical devices furnished with boiler but not specified to be factory mounted.

E. Install control wiring to field-mounted electrical devices.

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 boiler to permit service and maintenance.

C. Install piping from equipment drain connection to nearest floor drain. Piping shall be at least full size of connection. Provide an isolation valve if required.

D. Connect gas piping to boiler gas-train inlet with unions. Piping shall be at least full size of gas train connection. Provide a reducer if required.

E. Connect hot-water piping to supply and return boiler tappings with shutoff valve and union or flange at each connection.

F. Install piping from safety relief valves to nearest floor drain.

G. Boiler Venting

   1. Install flue venting kit and combustion-air intake.

   2. Connect venting full size to boiler connections.
H. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."

I. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

3.4 FIELD QUALITY CONTROL

A. 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.
   2. Obtain all required permits.
   3. Complete all required State of Pennsylvania forms for boiler installations.

B. Tests and Inspections
   1. Perform installation and startup checks according to manufacturer's written instructions.
   2. Perform hydrostatic test. Repair leaks and retest until no leaks exist.
   3. Start units to confirm proper motor rotation and unit operation. Adjust air-fuel ratio and combustion.
   4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
      a. Check and adjust initial operating set points and high- and low-limit safety set points of fuel supply, water level and water temperature.
      b. Set field-adjustable switches and circuit-breaker trip ranges as indicated.

C. Remove and replace malfunctioning units and retest as specified above.

D. Occupancy Adjustments: When requested within 2 months of date of Substantial Completion, provide on-site assistance adjusting system to suit actual occupied conditions. Provide up to two visits to Project during other than normal occupancy hours for this purpose.

E. Performance Tests: The boiler manufacturer is expected to provide partial load thermal efficiency curves. These thermal efficiency curves must include at least three separate curves at various BTU input levels. If these curves are not available, it is the responsibility of the boiler manufacturer to complete the following performance tests
   1. Engage a factory-authorized service representative to inspect component assemblies and equipment installations, including connections, and to conduct performance testing.
   2. Boilers shall comply with performance requirements indicated, as determined by field performance tests. Adjust, modify, or replace equipment to comply.
   3. Perform field performance tests to determine capacity and efficiency of boilers.
      a. Test for full capacity.
b. Test for boiler efficiency at low fire, 20, 40, 60, 80, 100, 80, 60, 40 and 20 percent of full capacity. Determine efficiency at each test point.

4. Repeat tests until results comply with requirements indicated.

5. Provide analysis equipment required to determine performance.

6. Provide temporary equipment and system modifications necessary to dissipate the heat produced during tests if building systems are not adequate.


8. Document test results in a report and submit to Engineer.

END OF SECTION
SECTION 260500

GENERAL REQUIREMENTS

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

A. This Section is coordinate with and complementary to the General Conditions and Supplementary General Conditions of the work, wherever applicable to Mechanical and Electrical Work.

B. Drawings are diagrammatic and are a graphic representation of contract requirements to the best available standards at the scale required. Sizes and locations of equipment are shown to scale where possible, but may be distorted for clarity on the Drawings. Final locations of outlets and equipment shall be as shown in enlarged details or as approved by the Architect or his representative.

C. Light and power and system riser diagrams and schematic diagrams generally indicate existing equipment connections in addition to equipment connections to be used for various systems. System conduit and wiring shall be as required for actual systems installed on this project. Provide all work shown on diagrams whether or not it is duplicated on the plans.

D. Division 23 - Basic Mechanical Requirements.

E. Division 23 - Electrical Requirements for Mechanical Equipment.

1.2 SCOPE OF WORK

A. The Specifications and the accompanying Drawings are intended to secure the provisions of all material, labor, equipment, and services necessary to install complete, test, and make ready for operation the Electrical Systems in accordance with the Specifications and Drawings. All systems shall be complete with necessary appurtenances and minor auxiliaries, including pull boxes, offsets to clear interferences, and supports which are not shown but are needed to make each system complete in every respect. All work described in the Specifications and not shown on the Drawings, or vice versa, shall be furnished in complete working order. If mention has been omitted of any item of work or material necessary for completion of the system, then such items must be and are hereby included. The work includes but is not limited to the following:

1. Raceways and installation components.
2. Wire and Cable.
4. Fuses.
5. Safety and disconnect switches.
7. Motor controllers.
8. Emergency generators.
10. Control equipment.
11. Control and alarm wiring system.
12. Grounding system.
13. Modifications to fire alarm system.
14. Modifications to the security system
15. Testing.
16. Alternate pieces.
17. Furnishing and setting of all sleeves through floors, roof and walls where required, including waterproofing and fireproof sealing and cap flashing.
18. Excavation and backfill (Excavation in rock shall be included).
19. All concrete work for site lighting pole bases and patch work.
20. Hardware, such as inserts, bolts, etc., associated with concrete bases.
21. Cutting, drilling and boring associated with electrical work.
22. Prime painting, where required for electrical equipment and installation.
23. Provisions for temporary light and power.
24. Final connection of all equipment unless otherwise noted.
25. Seismic restraints.

1.3 EXAMINATION OF EXISTING CONDITIONS ON PREMISES

A. Before submitting his bid, this Contractor shall visit the site of the work and shall thoroughly familiarize himself with the observable existing conditions affecting the work. By the act of submitting a bid, the Contractor shall be deemed to have made such an examination and to have accepted such conditions and to have made allowance therefore in preparing his bid. No additional compensation will be granted on account of extra work made necessary by the Contractor's failure to investigate such existing conditions. Verify all grades, elevations, dimensions and clearances at the site.

1.4 REMOVAL AND RELOCATION OF EXISTING WORK

A. Disconnect, remove and/or relocate electrical material, equipment, devices, components, and other work noted and required by demolition or alterations in existing construction.
B. Provide new material and equipment required for relocated equipment.
C. Remove conductors from existing raceways to be rewired. Clean raceways as required prior to rewiring.
D. Tape both ends of abandoned conductors, and cap outlets and abandoned raceways.
E. Cut and cap abandoned floor raceways flush with concrete floor or behind walls and ceilings.
F. Dispose of removed raceways and wiring. Turn over removed electrical equipment to Owner or discard as directed. Salvage equipment shall be limited to existing lighting fixtures, and panel boards.
G. All electrical work in adjoining areas, whether indicated on the Drawings or not, which is to continue to function but is affected by demolition work shall be reconnected and restored to present function as part of the electrical system of the building.
H. Connect new work to existing work in a neat and acceptable manner, with minimum interference to existing facilities.
I. Maintain continuous operation of existing facilities affected by the work. The Electrical Contractor shall do all work necessary to permit the operation of all existing electrical systems during the construction period.

J. Alarm and emergency systems shall be interrupted only with the written consent of the Owner.

K. Alterations and additions to the present electrical systems being retained shall be performed with a minimum interruption in the operating of these systems. Temporary shutdowns, when required, shall be made only with written consent of Owner at times not to interfere with normal operations. The Electrical Contractor shall be responsible for all overtime work necessary to meet this requirement. If interruptions must occur during the normal hours at the building, the Electrical Contractor shall, at his own expense, provide temporary services as required to permit the normal functioning of all active facilities during the interruption.

L. Where indicated on the Drawings or required by alteration scheme, the Electrical Contractor shall remove all electrical outlets, switches, and other devices, complete with associated wiring, conduit, etc., from partitions, walls, and floors that are to be removed. When the removal of these makes dead electrical wiring that is to remain, the Electrical Contractor shall install junction boxes or other devices necessary to make the circuits affected continuous and ready for operation. Otherwise, wiring shall be removed back to the nearest electrical outlet box that is to remain, or to the panelboard.

M. All raceways which become exposed beyond finished surfaces because of the alteration work shall be removed and rerouted behind finished surfaces.

N. Wiring that is to be removed as a result of demolition work, but is required to continue to function, shall be interrupted at convenient locations, rerouted (new wiring and conduits) and reconnected. New materials shall be equivalent to existing ones in all respects; conductor ampacity, conduit size, etc.

1.5 DISPOSAL OF REMOVED MATERIAL

A. All material removed and not to be reused shall be disposed of in accordance with all applicable local, state, and federal regulations.

B. All fluorescent lamp ballasts shall be disposed of in accordance with the Toxic Substance Control Act of 1976 which states that all PCB-containing lighting fixture ballasts that are leaking shall be treated as hazardous waste. PCB-containing ballasts that are not leaking can be either incinerated, or dismantled so that the recyclable materials can be separated from the PCB-containing components, which shall be incinerated or taken to a hazardous waste landfill.

C. All mercury-containing lamps; i.e., fluorescent, high pressure sodium, mercury vapor and metal halide; that are to be removed shall be disposed of in accordance with current Resource Conservation and Recovery Act regulations.

1.6 QUALITY ASSURANCE AND STANDARDS

A. The complete installation shall be in accordance with the applicable requirements and standards of National Electrical Manufacturers Association (NEMA), National Fire Protection Association (NFPA), International Building Code (IBC), Local Inspection Agency, along with state and local municipal codes and all applicable codes and authorities having jurisdiction. Any items or requirements noted in the Specifications or on Drawings which conflict with these shall be referred to the Architect for decision. All work necessary to comply with these requirements shall be performed by the Contractor at no extra cost to the Owner.
B. All electrical equipment, materials, and appliances shall have the listing of Underwriter's Laboratories, Inc., and shall bear labels attesting to UL listing.

1.7 SUBMITTALS
A. Follow the procedures specified in Division 1 Section "Submittals". Increase by one additional copy submittals of electrical related product data (to be retained by Architect).
B. The Contractor shall submit shop drawings with such promptness as to cause no delay in his own work or that of another contractor.
C. Submit shop drawings complete in every detail for items as described in the contract documents, or as may be required by the Architect.
D. Submit shop drawings as indicated in subsequent Sections of this Specification.

1.8 COORDINATION OF WORK WITH OTHER TRADES
A. The work of this Section shall be coordinated with the work of all other Contracts, the Utility Company, and the Telephone Company. It shall be so arranged that there will be no delay in the proper installation and completion of all work.
B. Examine all Architectural, Structural, Heating, Ventilating and Air Conditioning, Sprinkler and Plumbing Drawings relating to this Project, and verify all governing conditions at the site and become fully informed as to the extent and character of the work required and its relation to other work in the building. No consideration will be granted for any alleged misunderstanding of the materials to be furnished for work to be done.
C. Scaled and figured dimensions with respect to the items are approximate only; sizes of equipment have been taken from typical equipment items of the class indicated. Before proceeding with work, the Contractor shall carefully check all dimensions and sizes and shall assume full responsibility for the fitting in of equipment and materials to the building and to meet architectural and structural conditions.
D. Coordinate work with other disciplines. Confer with other contractors whose work might affect this installation; and arrange all parts of this work and equipment in proper relation to the work and equipment of others, with the building construction and with architectural finish so that this work will harmonize in service, appearance, and function.
E. Examine all work prepared by others to receive the work of this Section and report any defects affecting installation to the General Contractor for correction. Commencement of work will be construed as complete acceptance of preparatory work by others.
F. Exposed piping shall be installed to provide the maximum amount of headroom but in no case shall piping be installed less than seven feet six inches clear (7' 6") above the finished floor. Piping installed in areas where hung ceilings or other furred spaces are indicated shall be installed concealed.
G. The Contractor is referred to the Architectural Drawings for locations and types of hung ceilings and furred spaces.

H. Verify locations of all electrical equipment with Architectural Drawings and interior details and finishes. In centering outlets and locating boxes and outlets, allow for overhead pipes, ducts, trim, paneling, hung ceilings and the like and correct any inaccuracy resulting from failure to do so without expense to Owner.

I. The Electrical Contractor shall coordinate all ceiling work with Ceiling Contractor and shall determine ceiling type prior to the purchasing and installation of lighting fixtures, speakers, smoke detectors, exit lights or any other ceiling mounted electrical elements. Electrical work shall also be coordinated with location of diffusers, sprinklers and other mechanical work.

J. The Electrical Contractor shall prepare layout drawings showing all of electrical elements required to be in or at the ceiling. The Electrical Contractor shall coordinate with the ceiling design and all elements to be installed in or at the ceiling by the Contractors for Mechanical, Plumbing and Fire Protection work. It is intended that all electrical, mechanical and plumbing features be organized and arranged in regular patterns. The Electrical and Mechanical Contractors shall cooperate with each other and the Architect in the placement of each of their various systems in order to accomplish the regularly organized ceilings that are required for the project.

K. Where work will be installed in close proximity to work of other trades, or where there is evidence that the work will interfere with the work of other trades, assist in working out space conditions to make a satisfactory installation of all trades. The Electrical Contractor shall prepare coordinated drawings and sections at a scale of not less than 3/8" = 1'-0", clearly showing how work is to be installed in relation to work of other trades.

L. The Electrical Contractor shall ascertain where all equipment rooms, shafts, and equipment spaces have been planned for his use. Before proceeding with any work, the Electrical Contractor shall carefully check and verify all dimensions, sizes, etc., and assume full responsibility for the fitting-in of his equipment and materials to the other parts of the equipment and to the structure. Coordinate all work with all trades that make use of the same spaces for best utilization of available room. Any changes to building structure required to accommodate the work of this Division shall be initiated, coordinated, provided, and paid for by the Electrical Contractor. Any such modifications shall be reviewed and accepted in writing beforehand by the Architect.

M. The Electrical Contractor shall constantly refer to the drawings of all other trades to coordinate the Electrical work with the other work on the project. The Electrical "as-built" construction drawings being prepared by the Electrical Contractor shall reflect any changes as they occur.

N. When roughing-in is to be furnished for connection of equipment in this contract, or for equipment by others, approximate locations of connections are shown. The right is reserved to change locations shown before installation at no increase in cost unless there is a significant increase in the amount of material required.

O. Installation, connection, and inter-connection of systems shall be completed in accordance with manufacturer's instructions and the best practices of trade. All Contractors shall provide
P. All conduits and wiring shall be run close to ceiling where conditions allow.

1.9 INSPECTION AND_tests

A. At the time of the final inspection and tests, all connections at the panels and all splices, etc., must have been completed. All fuses must be in place and the circuits continuous from service switches to all receptacles, outlets, motors, etc. Each entire wiring system must test free from short circuits and grounds. When wiring systems are "megger" tested, the insulation resistance between conductors and between conductors and grounds, based on maximum load, shall not be less than that required by the National Electrical Code and local authorities having jurisdiction. A written record (five copies) of all test data shall be supplied to the Architect. The tests shall cover but not be limited to the following:

1. Secondary service and distribution system.
2. Fire alarm system.
3. All communications, signaling and alarm systems.
4. 10% of all power installations and motor controls randomly selected by the Architect.
5. 10% of all light installations and circuit switching randomly selected by the Architect.
6. Any part of the work called for in the Specifications and/or on the Drawings and as designated by the Architect.

B. Provide all necessary testing equipment, instruments, and skilled personnel for the tests. If in the opinion of the Architect, the results of such tests show that the work has not complied with the requirements of the Specifications or Drawings, the Contractor shall make all additions or changes necessary to put the system in proper working condition and shall pay for all expenses and for all subsequent tests which are necessary to determine whether the work is satisfactory. Any additional work or subsequent tests shall be carried out at the convenience of the Owner prior to final payment.

1.10 PERMITS, CERTIFICATES AND FEES

A. Obtain and deliver a final Certificate of Approval from the applicable inspection authority having jurisdiction. Make delivery to the Architect for transmittal to the Owner upon completion of the work and before final payment. Pay all charges made by the inspection authority and include their cost in the bid.

B. This work shall include the procurement of and payment for all permits, certificates and fees for the performance of the electrical work in compliance with codes, applicable laws and municipal regulations including those from local utilities for services.
1.11 PROTECTION, MAINTENANCE AND PRODUCT HANDLING OF ELECTRICAL EQUIPMENT

A. Electrical equipment shall be delivered and stored at the site, properly packed and crated until finally installed. Store materials in spaces as designated. Investigate each space through which equipment must be moved. If necessary, equipment shall be shipped from manufacturer in crated sections of size suitable for moving through restricted spaces.

B. Provide effective protection against damage for all material and equipment during shipment and storage at the Project Site. Cover all stored equipment to exclude dust and moisture. Place stored conduit on dunnage with appropriate weather cover and caps on exposed ends.

C. Uninstalled equipment and materials shall be adequately protected against loss or theft; damage caused by water, paint, fire, plaster, moisture, acids, fumes, dust or other environmental conditions; or physical damage; during delivery, storage, installation and shutdown conditions. This Contractor shall replace any damaged or stolen material without extra cost to the Owner.

D. Provide effective protection for all material and equipment against damage that may be caused by environmental conditions. Do no work when conditions or temperature in area or moisture on materials or substrates are not in accordance with material manufacturer's recommend conditions for installation.

E. This Contractor shall be responsible for the maintenance of all installed equipment and systems until final acceptance by the Architect and the Owner. The operation of the equipment by the Owner does not constitute an acceptance of the work. Work will be accepted only after the Contractor has adjusted his equipment, demonstrated that it fulfills the requirements of the Drawings and Specifications, and has furnished all required certificates.

F. This Contractor shall guarantee in writing to the Owner that all work installed by him shall be free of defects in workmanship and materials and that all apparatus will develop the capacities and characteristics as indicated, and that, if during a period of one year from date of final approval of work by the Architect, any defects in workmanship, materials or performance appear, he will remedy them without any cost to the Owner. Guarantee requirements shall consist of the aforesaid and other requirements, as established under applicable contract documents.

G. After cabinets and boxes are installed, cover openings to prevent entrance of water and foreign materials. Close conduit openings with temporary metal or plastic caps, including those terminated in cabinets.

H. Protect all rough and finished floors and other finished surfaces from damage which may be caused by construction materials and methods. Protect floors with tarpaulins, chip pans and oil proof floor covering. Protect finished surfaces from welding and cutting splatters with baffles and splatter blankets. Protect finished surfaces from paint droppings, adhesive and other maring agents with drop cloths. Protect other surfaces with appropriate protective measures.

I. Have materials delivered to site. Unload and store materials in designated location, and protect from damage. Deliver materials to their point of installation.
J. Deliver materials to Project site in manufacturer's original unopened containers with manufacturer's name and product identification clearly marked thereon.

1.12 ACCESSIBILITY AND MEASUREMENTS

A. All work shall be installed so as to be readily accessible for operation, maintenance and repair. Minor deviations from the plans may be made to accomplish this, subject to the approval of the Architect.

B. Before ordering any material or doing any work, the Contractor shall verify all measurements at the Building, and shall be responsible for the correctness of same as related to the work under this Contract.

1.13 TEMPORARY LIGHT AND POWER

A. Electric services for temporary light and power shall be obtained from the existing electrical service and extended as required. Coordinate with the Owner and provide all required material and work.

B. The Electrical Contractor shall furnish, install and maintain the temporary lighting and power system for all Contractors. The use of electricity shall be kept to a minimum.

C. The Owner will pay for all energy required by the temporary lighting and power system.

D. Provide all wiring, supports, lamp sockets, receptacle sockets and any other materials, supplies or equipment necessary for temporary light and power system.

E. Ground fault protection required by OSHA for temporary receptacle circuits shall be accomplished by providing branch circuit panels containing ground fault protection circuit breakers.

F. Provide a grounding conductor connection to each receptacle grounding terminal. Minimum size branch circuit and grounding conductors shall be No. 12 AWG.

G. Install separate stringer circuits for lighting and receptacles. Provide one lamp socket and one duplex receptacle (or two single receptacles) for every 400 square feet of new general construction area. (Approximately 20 feet on centers). In addition, provide one lamp socket and one duplex receptacle every 20 feet along the peripheral walls of the construction areas for temporary conditions. Each lamp socket shall be provided with a 100 watt lamp. Replace burned out lamps as required for as long as the temporary lighting system is maintained in operation.

H. Provide sufficient supplementary temporary lighting to permit proper execution of the work. This supplementary lighting shall consist of but not be limited to the following:
   1. Construction hoist landings.
   2. Stairways and stairway landings where existing illumination is inadequate due to alterations or construction.
3. Interior rooms not covered with general construction area lighting.

1.14 IDENTIFICATION NAMEPLATES

A. Identify and mark all electrical equipment to meet OSHA standards and as specified herein.

B. Furnish a nameplate for each separately installed feeder switch and circuit breaker, each individual panel, dry type transformer, disconnect switch, push button station, controller, manual motor starter, and equipment enclosure.

C. Unless otherwise noted, nameplates shall be black laminate with white letters of uniform size consisting of reasonably large capital letters, 3/16-inch minimum.

D. Inscription shall consist of name and number of equipment as shown on the Drawings and as approved by the Architect.

1.15 NAMES AND TRADE NAMES

A. Where trade and manufacturers' names are specified or indicated on the Drawings, they are intended to indicate the standard of material or articles required. This shall not remove the responsibility of the Contractor from verifying the equipment's compliance with all rules and regulations governing the use of such equipment. No purchase of any equipment shall be done without written authorization if such equipment will not abide with all rules and regulations covering its intended use.

1.16 MATERIAL AND WORKMANSHIP

A. All material shall be new and of the best quality and shall have the Underwriters Laboratories label attached. The Label shall be of the type for the intended application. The work throughout shall be executed in the best and most thorough manner under the direction of, and to the satisfaction of the Architect, who will interpret the meaning of the Drawings and Specifications. The Architect shall have the power to reject any work and materials which, in his opinion, is not in full accordance therewith.

B. If, after installation, operation of the equipment proves to be unsatisfactory to the Owner by reason of defects, errors or omissions, the Owner reserves the right to operate equipment until it can be removed from service for correction by Contractor. Contractor shall pay for damages to work of other trades caused by this defective equipment and its replacement.

1.17 SEISMIC RESTRAINTS

A. Provide lateral restraints for all electrical equipment installed on project. Typically lateral restraints shall consist of angle iron and "uni strut" bracing, cross bracing, hanger rods, anchor clips, expansion shield anchor bolts, etc. The purpose of the restraints is to provide resistance to lateral (horizontal) movement during earthquake.

B. All equipment shall be anchored to the floor, ceiling structure or walls.
C. All suspended equipment, wiring trough and conduit trade size 2 1/2" or larger shall have (lateral) horizontal bracing capable of resisting 10% of the equipment weight. Horizontal bracing shall be placed at each point where vertical supports are specified or required.

D. Stem mounted fixtures shall have stems and swivel canopies designed for seismic loads. Ceiling outlet boxes and hangers for stem mounted fixtures shall have lateral bracing capable of withstanding full vertical load. Lateral bracing shall be attached to the ceiling (at an angle) or wall structure.

E. Recessed and surface mounted light fixtures must be secured to the ceiling system so as to resist 25% of their weight laterally; i.e. a 40-pound fixture must be resistant to a 10-pound lateral force. Suitable anchor clips must be provided for all lay in fixtures. Surface mounted fixtures must be supported at two points in addition to the outlet box.

1.18 OPERATING INSTRUCTIONS (SYSTEMS AND EQUIPMENT FURNISHED UNDER ELECTRICAL WORK)

A. Fifteen (15) days prior to the completion of all work and the final inspection of the installation by the Owner, five copies of a complete Instruction Manual, bound in booklet form and suitably indexed, shall be submitted to the Architect for approval. All written material contained in the Manual shall be typewritten or printed. Refer to Section 017823, “Operation and Maintenance Data.”

B. The Manual shall contain the following items:

1. Table of Contents
2. Introduction
4. Description of system or equipment.
5. Complete schematic drawings of all systems.
6. Functional and sequential description of all systems.
7. Systems operation:
   a. Operation procedures.
   b. All posted instruction charts.
8. Maintenance:
   a. Systems trouble shooting charts.
   b. Procedures for checking out functions.
   c. Recommended list of spare parts.
10. Manufacturer's Data (where multiple model, type and size listings are included, clearly and conspicuously indicate those that are pertinent to this installation):
11. Description literature, drawings, illustrations, certified performance charts, technical data, etc.
13. Maintenance including complete troubleshooting charts.
14. Parts list.
15. Names, addresses and telephone numbers of recommended repair and service companies.

END OF SECTION
SECTION 260519
LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Building wires and cables rated 600 V and less.
   2. Connectors, splices, and terminations rated 600 V and less.

B. Related Requirements:
   1. Division 26, Section "Control-Voltage Electrical Power Cables" for control systems communications cables and Classes 1, 2 and 3 control cables.
   2. Division 27, Section "Communications Horizontal Cabling" for cabling used for voice and data circuits.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.3 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

PART 2 - PRODUCTS

2.1 CONDUCTORS AND CABLES

A. Aluminum and Copper Conductors: Comply with NEMA WC 70/ICEA S-95-658.

B. Conductor Insulation: Comply with NEMA WC 70/ICEA S-95-658 for Type THHN-2-THWN-2.

C. Multiconductor Cable: Comply with NEMA WC 70/ICEA S-95-658 for metal-clad cable, Type MC with ground wire.
2.2 CONNECTORS AND SPLICES
   A. Description: Factory-fabricated connectors and splices of size, ampacity rating, material, type, and class for application and service indicated.

2.3 SYSTEM DESCRIPTION
   A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
   B. Comply with NFPA 70.

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, except VFC cable, which shall be extra flexible stranded.

3.2 CONDUCTOR INSULATION AND MULTICONDUCTOR CABLE APPLICATIONS AND WIRING METHODS
   A. Exposed Feeders: Type THHN-2-THWN-2, single conductors in raceway.
   B. Feeders Concealed in Ceilings, Walls, Partitions, and Crawlspace: Type THHN-2-THWN-2, single conductors in raceway.
   C. Feeders Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THHN-2-THWN-2, single conductors in raceway.
   D. Exposed Branch Circuits, Including in Crawlspace: Type THHN-2-THWN-2, single conductors in raceway.
   E. Branch Circuits Concealed in Ceilings, Walls, and Partitions: Type THHN-2-THWN-2, single conductors in raceway.
   F. Branch Circuits Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THHN-2-THWN-2, single conductors in raceway.
   G. VFC Output Circuits: Type TC-ER cable with braided shield.

3.3 INSTALLATION OF CONDUCTORS AND CABLES
   A. Conceal cables in finished walls, ceilings, and floors unless otherwise indicated.
B. Complete raceway installation between conductor and cable termination points according to Division 26, Section "Raceways and Boxes for Electrical Systems" prior to pulling conductors and cables.

C. 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.

D. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables or raceway.

E. Install exposed cables parallel and perpendicular to surfaces of exposed structural members, and follow surface contours where possible.

F. Support cables according to Division 26, Section "Hangers and Supports 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-486B.

B. Make splices, terminations, and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.

1. Use oxide inhibitor in each splice, termination, and tap for aluminum conductors.

C. Wiring at Outlets: Install conductor at each outlet, with at least 6 inches (150 mm) of slack.

3.5 IDENTIFICATION

A. Identify and color-code conductors and cables according to Division 26, Section "Identification for Electrical Systems."

B. Identify each spare conductor at each end with identity number and location of other end of conductor, and identify as spare conductor.

3.6 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS

A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies. Comply with requirements in Division 26, Section "Sleeves and Sleeve Seals for Electrical Raceways and Cabling."
3.7 FIRE-STOPPING

A. Apply fire-stopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly according to Division 07, Section "Penetration Fire-stopping."

3.8 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. After installing conductors and cables and before electrical circuitry has been energized, test for compliance with requirements.

END OF SECTION
SECTION 260526
GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY
A. Section includes grounding and bonding systems and equipment.

1.2 ACTION SUBMITTALS
A. Product Data: For each type of product indicated.

PART 2 - PRODUCTS

2.1 MANUFACTURERS
A. Manufacturers: Subject to compliance with requirements, provide products by one of the following.

1. Burndy; Part of Hubbell Electrical Systems.
2. Dossert; AFL Telecommunications LLC.
3. ERICO International Corporation.
4. Fushi Copperweld Inc.
5. Galvan Industries, Inc.; Electrical Products Division, LLC.
6. Harger Lightning and Grounding.
7. ILSCO.
9. Robbins Lightning, Inc.
10. Siemens Power Transmission & Distribution, Inc.

2.2 SYSTEM DESCRIPTION
A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Comply with UL 467 for grounding and bonding materials and equipment.

2.3 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:

4. Bonding Cable: 28 kcmil, 14 strands of No. 17 AWG conductor, 1/4 inch (6 mm) 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 (41 mm) wide and 1/16 inch (1.6 mm) thick.
7. Tinned Bonding Jumper: Tinned-copper tape, braided conductors terminated with copper ferrules; 1-5/8 inches (41 mm) wide and 1/16 inch (1.6 mm) thick.

2.4 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.

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, 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 AWG and smaller, and stranded conductors for No. 6 AWG and larger unless otherwise indicated.

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.
5. Three-phase motor and appliance branch circuits.
6. Flexible raceway runs.
7. Armored and metal-clad cable runs.
8. Busway Supply Circuits: Install insulated equipment grounding conductor from grounding bus in the switchgear, switchboard, or distribution panel to equipment grounding bar terminal on busway.

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.

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. 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.

C. Grounding and Bonding for Piping:

1. Bond each aboveground portion of gas piping system downstream from equipment shutoff valve.

3.4 FIELD QUALITY CONTROL

A. Perform tests and inspections. Inspect physical and mechanical condition. Verify tightness of accessible, bolted, electrical connections with a calibrated torque wrench according to manufacturer's written instructions.

END OF SECTION
SECTION 260529
HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes:
   1. Hangers and supports for electrical equipment and systems.
   2. Construction requirements for concrete bases.

1.2 PERFORMANCE REQUIREMENTS

A. Delegated Design: Design supports for multiple raceways, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

B. Design supports for multiple raceways capable of supporting combined weight of supported systems and its contents.

C. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

D. Rated Strength: Adequate in tension, shear, and pullout force to resist maximum loads calculated or imposed for this Project, with a minimum structural safety factor of five times the applied force.

1.3 ACTION SUBMITTALS

A. Product Data: For steel 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. Equipment supports.

1.4 INFORMATIONAL SUBMITTALS

A. Welding certificates.
1.5 QUALITY ASSURANCE

A. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

B. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS

A. Steel Slotted Support Systems: Comply with MFMA-4, factory-fabricated components for field assembly.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   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. Raceway and Cable Supports: As described in NECA 1 and NECA 101.

C. Conduit and Cable Support Devices: Steel hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.

D. Support for Conductors in Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug or plugs for non-armored electrical conductors or cables in riser conduits. Plugs shall have number, size, and shape of conductor gripping pieces as required to suit individual conductors or cables supported. Body shall be malleable iron.

E. Structural Steel for Fabricated Supports and Restraints: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.
F. Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following:

1. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete, steel, or wood, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.

   a. 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) 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:

   b. Manufacturers: Subject to compliance with requirements, provide products by one of 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.


2.2 FABRICATED METAL EQUIPMENT SUPPORT ASSEMBLIES

A. Description: Welded or bolted, structural-steel shapes, shop or field fabricated to fit dimensions of supported equipment.
B. Materials: Comply with requirements in Division 05, Section "Metal Fabrications" for steel shapes and plates.

PART 3 - EXECUTION

3.1 APPLICATION

A. Comply with NECA 1 and NECA 101 for application of hangers and supports for electrical equipment and systems except if requirements in this Section are stricter.

B. Maximum Support Spacing and Minimum Hanger Rod Size for Raceway: Space supports for EMT, IMC, and RMC as NFPA 70. Minimum rod size shall be 1/4 inch (6 mm) in diameter.

C. Multiple Raceways or Cables: Install trapeze-type supports fabricated with steel slotted 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.

D. Spring-steel clamps designed for supporting single conduits without bolts may be used for 1-1/2-inch (38-mm) and smaller raceways serving branch circuits and communication systems above suspended ceilings and for fastening raceways to trapeze supports.

3.2 SUPPORT INSTALLATION

A. Comply with NECA 1 and NECA 101 for installation requirements except as specified in this Article.

B. Raceway Support Methods: In addition to methods described in NECA 1, EMT may be supported by openings through structure members, as permitted in NFPA 70.

C. Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb (90 kg).

D. Mounting and Anchorage of Surface-Mounted Equipment and Components: Anchor and fasten electrical items and their supports to building structural elements by the following methods unless otherwise indicated by code:

1. To Wood: Fasten with lag screws or through bolts.
2. To New Concrete: Bolt to concrete inserts.
3. To Masonry: Approved toggle-type bolts on hollow masonry units and expansion anchor fasteners on solid masonry units.
4. To Existing Concrete: Expansion anchor fasteners.
5. Instead of expansion anchors, powder-actuated driven threaded studs provided with lock washers and nuts may be used in existing standard-weight concrete 4 inches (100 mm)
thick or greater. Do not use for anchorage to lightweight-aggregate concrete or for slabs less than 4 inches (100 mm) thick.

6. To Steel: Welded threaded studs complying with AWS D1.1/D1.1M, with lock washers and nuts.
7. To Light Steel: Sheet metal screws.
8. Items Mounted on Hollow Walls and Nonstructural Building Surfaces: Mount cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices on slotted-channel racks attached to substrate by means that meet seismic-restraint strength and anchorage requirements.

E. Drill holes for expansion anchors in concrete at locations and to depths that avoid reinforcing bars.

3.3 INSTALLATION OF FABRICATED METAL SUPPORTS

A. Comply with installation requirements in Division 05, Section "Metal Fabrications" for site-fabricated metal supports.
B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor electrical materials and equipment.
C. Field Welding: Comply with AWS D1.1/D1.1M.

3.4 CONCRETE BASES

A. Construct concrete bases of dimensions indicated but not less than 4 inches (100 mm) larger in both directions than supported unit, and so anchors will be a minimum of 10 bolt diameters from edge of the base.
B. Use 3000-psi (20.7-MPa), 28-day compressive-strength concrete. Concrete materials, reinforcement, and placement requirements are specified in Division 03, Section "Miscellaneous Cast-in-Place Concrete."
C. Anchor equipment to concrete base.

1. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
2. Install anchor bolts to elevations required for proper attachment to supported equipment.
3. Install anchor bolts according to anchor-bolt manufacturer's written instructions.

3.5 PAINTING

A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.
1. Apply paint by brush or spray to provide minimum dry film thickness of 2.0 mils (0.05 mm).

B. Touchup: Comply with requirements in Division 09, Section "Painting" 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
SECTION 260533
RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY
A. Section Includes:
   1. Metal conduits, tubing, and fittings.
   2. Nonmetal conduits, tubing, and fittings.
   3. Metal wire-ways and auxiliary gutters.
   5. Surface raceways.

1.2 ACTION SUBMITTALS
A. Product Data: For surface raceways, wire-ways and fittings, floor boxes, hinged-cover enclosures, and cabinets.

PART 2 - PRODUCTS

2.1 METAL CONDUITS, TUBING, AND FITTINGS
A. Listing and Labeling: Metal conduits, tubing, and fittings shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
B. GRC: Comply with ANSI C80.1 and UL 6.
C. ARC: Comply with ANSI C80.5 and UL 6A.
D. IMC: Comply with ANSI C80.6 and UL 1242.
E. PVC-Coated Steel Conduit: PVC-coated rigid steel conduit.
   1. Comply with NEMA RN 1.
   2. Coating Thickness: 0.040 inch (1 mm), minimum.
F. EMT: Comply with ANSI C80.3 and UL 797.
G. FMC: Comply with UL 1; zinc-coated steel.
H. LFMC: Flexible steel conduit with PVC jacket and complying with UL 360.
I. Fittings for Metal Conduit: Comply with NEMA FB 1 and UL 514B.
   1. Conduit Fittings for Hazardous (Classified) Locations: Comply with UL 886 and NFPA 70.
   2. Fittings for EMT:
      a. Material: Steel.
      b. Type: compression.
   3. Expansion Fittings: PVC or steel to match conduit type, complying with UL 651, rated for environmental conditions where installed, and including flexible external bonding jumper.
   4. Coating for Fittings for PVC-Coated Conduit: Minimum thickness of 0.040 inch (1 mm), with overlapping sleeves protecting threaded joints.

J. Joint Compound for IMC, GRC, or ARC: Approved, as defined in NFPA 70, by authorities having jurisdiction for use in conduit assemblies, and compounded for use to lubricate and protect threaded conduit joints from corrosion and to enhance their conductivity.

2.2 NONMETALLIC CONDUITS, TUBING, AND FITTINGS

A. Listing and Labeling: Nonmetallic conduits, tubing, and fittings shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. ENT: Comply with NEMA TC 13 and UL 1653.

C. RNC: Type EPC-40-PVC, complying with NEMA TC 2 and UL 651 unless otherwise indicated.

D. LFNC: Comply with UL 1660.

E. Continuous HDPE: Comply with UL 651B.

F. Coilable HDPE: Preassembled with conductors or cables, and complying with ASTM D 3485.

G. Fittings for ENT and RNC: Comply with NEMA TC 3; match to conduit or tubing type and material.

H. Fittings for LFNC: Comply with UL 514B.

I. Solvent cements and adhesive primers shall have a VOC content of 510 and 550 g/L or less, respectively, when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

J. Solvent cements and adhesive 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."
2.3  METAL WIREWAYS AND AUXILIARY GUTTERS

A. Description: Sheet metal, complying with UL 870 and NEMA 250, Type 1 unless otherwise indicated, and sized according to NFPA 70.

1. Metal wire-ways installed outdoors shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Fittings and Accessories: Include covers, couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wire-ways as required for complete system.

2.4  NONMETALLIC WIRE-WAYS AND AUXILIARY GUTTERS

A. Listing and Labeling: Nonmetallic wire-ways and auxiliary gutters shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Description: Fiberglass polyester, extruded and fabricated to required size and shape, without holes or knockouts. Cover shall be gasketed with oil-resistant gasket material and fastened with captive screws treated for corrosion resistance. Connections shall be flanged and have stainless-steel screws and oil-resistant gaskets.

C. Description: PVC, extruded and fabricated to required size and shape, and having snap-on cover, mechanically coupled connections, and plastic fasteners.

D. Fittings and Accessories: Couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings shall match and mate with wire-ways as required for complete system.

E. Solvent cements and adhesive primers shall have a VOC content of 510 and 550 g/L or less, respectively, when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

F. Solvent cements and adhesive 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."

2.5  SURFACE RACEWAYS

A. Listing and Labeling: Surface raceways shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Surface Metal Raceways: Galvanized steel with snap-on covers complying with UL 5.

C. Surface Nonmetallic Raceways: Two- or three-piece construction, complying with UL 5A, and manufactured of rigid PVC. Product shall comply with UL 94 V-0 requirements for self-extinguishing characteristics.
2.6 BOXES, ENCLOSURES, AND CABINETS

A. General Requirements for Boxes, Enclosures, and Cabinets: Boxes, enclosures, and cabinets installed in wet locations shall be listed for use in wet locations.

B. Sheet Metal Outlet and Device Boxes: Comply with NEMA OS 1 and UL 514A.

C. Cast-Metal Outlet and Device Boxes: Comply with NEMA FB 1, ferrous alloy, Type FD, with gasketed cover.

D. Nonmetallic Outlet and Device Boxes: Comply with NEMA OS 2 and UL 514C.

E. Luminaire Outlet Boxes: Nonadjustable, designed for attachment of luminaire weighing 50 lb (23 kg). Outlet boxes designed for attachment of luminaires weighing more than 50 lb (23 kg) shall be listed and marked for the maximum allowable weight.

F. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.

G. Cast-Metal Access, Pull, and Junction Boxes: Comply with NEMA FB 1 and UL 1773, cast aluminum with gasketed cover.

H. Box extensions used to accommodate new building finishes shall be of same material as recessed box.

I. Device Box Dimensions: 4 inches square by 2-1/8 inches deep (100 mm square by 60 mm deep).

J. Gangable boxes are allowed.

K. Hinged-Cover Enclosures: Comply with UL 50 and NEMA 250, Type 1 with continuous-hinge cover with flush latch unless otherwise indicated.

1. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.
3. Interior Panels: Steel; all sides finished with manufacturer's standard enamel.

L. 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 panel boards.
4. Metal barriers to separate wiring of different systems and voltage.
5. Accessory feet where required for freestanding equipment.
6. Nonmetallic cabinets shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
PART 3 - EXECUTION

3.1 RACEWAY APPLICATION

A. Outdoors: Apply raceway products as specified below unless otherwise indicated:

1. Exposed Conduit: GRC.
2. Concealed Conduit, Aboveground: GRC.
4. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC.
5. Boxes and Enclosures, Aboveground: NEMA 250, Type 3R.

B. Indoors: Apply raceway products as specified below 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: GRC. Raceway locations include the following:
   a. Loading dock.
   b. Corridors used for traffic of mechanized carts, forklifts, and pallet-handling units.
   c. Mechanical rooms.
   d. Gymnasiums.
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: GRC.
7. Boxes and Enclosures: NEMA 250, Type 1, except use NEMA 250, Type 4 stainless steel in institutional and commercial kitchens and damp or wet locations.

C. Minimum Raceway Size: 3/4-inch (21-mm) 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. Comply with NEMA FB 2.10.
2. PVC Externally Coated, Rigid Steel Conduits: Use only fittings listed for use with this type of conduit. Patch and seal all joints, nicks, and scrapes in PVC coating after installing conduits and fittings. Use sealant recommended by fitting manufacturer and apply in thickness and number of coats recommended by manufacturer.
4. Flexible Conduit: Use only fittings listed for use with flexible conduit. Comply with NEMA FB 2.20.

E. Do not install aluminum conduits, boxes, or fittings in contact with concrete or earth.
F. Install surface raceways only where indicated on Drawings.

G. Do not install nonmetallic conduit where ambient temperature exceeds 120 deg F (49 deg C).

3.2 INSTALLATION

A. Comply with NECA 1 and NECA 101 for installation requirements except where requirements on Drawings or in this article are stricter. Comply with NECA 102 for aluminum conduits. Comply with NFPA 70 limitations for types of raceways allowed in specific occupancies and number of floors.

B. Keep raceways at least 6 inches (150 mm) away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.

C. Comply with requirements in Division 26, Section "Hangers and Supports for Electrical Systems" for hangers and supports.

D. Arrange stub-ups so curved portions of bends are not visible above finished slab.

E. Install no more than the equivalent of three 90-degree bends in any conduit run except for control wiring conduits, for which fewer bends are allowed. Support within 12 inches (300 mm) of changes in direction.

F. Conceal conduit and EMT within finished walls, ceilings, and floors unless otherwise indicated. Install conduits parallel or perpendicular to building lines.

G. Support conduit within 12 inches (300 mm) of enclosures to which attached.

H. Raceways Embedded in Slabs:
   1. Run conduit larger than 1-inch (27-mm) trade size, parallel or at right angles to main reinforcement. Where at right angles to reinforcement, place conduit close to slab support. Secure raceways to reinforcement at maximum 10-foot (3-m) intervals.
   2. Arrange raceways to cross building expansion joints at right angles with expansion fittings.
   3. Arrange raceways to keep a minimum of 2 inches (50 mm) of concrete cover in all directions.
   4. Do not embed thread-less fittings in concrete unless specifically approved by Architect for each specific location.
   5. Change from ENT to GRC before rising above floor.

I. Stub-ups to Above Recessed Ceilings:
   1. Use EMT, IMC, or RMC for raceways.
   2. Use a conduit bushing or insulated fitting to terminate stub-ups not terminated in hubs or in an enclosure.
J. 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.

K. Coat field-cut threads on PVC-coated raceway with a corrosion-preventing conductive compound prior to assembly.

L. Raceway Terminations at Locations Subject to Moisture or Vibration: Use insulating bushings to protect conductors including conductors smaller than No. 4 AWG.

M. Terminate threaded conduits into threaded hubs or with locknuts on inside and outside of boxes or cabinets. Install bushings on conduits up to 1-1/4-inch (35-mm) trade size and insulated throat metal bushings on 1-1/2-inch (41-mm) trade size and larger conduits terminated with locknuts. Install insulated throat metal grounding bushings on service conduits.

N. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 200-lb (90-kg) tensile strength. Leave at least 12 inches (300 mm) of slack at each end of pull wire. Cap underground raceways designated as spare above grade alongside raceways in use.

O. Surface Raceways:

1. Install surface raceway with a minimum 2-inch (50-mm) radius control at bend points.
2. Secure surface raceway with screws or other anchor-type devices at intervals not exceeding 48 inches (1200 mm) and with no less than two supports per straight raceway section. Support surface raceway according to manufacturer's written instructions. Tape and glue are not acceptable support methods.

P. Install raceway sealing fittings at accessible locations according to NFPA 70 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.

Q. Install devices to seal raceway interiors at accessible locations. Locate seals so no fittings or boxes are between the seal and the following changes of environments. Seal the interior of all raceways at the following points:

1. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
2. Where an underground service raceway enters a building or structure.
3. Where otherwise required by NFPA 70.

R. Expansion-Joint Fittings:

1. Install in each run of aboveground RNC that is located where environmental temperature change may exceed 30 deg F (17 deg C) and that has straight-run length that exceeds 25 feet (7.6 m).
2. Install type and quantity of fittings that accommodate temperature change listed for each of the following locations:
a. Outdoor Locations Not Exposed to Direct Sunlight: 125 deg F (70 deg C) temperature change.
b. Outdoor Locations Exposed to Direct Sunlight: 155 deg F (86 deg C) temperature change.
c. Indoor Spaces Connected with Outdoors without Physical Separation: 125 deg F (70 deg C) temperature change.

3. Install fitting(s) that provide expansion and contraction for at least 0.00041 inch per foot of length of straight run per degree F (0.06 mm per meter of length of straight run per degree C) of temperature change for PVC conduits.

4. Install expansion fittings at all locations where conduits cross building or structure expansion joints.

5. Install each expansion-joint fitting with position, mounting, and piston setting selected according to manufacturer's written instructions for conditions at specific location at time of installation. Install conduit supports to allow for expansion movement.

S. Flexible Conduit Connections: Comply with NEMA RV 3. Use a maximum of 72 inches (1830 mm) of flexible conduit for recessed and semi-recessed luminaires, 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.

T. Mount boxes at heights indicated on Drawings. If mounting heights of boxes are not individually indicated, give priority to ADA requirements. Install boxes with height measured to center of box unless otherwise indicated.

U. Recessed Boxes in Masonry Walls: Saw-cut opening for box in center of cell of masonry block, and install box flush with surface of wall. Prepare block surfaces to provide a flat surface for a rain-tight connection between the box and cover plate or the supported equipment and box.

V. Horizontally separate boxes mounted on opposite sides of walls so they are not in the same vertical channel.

W. Locate boxes so that cover or plate will not span different building finishes.

X. Support boxes of three gangs or more from more than one side by spanning two framing members or mounting on brackets specifically designed for the purpose.

Y. Fasten junction and pull boxes to or support from building structure. Do not support boxes by conduits.

Z. Set metal floor boxes level and flush with finished floor surface.

AA. Set nonmetallic floor boxes level. Trim after installation to fit flush with finished floor surface.

3.3 INSTALLATION OF UNDERGROUND CONDUIT

A. Direct-Buried Conduit:
1. Excavate trench bottom to provide firm and uniform support for conduit. Prepare trench bottom as specified in Division 31, Section "Earth Moving" for pipe less than 6 inches (150 mm) in nominal diameter.
2. Install backfill as specified in Division 31, Section "Earth Moving."
3. After installing conduit, backfill and compact. Start at tie-in point, and work toward end of conduit run, leaving conduit at end of run free to move with expansion and contraction as temperature changes during this process. Firmly hand tamp backfill around conduit to provide maximum supporting strength. After placing controlled backfill to within 12 inches (300 mm) of finished grade, make final conduit connection at end of run and complete backfilling with normal compaction as specified in Division 31, Section "Earth Moving."
4. Install manufactured duct elbows for stub-up at poles and equipment and at building entrances through floor unless otherwise indicated. Encase elbows for stub-up ducts throughout length of elbow.
5. Install manufactured rigid steel conduit elbows for stub-ups at poles and equipment and at building entrances through floor.
   a. Couple steel conduits to ducts with adapters designed for this purpose, and encase coupling with 3 inches (75 mm) of concrete for a minimum of 12 inches (300 mm) on each side of the coupling.
   b. For stub-ups at equipment mounted on outdoor concrete bases and where conduits penetrate building foundations, extend steel conduit horizontally a minimum of 60 inches (1500 mm) from edge of foundation or equipment base. Install insulated grounding bushings on terminations at equipment.
6. Underground Warning Tape: Comply with requirements in Division 26, Section "Identification for Electrical Systems."

3.4 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS
   A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies. Comply with requirements in Division 26, Section "Sleeves and Sleeve Seals for Electrical Raceways and Cabling."

3.5 FIRE-STOPPING
   A. Install fire-stopping at penetrations of fire-rated floor and wall assemblies. Comply with requirements in Division 07, Section "Penetration Fire-stopping."

3.6 PROTECTION
   A. Protect coatings, finishes, and cabinets from damage and deterioration.
   1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
   2. Repair damage to PVC coatings or paint finishes with matching touchup coating recommended by manufacturer.
END OF SECTION
SECTION 260544
SLEEVES AND SLEEVE SEALS FOR ELECTRICAL RACEWAYS AND CABLING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Sleeves for raceway and cable penetration of non-fire-rated construction walls and floors.
2. Sleeve-seal systems.
5. Silicone sealants.

B. Related Requirements:

1. Division 07, Section "Penetration Firestopping" for penetration firestopping installed in fire-resistance-rated walls, horizontal assemblies, and smoke barriers, with and without penetrating items.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

PART 2 - PRODUCTS

2.1 SLEEVES

A. Wall Sleeves:

2. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop unless otherwise indicated.

B. Sleeves for Conduits Penetrating Non-Fire-Rated Gypsum Board Assemblies: Galvanized-steel sheet; 0.0239-inch (0.6-mm) minimum thickness; round tube closed with welded longitudinal joint, with tabs for screw-fastening the sleeve to the board.

C. Sleeves for Rectangular Openings:

2. Minimum Metal Thickness:
a. For sleeve cross-section rectangle perimeter less than 50 inches (1270 mm) and with no side larger than 16 inches (400 mm), thickness shall be 0.052 inch (1.3 mm).
b. For sleeve cross-section rectangle perimeter 50 inches (1270 mm) or more and one or more sides larger than 16 inches (400 mm), thickness shall be 0.138 inch (3.5 mm).

2.2 SLEEVE-SEAL SYSTEMS

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 Company (The).
   d. Pipeline Seal and Insulator, Inc.
   e. Proco Products, Inc.

2. Sealing Elements: EPDM rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
3. Pressure Plates: Carbon steel.
4. Connecting Bolts and Nuts: Carbon steel, with corrosion-resistant coating, of length required to secure pressure plates to sealing elements.

2.3 SLEEVE-SEAL FITTINGS

A. Description: Manufactured plastic, sleeve-type, waterstop assembly made for embedding in concrete slab or wall. Unit shall have plastic or rubber waterstop collar with center opening to match piping OD.

1. Manufacturers: Subject to compliance with requirements, provide products by the following:
   a. Presealed Systems.

2.4 GROUT

A. Description: Nonshrink; recommended for interior and exterior sealing openings in non-fire-rated walls or floors.


C. Design Mix: 5000-psi (34.5-MPa), 28-day compressive strength.
D. Packaging: Premixed and factory packaged.

2.5 SILICONE SEALANTS

A. Silicone Sealants: Single-component, silicone-based, neutral-curing elastomeric sealants of grade indicated below.

1. Grade: Pourable (self-leveling) formulation for openings in floors and other horizontal surfaces that are not fire rated.
2. Sealant shall have VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
3. 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."

B. Silicone Foams: Multi-component, silicone-based liquid elastomers that, when mixed, expand and cure in place to produce a flexible, non-shrinking foam.

PART 3 - EXECUTION

3.1 SLEEVE INSTALLATION FOR NON-FIRE-RATED ELECTRICAL PENETRATIONS

A. Comply with NECA 1.

B. Comply with NEMA VE 2 cable penetrations.

C. Sleeves for Conduits Penetrating Above-Grade Non-Fire-Rated Concrete and Masonry-Unit Floors and Walls:

1. Interior Penetrations of Non-Fire-Rated Walls and Floors:

   a. Seal annular space between sleeve and raceway or cable, using joint sealant appropriate for size, depth, and location of joint. Comply with requirements in Division 07, Section "Joint Sealants."
   b. Seal space outside of sleeves with mortar or grout. Pack sealing material solidly between sleeve and wall so no voids remain. Tool exposed surfaces smooth; protect material while curing.

2. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.
3. Size pipe sleeves to provide 1/4-inch (6.4-mm) annular clear space between sleeve and raceway or cable unless sleeve seal is to be installed or unless seismic criteria require different clearance.
4. Install sleeves for wall penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of walls. Cut sleeves to length for mounting flush with both surfaces of walls. Deburr after cutting.
5. Install sleeves for floor penetrations. Extend sleeves installed in floors 2 inches (50 mm) above finished floor level. Install sleeves during erection of floors.
D. Sleeves for Conduits Penetrating Non-Fire-Rated Gypsum Board Assemblies:
   1. Use circular metal sleeves unless penetration arrangement requires rectangular sleeved opening.
   2. Seal space outside of sleeves with approved joint compound for gypsum board assemblies.

E. Roof-Penetration Sleeves: Seal penetration of individual raceways and cables with flexible boot-type flashing units applied in coordination with roofing work.

F. Aboveground, Exterior-Wall Penetrations: Seal penetrations using steel pipe sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch (25-mm) annular clear space between pipe and sleeve for installing mechanical sleeve seals.

G. Underground, Exterior-Wall and Floor Penetrations: Install cast-iron pipe sleeves. Size sleeves to allow for 1-inch (25-mm) annular clear space between raceway or cable and sleeve for installing sleeve-seal system.

3.2 SLEEVE-SEAL-SYSTEM INSTALLATION
   A. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at raceway entries into building.
   B. Install 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.

3.3 SLEEVE-SEAL-FITTING INSTALLATION
   A. Install sleeve-seal fittings in new walls and slabs as they are constructed.
   B. Assemble fitting components of length to be flush with both surfaces of concrete slabs and walls. Position waterstop flange to be centered in concrete slab or wall.
   C. Secure nailing flanges to concrete forms.
   D. Using grout, seal the space around outside of sleeve-seal fittings.

END OF SECTION
SECTION 260553
IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Identification for raceways.
   2. Identification of power and control cables.
   3. Identification for conductors.
   5. Warning labels and signs.
   6. Instruction signs.
   7. Equipment identification labels.
   8. Miscellaneous identification products.

1.2 ACTION SUBMITTALS

A. Product Data: For each electrical identification product indicated.

1.3 QUALITY ASSURANCE

A. Comply with ANSI A13.1.
B. Comply with NFPA 70.
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.

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, pre-tensioned, 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, pre-tensioned, flexible, solid-colored acrylic sleeve, 2 inches (50 mm) long, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.

F. Write-On Tags: Polyester tag, 0.010 inch (0.25 mm) 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 ARMORED AND METAL-CLAD 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. Colors for Raceways Carrying Circuits at 600 V and Less:

1. Black letters on an orange field.
2. Legend: Indicate voltage and system or service type.

C. 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.

D. Self-Adhesive Vinyl Tape: Colored, heavy duty, waterproof, fade resistant; 2 inches (50 mm) wide; compounded for outdoor use.

2.3 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. Write-On Tags: Polyester tag, 0.010 inch (0.25 mm) 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.

D. Snap-Around Labels: Slit, pre-tensioned, 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: Slit, pre-tensioned, flexible, solid-colored acrylic sleeve, 2 inches (50 mm) long, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.

2.4 CONDUCTOR IDENTIFICATION MATERIALS

A. Color-Coding Conductor Tape: Colored, self-adhesive vinyl tape not less than 3 mils (0.08 mm) thick by 1 to 2 inches (25 to 50 mm) 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. Marker Tapes: Vinyl or vinyl-cloth, self-adhesive wraparound type, with circuit identification legend machine printed by thermal transfer or equivalent process.

D. Write-On Tags: Polyester tag, 0.010 inch (0.25 mm) 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.

2.5 FLOOR MARKING TAPE

A. 2-inch- (50-mm-) wide, 5-mil (0.125-mm) pressure-sensitive vinyl tape, with black and white stripes and clear vinyl overlay.

2.6 UNDERGROUND-LINE WARNING TAPE

A. Tape:

1. Recommended by manufacturer for the method of installation and suitable to identify and locate underground electrical utility lines.
2. Printing on tape shall be permanent and shall not be damaged by burial operations.
3. Tape material and ink shall be chemically inert, and not subject to degrading when exposed to acids, alkalis, and other destructive substances commonly found in soils.

B. Color and Printing:
   1. Comply with ANSI Z535.1 through ANSI Z535.5.
   2. Inscriptions for Red-Colored Tapes: ELECTRIC LINE, HIGH VOLTAGE.
   3. Inscriptions for Orange-Colored Tapes: TELEPHONE CABLE, CATV CABLE, COMMUNICATIONS CABLE, OPTICAL FIBER CABLE.

C. Tag: Type ID:
   1. Detectable three-layer laminate, consisting of a printed pigmented polyolefin film, a solid aluminum-foil core, and a clear protective film that allows inspection of the continuity of the conductive core, bright-colored, continuous-printed on one side with the inscription of the utility, compounded for direct-burial service.
   2. Overall Thickness: 5 mils (0.125 mm).
   3. Foil Core Thickness: 0.35 mil (0.00889 mm).
   4. Weight: 28 lb/1000 sq. ft. (13.7 kg/100 sq. m).
   5. 3-Inch (75-mm) Tensile According to ASTM D 882: 70 lbf (311.3 N), and 4600 psi (31.7 MPa).

2.7 INSTRUCTION SIGNS

A. Engraved, laminated acrylic or melamine plastic, minimum 1/16 inch (1.6 mm) thick for signs up to 20 sq. inches (129 sq. cm) and 1/8 inch (3.2 mm) thick for larger sizes.
   1. Engraved legend with black letters on white face.
   2. Punched or drilled for mechanical fasteners.
   3. Framed with mitered acrylic molding and arranged for attachment at applicable equipment.

B. Adhesive Film Label: Machine printed, in black, by thermal transfer or equivalent process. Minimum letter height shall be 3/8 inch (10 mm).

C. 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 (10 mm). Overlay shall provide a weatherproof and UV-resistant seal for label.

2.8 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 (10 mm). 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 (10 mm).
2.9 MISCELLANEOUS IDENTIFICATION PRODUCTS

A. Paint: Comply with requirements in 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. Location: Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment.

B. Apply identification devices to surfaces that require finish after completing finish work.

C. Self-Adhesive Identification Products: Clean surfaces before application, using materials and methods recommended by manufacturer of identification device.

D. Attach signs and plastic labels that are not self-adhesive type with mechanical fasteners appropriate to the location and substrate.

E. 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 (15-m) maximum intervals in straight runs, and at 25-foot (7.6-m) maximum intervals in congested areas.

F. Underground-Line Warning Tape: During backfilling of trenches install continuous underground-line warning tape directly above line at 6 to 8 inches (150 to 200 mm) below finished grade. Use multiple tapes where width of multiple lines installed in a common trench or concrete envelope exceeds 16 inches (400 mm) overall.

G. Painted Identification: Comply with requirements in painting Sections for surface preparation and paint application.

3.2 IDENTIFICATION SCHEDULE

A. Accessible Raceways and Metal-Clad Cables, 600 V or Less, for Service, Feeder, and Branch Circuits More Than 30 A, and 120 V to ground: Install labels at 10-foot (3-m) 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:

2. Power.

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 service feeder and branch-circuit conductors.

   a. Color shall be factory applied or field applied for sizes larger than No. 8 AWG, if authorities having jurisdiction permit.
   b. Colors for 208/120-V Circuits:

      1) Phase A: Black.
      2) Phase B: Red.
      3) Phase C: Blue.

   c. Field- Applied, Color-Coding Conductor Tape: Apply in half-lapped turns for a minimum distance of 6 inches (150 mm) from terminal points and in boxes where splices or taps are made. Apply last two turns of tape with no tension to prevent possible unwinding. Locate bands to avoid obscuring factory cable markings.

D. Conductors to Be Extended in the Future: Attach write-on tags to conductors and list source.


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.

F. Locations of Underground Lines: Identify with underground-line warning tape for power, lighting, communication, and control wiring and optical fiber cable.

1. Limit use of underground-line warning tape to direct-buried cables.
2. Install underground-line warning tape for both direct-buried cables and cables in raceway.

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: Self-adhesive warning labels.

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. 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: Adhesive film label. Unless otherwise indicated, provide a single line of text with 1/2-inch- (13-mm-) high letters on 1-1/2-inch- (38-mm-) high label; where two lines of text are required, use labels 2 inches (50 mm) 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.

END OF SECTION
SECTION 260923
LIGHTING CONTROL DEVICES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Time switches.
   2. Photoelectric switches.
   3. Indoor occupancy, switchbox-mounted occupancy and outdoor motion sensors.

B. Related Requirements:
   1. Division 26, Section "Wiring Devices" for wall-box dimmers, wall-switch occupancy sensors, and manual light switches.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.3 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

1.4 CLOSEOUT SUBMITTALS

A. Operation and maintenance data

PART 2 - PRODUCTS

2.1 INDOOR OCCUPANCY SENSORS

2.2 Retain "Manufacturers" Paragraph and list of manufacturers below to require products from manufacturers listed or a comparable product from other manufacturers.

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Hubbell Building Automation, Inc.
2. Bryant Electric; a Hubbell company.
3. Cooper Industries, Inc.
5. Lightolier Controls.
6. Lithonia Lighting; Acuity Lighting Group, Inc.
7. Lutron Electronics Co., Inc.
8. NSi Industries LLC; TORK Products.
9. RAB Lighting.
10. Sensor Switch, Inc.
11. Square D; a brand of Schneider Electric.
12. Watt Stopper.

B. General Requirements for Sensors: Wall- or ceiling-mounted, solid-state indoor occupancy sensors with a separate power pack.

1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
2. Operation: Unless otherwise indicated, turn lights on when coverage area is occupied, and turn them off when unoccupied; with a time delay for turning lights off, adjustable over a minimum range of 1 to 15 minutes.
3. Sensor Output: Contacts rated to operate the connected relay, complying with UL 773A. Sensor is powered from the power pack.
4. Power Pack: Dry contacts rated for 20-A ballast load at 120- and 277-V ac, for 13-A tungsten at 120-V ac, and for 1 hp at 120-V ac. Sensor has 24-V dc, 150-mA, Class 2 power source, as defined by NFPA 70.
5. Mounting:
   a. Sensor: Suitable for mounting in any position on a standard outlet box.
   b. Relay: Externally mounted through a 1/2-inch (13-mm) knockout in a standard electrical enclosure.
   c. Time-Delay and Sensitivity Adjustments: Recessed and concealed behind hinged door.
6. Indicator: Digital display, to show when motion is detected during testing and normal operation of sensor.
7. Bypass Switch: Override the "on" function in case of sensor failure.
8. Automatic Light-Level Sensor: Adjustable from 2 to 200 fc (21.5 to 2152 lux); turn lights off when selected lighting level is present.

C. PIR Type: Ceiling mounted; detect occupants in coverage area by their heat and movement.

1. Detector Sensitivity: Detect occurrences of 6-inch- (150-mm-) minimum movement of any portion of a human body that presents a target of not less than 36 sq. in. (232 sq. cm).
2. Detection Coverage (Room): Detect occupancy anywhere in a circular area of 1000 sq. ft. (93 sq. m) when mounted on a 96-inch- (2440-mm-) high ceiling.
3. Detection Coverage (Corridor): Detect occupancy within 90 feet (27.4 m) when mounted on a 10-foot- (3-m-) high ceiling.
D. Ultrasonic Type: Ceiling mounted; detect occupants in coverage area through pattern changes of reflected ultrasonic energy.

1. Detector Sensitivity: Detect a person of average size and weight moving not less than 12 inches (305 mm) in either a horizontal or a vertical manner at an approximate speed of 12 inches/s (305 mm/s).
2. Detection Coverage (Small Room): Detect occupancy anywhere within a circular area of 600 sq. ft. (56 sq. m) when mounted on a 96-inch- (2440-mm-) high ceiling.
3. Detection Coverage (Standard Room): Detect occupancy anywhere within a circular area of 1000 sq. ft. (93 sq. m) when mounted on a 96-inch- (2440-mm-) high ceiling.
4. Detection Coverage (Large Room): Detect occupancy anywhere within a circular area of 2000 sq. ft. (186 sq. m) when mounted on a 96-inch- (2440-mm-) high ceiling.
5. Detection Coverage (Corridor): Detect occupancy anywhere within 90 feet (27.4 m) when mounted on a 10-foot- (3-m-) high ceiling in a corridor not wider than 14 feet (4.3 m).

E. Dual-Technology Type: Ceiling mounted; detect occupants in coverage area using PIR and ultrasonic detection methods. The particular technology or combination of technologies that control on-off functions is selectable in the field by operating controls on unit.

1. Sensitivity Adjustment: Separate for each sensing technology.
2. Detector Sensitivity: Detect occurrences of 6-inch- (150-mm-) minimum movement of any portion of a human body that presents a target of not less than 36 sq. in. (232 sq. cm), and detect a person of average size and weight moving not less than 12 inches (305 mm) in either a horizontal or a vertical manner at an approximate speed of 12 inches/s (305 mm/s).
3. Detection Coverage (Standard Room): Detect occupancy anywhere within a circular area of 1000 sq. ft. (93 sq. m) when mounted on a 96-inch- (2440-mm-) high ceiling.

2.3 SWITCHBOX-MOUNTED OCCUPANCY SENSORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Hubbell Building Automation, Inc.
2. Bryant Electric; a Hubbell company.
3. Cooper Industries, Inc.
5. Lightolier Controls.
6. Lithonia Lighting; Acuity Lighting Group, Inc.
7. Lutron Electronics Co., Inc.
8. NSi Industries LLC; TORK Products.
9. RAB Lighting.
10. Sensor Switch, Inc.
11. Square D; a brand of Schneider Electric.
12. Watt Stopper.
B. General Requirements for Sensors: Automatic-wall-switch occupancy sensor, suitable for mounting in a single gang switchbox.

1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
2. Operating Ambient Conditions: Dry interior conditions, 32 to 120 deg F (0 to 49 deg C).
3. Switch Rating: Not less than 800-VA fluorescent at 120 V, 1200-VA fluorescent at 277 V, and 800-W incandescent.

C. Wall-Switch Sensor Tag SOS:

1. Standard Range: 180-degree field of view, field adjustable from 180 to 40 degrees; with a minimum coverage area of 900 sq. ft. (84 sq. m).
2. Sensing Technology: Dual technology - PIR and ultrasonic.
3. Switch Type: SP, field selectable automatic "on," or manual "on" automatic "off."
4. Voltage: Match the circuit voltage dual-technology type.
5. Ambient-Light Override: Concealed, field-adjustable, light-level sensor from 10 to 150 fc (108 to 1600 lux). The switch prevents the lights from turning on when the light level is higher than the set point of the sensor.
6. Concealed, field-adjustable, "off" time-delay selector at up to 30 minutes.
7. Concealed "off" time-delay selector at 30 seconds, and 5, 10, and 20 minutes.
8. Adaptive Technology: Self-adjusting circuitry detects and memorizes usage patterns of the space and helps eliminate false "off" switching.

2.4 OUTDOOR MOTION SENSORS

2.5 LIGHTING CONTACTORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

2. ASCO Power Technologies, LP; a division of Emerson Electric Co.
4. General Electric Company; GE Consumer & Industrial - Electrical Distribution; Total Lighting Control.
5. Square D; a brand of Schneider Electric.

B. Description: Electrically operated and mechanically held, combination-type lighting contactors with non-fused 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.

2.6 CONDUCTORS AND CABLES

A. Power 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. Classes 2 and 3 Control Cable: Multi-conductor cable with stranded-copper conductors not smaller than No. 18 AWG. Comply with requirements in Division 26, Section "Low-Voltage Electrical Power Conductors and Cables."

C. Class 1 Control Cable: Multi-conductor cable with stranded-copper conductors not smaller than No. 14 AWG. Comply with requirements in Division 26, Section "Low-Voltage Electrical Power Conductors and Cables."

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install and aim sensors in locations to achieve not less than 90 percent coverage of areas indicated. Do not exceed coverage limits specified in manufacturer's written instructions.

B. Occupancy Adjustments: When requested within 12 months from date of Substantial Completion, provide on-site assistance in adjusting sensors to suit actual occupied conditions. Provide up to two visits to Project during other-than-normal occupancy hours for this purpose.

1. For occupancy and motion sensors, verify operation at outer limits of detector range. Set time delay to suit Owner's operations.

C. 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.

D. Wiring Method: Comply with Division 26, Section "Low-Voltage Electrical Power Conductors and Cables." Minimum conduit size is 1/2 inch (13 mm).

E. Identify components and power and control wiring according to Division 26, Section "Identification for Electrical Systems."

3.2 FIELD QUALITY CONTROL

A. 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.

B. Lighting control devices will be considered defective if they do not pass tests and inspections.

C. Prepare test and inspection reports.

END OF SECTION
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 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes: Distribution, dry-type transformers rated 600 V and less, with capacities up to 1500 kVA.

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 each type and size of transformer.
   2. Include rated nameplate data, capacities, weights, dimensions, minimum clearances, installed devices and features, and performance for each type and size of transformer.

B. Shop Drawings:
   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. Vibration Isolation Base Details: Detail fabrication including anchorages and attachments to structure and to supported equipment.
   3. Include diagrams for power, signal, and control wiring.

1.4 INFORMATIONAL SUBMITTALS

A. Seismic Qualification Certificates: For transformers, 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.
B. Qualification Data: For testing agency.

C. Source quality-control reports.

D. Field quality-control reports.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For transformers to include in emergency, operation, and maintenance manuals.

1.6 QUALITY ASSURANCE

A. Testing Agency Qualifications: Member company of NETA or an NRTL.

1. Testing Agency's Field Supervisor: Certified by NETA to supervise on-site testing.

1.7 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.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain each transformer type from single source from single manufacturer.

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Square D
2. Schneider (General Electric)
3. ABB
4. Siemens
5. Sorgel
6. Westinghouse
2.2 GENERAL TRANSFORMER REQUIREMENTS

A. Description: Factory-assembled and -tested, air-cooled units for 60-Hz service.

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. Transformers Rated 15 kVA and Larger: Comply with NEMA TP 1 energy-efficiency levels as verified by testing according to NEMA TP 2.

D. Cores: Electrical grade, non-aging silicon steel with high permeability and low hysteresis losses.

E. Coils: Continuous windings without splices except for taps.
   1. Internal Coil Connections: Brazed or pressure type.
   2. Coil Material: Aluminum.

F. Encapsulation: Transformers smaller than 30 kVA shall have core and coils completely resin encapsulated.

G. Shipping Restraints: Paint or otherwise color code bolts, wedges, blocks, and other restraints that are to be removed after installation and before energizing. Use fluorescent colors that are easily identifiable inside the transformer enclosure.

2.3 DISTRIBUTION TRANSFORMERS

A. Comply with NFPA 70, and list and label as complying with UL 1561.

B. Provide transformers that are constructed to withstand seismic forces specified in Section 260548.16 "Seismic Controls for Electrical Systems."

C. Cores: One leg per phase.

D. Enclosure: Ventilated.
   1. NEMA 250, Type 2: Core and coil shall be encapsulated within resin compound to seal out moisture and air.
   2. KVA Ratings: Based on convection cooling only and not relying on auxiliary fans.

E. Transformer Enclosure Finish: Comply with NEMA 250.
   1. Finish Color: Gray.

F. Taps for Transformers 3 kVA and Smaller: One 5 percent tap above normal full capacity.

G. Taps for Transformers 7.5 to 24 kVA: One 5 percent tap above and one 5 percent tap below normal full capacity.

H. Taps for Transformers 25 kVA and Larger: Two 2.5 percent taps above and two 2.5 percent taps below normal full capacity.
I. Insulation Class, Smaller than 30 kVA: 185 deg C, UL-component-recognized insulation system with a maximum of 115-deg C rise above 40-deg C ambient temperature.

J. Insulation Class, 30 kVA and Larger: 220 deg C, UL-component-recognized insulation system with a maximum of 150-deg C rise above 40-deg C ambient temperature.

K. K-Factor Rating: Transformers indicated to be K-factor rated shall comply with UL 1561 requirements for nonsinusoidal load current-handling capability to the degree defined by designated K-factor.

1. Unit shall not overheat when carrying full-load current with harmonic distortion corresponding to designated K-factor.
2. Indicate value of K-factor on transformer nameplate.
3. Unit shall meet requirements of NEMA TP 1 when tested according to NEMA TP 2 with a K-factor equal to one.

L. Electrostatic Shielding: Each winding shall have an independent, single, full-width copper electrostatic shield arranged to minimize interwinding capacitance.

1. Arrange coil leads and terminal strips to minimize capacitive coupling between input and output terminals.
2. Include special terminal for grounding the shield.

M. Neutral: Rated 200 percent of full load current for K-factor rated transformers.

N. Wall Brackets: Manufacturer's standard brackets.

O. Fungus Proofing: Permanent fungicidal treatment for coil and core.

P. Low-Sound-Level Requirements: Maximum sound levels when factory tested according to IEEE C57.12.91, as follows:

1. 30 to 50 kVA: 45 db.
2. 51 to 150 kVA: 50 db.
3. 151 to 300 kVA: 55 db.
4. 301 to 500 kVA: 65 db.

2.4 BUCK-BOOST TRANSFORMERS

A. Description: Self-cooled, two-winding dry type, rated for continuous duty and with wiring terminals suitable for connection as autotransformer. Transformers shall be listed and labeled as complying with UL 506 or UL 1561.

1. Standard impedance at 60Hz: 2 percent to 5 percent (up to 10 kVA), 4 percent to 6.5 percent (above 10 kVA).
2. Nameplate Rating: Linear load, 60Hz.
3. Insulation Class: 220 deg C system.
4. Temperature Rise: 150 deg C.
5. Core Construction: Electrical grade, non-aging silicon steel with high permeability and low hysteresis losses.
6. Coil Conductors: Continuous aluminum windings, with terminations brazed, welded, or bolted.
7. Coil Impregnation: Vacuum impregnated with polyester resin.
8. Sound Level: Not exceeding values listed above for distribution transformers.
9. Enclosure: Ventilated, NEMA 250, Type 3R.
10. Terminations: Transformer coils shall terminate in mounting pads. Mounting lugs shall be provided on all units up to and including 270 A ratings.
11. Antivibration pads or isolators shall be used between the transformer core and coil and the enclosure.
12. Ground core and coil assembly to enclosure with a flexible copper grounding strap or equivalent.
13. Mounting:
   a. Ventilated Units up to 750 lb (340 kG): Suitable for wall, floor, or ceiling mounting (drip plate required).
   b. Ventilated Units over 750 lb (340 kG): Suitable for floor mounting only.
   c. Encapsulated Units up to 285 lb (130 kG): Suitable for wall or floor mounting.
   d. Encapsulated Units over 285 lb (130 kG): Suitable for floor mounting only.
14. Seismic: Floor-mounted units comply with Earthquake Loads Section of International Building Code with site-specific parameters of Occupancy Category III and Site Profile Type SD with the seismic forces defined as Spectral Acceleration for Short Periods equal to 1.0 g.

B. Enclosure: Ventilated.
   1. Finish Color: Gray.

2.5 IDENTIFICATION DEVICES

A. Nameplates: Engraved, laminated-plastic or metal nameplate for each [distribution] [buck-boost] transformer, mounted with corrosion-resistant screws. Nameplates and label products are specified in Section 260553 "Identification for Electrical Systems."

2.6 SOURCE QUALITY CONTROL

A. Test and inspect transformers according to IEEE C57.12.01 and IEEE C57.12.91.
   1. Resistance measurements of all windings at the rated voltage connections and at all tap connections.
   2. Ratio tests at the rated voltage connections and at all tap connections.
   3. Phase relation and polarity tests at the rated voltage connections.
   4. No load losses, and excitation current and rated voltage at the rated voltage connections.
   5. Impedance and load losses at rated current and rated frequency at the rated voltage connections.
   6. Applied and induced tensile tests.
   7. Regulation and efficiency at rated load and voltage.
   8. Insulation Resistance Tests:
a. High-voltage to ground.
b. Low-voltage to ground.
c. High-voltage to low-voltage.

9. Temperature tests.

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 Section 260526 "Grounding and Bonding for Electrical Systems" have been met. Maximum ground resistance shall be 5 ohms at location of transformer.

E. Environment: Enclosures shall be rated for the environment in which they are located. Covers for NEMA 250, Type 4X enclosures shall not cause accessibility problems.

F. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install wall-mounted transformers level and plumb with wall brackets fabricated by transformer manufacturer.

1. Coordinate installation of wall-mounted and structure-hanging supports with actual transformer provided.

2. Brace wall-mounted transformers as specified in Section 260548.16 "Seismic Controls for Electrical Systems."

B. Install transformers level and plumb on a concrete base with vibration-dampening supports. Locate transformers away from corners and not parallel to adjacent wall surface.

C. Construct concrete bases according to Section 033000 "Cast-in-Place Concrete" or Section 033053 "Miscellaneous Cast-in-Place Concrete" and anchor floor-mounted transformers according to manufacturer's written instructions and requirements in Section 260529 "Hangers and Supports for Electrical Systems."
1. Coordinate size and location of concrete bases with actual transformer provided. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified with concrete.

D. Secure transformer to concrete base according to manufacturer's written instructions.

E. Secure covers to enclosure and tighten all bolts to manufacturer-recommended torques to reduce noise generation.

F. Remove shipping bolts, blocking, and wedges.

3.3 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."

C. 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-486B.

D. Provide flexible connections at all conduit and conductor terminations and supports to eliminate sound and vibration transmission to the building structure.

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 ATS for dry-type, air-cooled, low-voltage transformers. 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 Substantial Completion, 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 two follow-up infrared scans of transformers, one at four months and the other at 11 months after Substantial Completion.
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 5 percent and not being lower than nameplate voltage minus 3 percent at maximum load conditions. Submit recording and tap settings as test results.

B. Connect buck-boost transformers to provide nameplate voltage of equipment being served, plus or minus 5 percent, at secondary terminals.


3.6 CLEANING

A. Vacuum dirt and debris; do not use compressed air to assist in cleaning.

END OF SECTION
SECTION 262416
PANELBOARDS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS
A. The applicable requirements and conditions of specifications Section 260500, “Common Work Results for Electrical,” are hereby made an integral part of this section.
B. The work governed by these specifications includes but is not limited to that as defined in specifications section "Scope of Work" of specifications Section 260500, “Common Work Results for Electrical.”

1.2 SUMMARY
A. Section Includes:
   1. Distribution panelboards.
   2. Lighting and appliance branch-circuit panelboards.
   3. Load centers.

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."

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 01 Section "Operation and Maintenance Data," include the following:
   1. Manufacturer's written instructions for testing and adjusting overcurrent protective devices.
   2. Time-current curves, including selectable ranges for each type of overcurrent protective device that allows adjustments.

1.6 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 (minus 30 deg C) to plus 104 deg F (plus 40 deg C).
   B. Service Conditions: NEMA PB 1, usual service conditions, as follows:
      1. Ambient temperatures within limits specified.

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.
   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 in Division 03.

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 Substantial Completion.

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.
3. 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.
4. 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.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR PANELBOARDS

A. Provide common area and house branch panels (panel boards) of dead front completely enclosed safety type construction, UL listed (with all components bearing UL labels), of a type suitable for use as service entrance, and containing thermal-magnetic "bolt-on" type circuit breaker branches as per the respective schedules on the drawings. For panels within individual dwelling units only, refer to the section of this specification "Load Centers".

B. Provide cabinets consisting of code gauge galvanized sheet steel boxes of sufficient depth, width, and length to mount the panels as indicated on the drawings and to facilitate wiring, with suitable lugs for mounting panel interiors, and with wiring gutters at top, bottom, and sides of sufficient size to adequately accommodate the raceways, conductors, and cables entering and leaving (provide all gutters at least 100 mm (4").)

C. Provide panel faces with adjustable indicating type clamps and of single door construction, with door opening over the circuit breaker section (secured with locks and pulls as specified under paragraph heading "Locks and Keys"), hung with heavy hinges, and with faces and doors not less than 2.7 mm (12 ga.) thick.

D. Provide metal frame circuit directory holders welded to the inside of the cabinet doors with transparent covers. Place typewritten directories in these holders.

E. Provide bus bars with ampacity as indicated on the drawings (or corresponding to main breaker, where applicable) and with all current carrying parts sized per UL 67 heat rise testing.

F. Provide panels with separate ground and neutral busses. Provide neutral bus with provisions for bonding and bond where required by the N.E.C.

G. Fabricate and test panelboards according to IEEE 344 to withstand seismic forces defined in Division 26 Section "Vibration and Seismic Controls for Electrical Systems."

H. Enclosures: Flush- and surface-mounted cabinets.
   1. Rated for environmental conditions at installed location.
      a. Indoor Dry and Clean Locations: NEMA 250, Type 1.
      b. Kitchen Areas: NEMA 250, Type 4X.
   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 pre-treating 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.


I. Incoming Mains Location: Top and bottom.

J. Phase, Neutral, and Ground Buses:
   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.

K. Conductor Connectors: Suitable for use with conductor material and sizes.
   2. Main and Neutral Lugs: Mechanical type.
   3. Ground Lugs and Bus-Configured Terminators: Mechanical type.
   4. Feed-Through Lugs: Mechanical type, suitable for use with conductor material. Locate at opposite end of bus from incoming lugs or main device.
   5. Subfeed (Double) Lugs: Mechanical type suitable for use with conductor material. Locate at same end of bus as incoming lugs or main device.
   6. Gutter-Tap Lugs: Mechanical type suitable for use with conductor material. Locate at same end of bus as incoming lugs or main device.
   7. Extra-Capacity Neutral Lugs: Rated 200 percent of phase lugs mounted on extra-capacity neutral bus.

L. Service Equipment Label: NRTL labeled for use as service equipment for panelboards or load centers with one or more main service disconnecting and overcurrent protective devices.

M. Future Devices: Mounting brackets, bus connections, filler plates, and necessary appurtenances required for future installation of devices.

N. Panelboard Short-Circuit Current Rating: Provide panels with 10,000A short circuit rating (A.I.C., Isc), unless indicated otherwise on the drawings. Provide panels fully short circuit rated, series short circuit rating of panels are not acceptable (unless specifically indicated otherwise).

2.2 LIGHTING AND APPLIANCE BRANCH-CIRCUIT PANELBOARDS

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 by one of the following:
   1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
4. Square D; a brand of Schneider Electric.

C. Panelboards: NEMA PB 1, lighting and appliance branch-circuit type.

D. Mains: Circuit breaker or lugs only.

E. Branch Overcurrent Protective Devices: Bolt-on circuit breakers, replaceable without disturbing adjacent units.

F. Contactors in Main Bus: NEMA ICS 2, Class A, mechanically held, general-purpose controller, with same short-circuit interrupting rating as panelboard.
   1. Internal Control-Power Source: Control-power transformer, with fused primary and secondary terminals, connected to main bus ahead of contactor connection.
   2. External Control-Power Source: 120V branch circuit or 24-V control circuit.

G. Doors: Concealed hinges; secured with flush latch with tumbler lock; keyed alike.

H. Column-Type Panelboards: Narrow gutter extension, with cover, to overhead junction box equipped with ground and neutral terminal buses.

2.3 LOAD CENTERS

A. Provide load centers (panels) within individual dwelling units, only, of dead front completely enclosed safety type construction, UL listed (with all components bearing UL labels), of a type suitable for use as service entrance, and containing thermal-magnetic "plug-in" type circuit breaker branches as per the respective schedules on the drawings. For common area and "house" panels, refer to the section of this specification "Branch Panels".

B. Provide cabinets consisting of code gauge painted sheet steel boxes of sufficient depth, width, and length to mount the panels as indicated on the drawings and to facilitate wiring, with suitable lugs for mounting panel interiors, and with wiring gutters at top, bottom, and sides of sufficient size to adequately accommodate the raceways, conductors, and cables entering and leaving.

C. Provide panel faces secured with screws direct into the cabinet and of single door construction, with door opening over the circuit breaker section (secured with non-locking pulls), hung with standard hinges, and with faces and doors of not less than 12 gauge.

D. Provide suitable circuit directory holders on the inside of the cabinet doors with transparent covers. Place typewritten directories in these holders.

E. Provide bus bars with ampacity as indicated on the drawings (or corresponding to main breaker, where applicable) and with all current carrying parts sized per UL 67 heat rise testing.

F. Provide panels with separate ground and neutral busses. Provide neutral bus with provisions for bonding and bond where required by the NEC.

G. Provide panels with 10,000A short circuit rating (A.I.C., Isc), unless indicated otherwise on the drawings. Provide panels fully short circuit rated, series short circuit rating of panels are not acceptable (unless specifically indicated otherwise).

H. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
I. Basis-of-Design Product: Subject to compliance with requirements, provide product by one of the following:
   1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
   4. Square D; a brand of Schneider Electric.

J. Load Centers: Comply with UL 67.

K. Mains: Lugs only.

L. Branch Overcurrent Protective Devices: Plug-in circuit breakers, replaceable without disturbing adjacent units.

M. Conductor Connectors: Mechanical type for main, neutral, and ground lugs and buses.

2.4 DISCONNECTING AND OVERCURRENT PROTECTIVE DEVICES

A. This section applies to all circuit breakers installed within or in conjunction with branch and distribution panels, enclosed circuit breakers, contactors, starters, and any other electrical equipment, unless indicated otherwise.

B. Provide all circuit breakers of the molded case type unless specifically indicated otherwise. Provide readily removable from the front of panels and equipment without disturbing adjacent units, having quick-make and quick-break toggle mechanisms and non-fusible contacts, having inverse time and short circuit characteristics, which trip free on overload or short circuit so that they cannot be held closed on overload, clearly indicating whether they are in the open, tripped, or closed position. Provide automatic release obtained through the medium of a bimetallic thermal type element (ambient compensated) engaged in the releasing latch of the breaker or mechanism.

C. Provide circuit breakers in branch and distribution panels with short circuit ratings as indicated in the respective equipment specifications. Provide circuit breakers as part of enclosed circuit breakers, contactors, starters, and any other electrical equipment with short circuit ratings not less than the short circuit rating of the first overcurrent device on the line side of the breaker, unless indicated otherwise on the drawings.

D. Provide field-installed handle locking devices for all circuit breakers not requiring switch control, for all circuit breakers feeding emergency lighting equipment (including battery equipment) and fire alarm controls, and for all circuit breakers fed from an emergency generator system (where applicable).

E. Provide 15A and 20A circuit breakers "SWD" and "HID" rated. Provide branch panel (250V and less) circuit breakers rated 70A and less as "HACR" rated. Provide enclosed circuit breakers and circuit breakers in distribution panels rated 250A and less as "HACR" rated.

F. For all 120V, 20A and 120V, 15A circuits (including multi-wire branch circuits feeding 120V loads) serving any new outlets (receptacle outlets, lighting outlets, fan outlets, equipment outlets, utilization outlets, etc.) in any dwelling unit family room, dining room, living room, parlor, library, den, bedroom, sunroom, recreation room, closet, hallway, or similar room or area, provide branch circuit breakers of the arc fault circuit interrupter (AFCI) type. This does not apply to circuits rated 208V and greater or circuits rated 30A and greater. For the purposes of this section, bedrooms include all bedrooms, hotel/motel guest rooms, dormitory rooms, and any other room capable of being converted to or used as a bedroom or for sleeping. Provide as
NEC approved and UL listed for the purpose. Provide whether indicated on the drawings (including panel schedules) or not, include all costs in bid.

G. Provide all circuit breakers over 250A of a type with interchangeable trip units. Provide all circuit breakers rated 1,000A or larger and operating at over 250V with integral ground fault protection for equipment.

H. Where circuit breakers include or facilitate adjustable settings, adjust and set as follows. Set adjustable continuous current settings (where applicable) to ratings shown on drawings. For adjustable instantaneous, short time, and ground fault settings (where applicable), the electrical contractor is responsible for (include all costs) a basic short circuit and coordination study performed by the respective circuit breaker manufacturer. Set breakers as per this study. Provide study in accordance with applicable ANSI and IEEE standards. Gather all information required by the manufacturer to perform this study. Submit a written report of the study to the engineer for review prior to releasing equipment for manufacture. The basic coordination study may be limited to a minimum of coordinating each adjustable setting circuit breaker with the nearest line side overcurrent device directly feeding the breaker and all nearest load side overcurrent device(s) fed directly by the breaker. The basic short circuit study may be limited to the minimum required to complete the coordination study and confirm proper settings. Setting adjustable circuit breaker settings to the minimum or factory "default" settings (i.e. as shipped from the factory) is not acceptable.

I. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

J. Basis-of-Design Product: Subject to compliance with requirements, provide product by one of the following:
1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
4. Square D; a brand of Schneider Electric.

K. Molded-Case Circuit Breaker (MCCB): Comply with UL 489, with interrupting capacity to meet available fault currents.
3. Electronic trip circuit breakers with rms sensing; field-replaceable rating plug or field-replaceable electronic trip; and the following field-adjustable settings:
   a. Instantaneous trip.
   b. Long- and short-time pickup levels.
   c. Long- and short-time time adjustments.
   d. Ground-fault pickup level, time delay, and I²t response.
4. Current-Limiting Circuit Breakers: Frame sizes 400A and smaller; let-through ratings less than NEMA FU 1, RK-5.
5. GFCI Circuit Breakers: Single- and two-pole configurations with Class A ground-fault protection (6-mA trip).
8. Molded-Case Circuit-Breaker (MCCB) Features and Accessory Components:
   a. Standard frame sizes, trip ratings, and number of poles.
   b. Lugs: Mechanical 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.
   e. Communication Capability: Circuit-breaker-mounted communication module with functions and features compatible with power monitoring and control system specified in Division 26 Section "Electrical Power Monitoring and Control."
   f. Shunt Trip: 120V or 24V trip coil energized from separate circuit, set to trip at 75 percent of rated voltage.
   g. Under-voltage Trip: Set to operate at 35 to 75 percent of rated voltage with field-adjustable 0.1- to 0.6-second time delay.
   h. Auxiliary Contacts: Two SPDT switches with "a" and "b" contacts; "a" contacts mimic circuit-breaker contacts and "b" contacts operate in reverse of circuit-breaker contacts.
   i. Alarm Switch: Single-pole, normally open contact that actuates only when circuit breaker trips.
   j. Key Interlock Kit: Externally mounted to prohibit circuit-breaker operation; key shall be removable only when circuit breaker is in off position.
   k. Zone-Selective Interlocking: Integral with electronic trip unit; for interlocking ground-fault protection function with other upstream or downstream devices.
   l. Multi-pole units enclosed in a single housing or factory assembled to operate as a single unit.
   m. Handle Padlocking Device: Fixed attachment, for locking circuit breaker handle in on or off position.
   n. Handle Clamp: Loose attachment, for holding circuit-breaker handle in on position.

L. Fused Switch: NEMA KS 1, Type HD; clips to accommodate specified fuses; lockable handle.
   1. Fuses, and Spare-Fuse Cabinet: Comply with requirements specified in Division 26 Section "Fuses."
   2. Fused Switch Features and Accessories: Standard ampere ratings and number of poles.
   3. Auxiliary Contacts: Two normally open and normally closed contact(s) that operate with switch handle operation.

2.5 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. Where panels are flush mounted, provide an adjacent junction box for branch wiring as indicated below. Provide suitable junction boxes (and/or wiring troughs) for branch wiring at branch panels as follows. These provisions do not apply to load centers. The electrical contractor must provide junction boxes for all flush mounted panels. The electrical contractor may utilize junction boxes (as an option to metal panel skirts) to avoid exposed visible cables in electrical closets and electrical rooms. The electrical contractor may utilize junction boxes at other locations and applications if desired, but the boxes and raceways (wherever used) must comply with all of the following requirements.

1. Locate each junction box above an accessible drop ceiling (or an access panel if ceiling is inaccessible) directly above or as close as practical to the panel. Where junction box is installed to satisfy requirements to hide cable wiring methods, locate outside of the electrical closet/room or inside the closet/room at a perimeter wall so there are no visible cables in the closet/room (except that not more than 300 mm (12”) total visible length of each cable is permitted leaving the junction box).

2. Provide junction boxes and raceways between boxes and panel as indicated below.

<table>
<thead>
<tr>
<th>Panel Size (Branch Ckt. Poles)</th>
<th>Junction Box Min. Dimensions</th>
<th>Quantity and Size of Conduits</th>
</tr>
</thead>
<tbody>
<tr>
<td>43-Poles &amp; Over (All Double panels)</td>
<td>48&quot;W x 8&quot;H x 8&quot;D (1.2m x 205mm x 205mm) * (8) 53 mm (2&quot;)</td>
<td></td>
</tr>
<tr>
<td>31-to 42-Poles</td>
<td>24&quot;W x 8&quot;H x 8&quot;D (0.6m x 205mm x 205mm) (4) 53 mm (2&quot;)</td>
<td></td>
</tr>
<tr>
<td>19-to 30-Poles</td>
<td>24&quot;W x 6&quot;H x 6&quot;D (0.6m x 155mm x 155mm) (3) 53 mm (2&quot;)</td>
<td></td>
</tr>
<tr>
<td>18-Poles and less</td>
<td>18&quot;W x 6&quot;H x 6&quot;D (460mm x 155mm x 155mm) (2) 53 mm (2&quot;)</td>
<td></td>
</tr>
</tbody>
</table>

- Two (2) 24"W x 8"H x 8"D (0.6 m x 205 mm x 205 mm) junction boxes may be substituted. Provide (2) 78 mm (3") conduit nipples between the junction boxes.

3. Adjust wiring sizes between each junction box and panel in accordance with N.E.C. de-rating factors. Utilize #8 A.W.G. wiring for branch circuits rated 25 A or 30 A. Utilize #6 A.W.G. wiring for branch circuits rated over 30 A but less than 60 A. Coordinate routing of wiring between junction box and panel with the engineer during construction for all circuits rated over 30 A. Where wiring sizes change due to de-rating considerations, splice wiring in the junction box as required.
4. Do not pass the incoming panel feeder and any branch circuits rated 60A and larger through junction boxes, run this wiring directly into panels. Do not terminate any branch wiring conductors (including grounding conductors associated with each branch circuit) in junction boxes. Terminate conductors only at circuit breakers, ground bus, and neutral bus in panels. Do not splice conductors in junction boxes, except straight-through splicing of two (2) conductors as provided above for de-rating.

5. Bond each junction box to the panel enclosure with a grounding conductor run in one of the raceways between the panel and junction box. Provide bonding conductor not smaller than the grounding conductor for the panel feeder.

C. Where branch wiring fed from the panel utilizes cable wiring methods (i.e. types "AC" and "MC" cables, where permitted elsewhere by the specifications) avoid visible exposed cables in electrical closets and electrical rooms by either of the following options:
   1. Provide suitable sheet metal panel "skirt" enclosure(s) above and/or below the panel as required to completely enclose cable wiring methods so not more than a 300 mm (12") total length of each cable is visible. Provide skirt enclosures fabricated of galvanized sheet steel not less than 0.55 mm (26 ga.) thick.

D. Comply with mounting and anchoring requirements specified in Division 26 Section "Vibration and Seismic Controls for Electrical Systems."

E. Mount top of trim 90 inches (2286 mm) above finished floor unless otherwise indicated.

F. 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.

G. Install overcurrent protective devices and controllers not already factory installed.
   1. Set field-adjustable, circuit-breaker trip ranges.

H. Install filler plates in unused spaces.

I. Stub four 1-inch (27-GRC) empty conduits from panelboard into accessible ceiling space or space designated to be ceiling space in the future. Stub four 1-inch (27-GRC) empty conduits into raised floor space or below slab not on grade.

J. Arrange conductors in gutters into groups and bundle and wrap with wire ties after completing load balancing.

K. 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 Owner's final room designations. Obtain approval before installing. Use a computer or typewriter to create directory; handwritten directories are not acceptable.

C. Panelboard Nameplates: Label each panelboard with a nameplate complying with requirements for identification specified in Division 26 Section "Identification for Electrical Systems."

D. Device Nameplates: Label each branch circuit device in distribution panelboards with a nameplate complying with requirements for identification specified in Division 26 Section "Identification for Electrical Systems."
3.4 FIELD QUALITY CONTROL

A. 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 Substantial Completion, 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 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.

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. Set field-adjustable circuit-breaker trip ranges as indicated.

C. Load Balancing: After Substantial Completion, but not more than 60 days after Final Acceptance, measure load balancing and make circuit changes.
   1. Measure as directed during period of normal system loading.
   2. Perform load-balancing circuit changes outside normal occupancy/working schedule of the facility and at time directed. Avoid disrupting critical 24-hour services such as fax machines and on-line data processing, computing, transmitting, and receiving equipment.
3. After circuit changes, recheck loads during normal load period. Record all load readings before and after changes and submit test records.

4. Tolerance: Difference exceeding 20 percent between phase loads, within a panelboard, is not acceptable. Rebalance and recheck as necessary to meet this minimum requirement.

3.6 PROTECTION

A. Temporary Heating: Apply temporary heat to maintain temperature according to manufacturer's written instructions.

END OF SECTION
SECTION 262726

WIRING DEVICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The applicable requirements and conditions of specifications Section 260500, “Basic Electrical System Requirements,” are hereby made an integral part of this section.

B. The work governed by these specifications includes but is not limited to that as defined in specifications section "Scope of Work" of specifications Section 260500, “Basic Electrical System Requirements.”

1.2 SUMMARY

A. This Section includes the following:

1. Receptacles, receptacles with integral GFCI, and associated device plates.
2. Twist-locking receptacles.
3. Receptacles with integral surge suppression units.
5. Snap switches and wall-box dimmers.
7. Wall-switch and exterior occupancy sensors.
8. Communications outlets.
9. Cord and plug sets.

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. TVSS: Transient voltage surge suppressor.
F. 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 pre-marking 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.

PART 2 – PRODUCTS

2.1 GENERAL
A. Provide all receptacles and switches as industrial and specification grade in public and common spaces and residential grade in all apartment units, totally enclosed in non-flammable and heat resistant heavy-duty thermoplastic case, with terminal screws on the side of the case. Provide color as selected and approved by the owner and architect.
B. Provide receptacles as duplex, parallel blade, side wired, three (3) wire, grounding type, 20A, 120V, and listed as "tamper-resistant", unless specifically indicated otherwise on the drawings. UL listed combination receptacle and separable snap-in wiring terminal assemblies (Hubbell "SNAPConnect" style, Pass & Seymour "PlugTail" style, or approved equal) may be used and may utilize pigtail connections on the wiring terminal assemblies. Pigtail conductor connections are not permitted (except for specialty devices where side terminal screws are not available options in the manufacturer's catalog).
C. Provide weatherproof receptacles listed as weather-resistant type and mounted in a weatherproof box with gasket and single spring-hinged weatherproof-while-in-use cover over both receptacle positions.
D. Provide receptacles at bathrooms, janitor closets, kitchen/kitchenette counters, outdoors, wet locations, and as indicated on the drawings or required by the NEC with integral ground fault circuit interrupter (GFCI) protection for personnel with trip characteristics as per UL standards.
E. Provide wall switches as single pole, three-way, or four-way as required, heavy duty flux tumbler type, UL "T" rated, specification grade, and rated 20A, 277V and 120V.
F. Provide horsepower rated single-pole thermal overload switches (manual motor starters, O/L switches, etc.) with thermal overload heater element coordinated with equipment served. Where overload protection is not required (where the switch acts only as disconnecting means) provide overload heater element rated in excess of the branch circuit breaker amperes.

G. For all switches where locking provisions are required by Code or indicated on the drawings and for all thermal overload switches, provide a suitable handle locking guard capable of visibly padlocking in the open or closed position (with switch handle position visible when locked).

2.2 MANUFACTURERS

A. Provide products of one of the following manufacturers:
   1. Cooper Wiring Devices; a division of Cooper Industries, Inc. (Cooper).
   2. Hubbell Incorporated; Wiring Device-Kellems (Hubbell).
   4. Pass & Seymour/Legrand; Wiring Devices & Accessories (Pass & Seymour).
   5. Approved equal.

2.3 STRAIGHT BLADE RECEPTACLES

A. Convenience Receptacles, 125V, 20A: Comply with NEMA WD 1, NEMA WD 6 configuration 5-20R, and UL 498.

B. Tamper-Resistant Convenience Receptacles, 125V, 20A: Comply with NEMA WD 1, NEMA WD 6 configuration 5-20R, and UL 498.

2.4 GFCI RECEPTACLES

A. General Description: Straight blade, feed-through type. Comply with NEMA WD 1, NEMA WD 6, UL 498, and UL 943, Class A, and include indicator light that is lighted when device is tripped.

2.5 AFCI TAMPER-RESISTANT RECEPTACLES


2.6 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.

2.7 SNAP SWITCHES

A. Comply with NEMA WD 1 and UL 20.
B. Switches, 120/277V, 20A: single pole, three-way, four-way.
C. Provide “DECORA” type switches.

2.8 OCCUPANCY SENSORS

A. Wall-Switch Sensors:
1. Subject to compliance with requirements, provide one of the following:
   a. Cooper; 6111 for 120V, 6117 for 277V.
   b. Hubbell; WS1277.
   c. Leviton; ODS 10-ID.
   d. Pass & Seymour; WS3000.
   e. Watt Stopper (The); WS-200.
   f. Approved equal.
2. 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. (84 sq. m).

E. Long-Range Wall-Switch Sensors:
1. Products: Subject to compliance with requirements, provide one of the following:
   a. Hubbell; ATD1600WRP.
   b. Leviton; ODW12-MRW.
   c. Watt Stopper (The); DT-200.
   d. Approved equal.
2. 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. (111 sq. m).

F. Wide-Range Wall-Switch Sensors:
1. 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.
   e. Approved equal.
2. 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. (111 sq. m).
2.9 COMMUNICATIONS OUTLETS

A. Telephone Outlet:
   1. Subject to compliance with requirements, provide one of the following:
      a. Cooper; 3560-6.
      b. Leviton; 40649.
      c. Approved equal.
   2. 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. Subject to compliance with requirements, provide one of the following:
      a. Cooper; 3562.
      b. Leviton; 40595.
      c. Approved equal.
   2. 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.

2.10 WALL PLATES

A. Single and combination types to match corresponding wiring devices.
   1. Plate-Securing Screws: Metal with head color to match plate finish.
   4. Material for Damp Locations: Cast aluminum with spring-loaded lift cover, and listed and labeled for use in "wet locations."

B. Wet-Location, Weatherproof Cover Plates: NEMA 250, complying with type 3R weather-resistant, in-use type thermoplastic with lockable cover.

2.11 FINISHES

A. Color: Wiring device catalog numbers in Section Text do not designate device color.
   1. Wiring Devices Connected to Normal Power System: As selected by Architect, unless otherwise indicated or required by NFPA 70 or device listing.
   3. Provide oversized cover plates.
PART 3 - EXECUTION

3.1 INSTALLATION

A. NECA 1 referenced in paragraph below includes device mounting-height requirements. See "Product Selection and Application Considerations" Article in the Evaluations for device mounting heights in that standard.

B. Comply with NECA 1, including the mounting heights listed in that standard, unless otherwise noted.

C. 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.

D. 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 pigtailed.
   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.

E. 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 pigtailed that are not less than 6 inches (152 mm) 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 15A or 20A circuits, splice No. 12 AWG pigtailed 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.

F. Receptacle Orientation:
   1. Install ground pin of vertically mounted receptacles up, and on horizontally mounted receptacles to the right.

G. Device Plates: 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.

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, multi-gang 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.
   2. In healthcare facilities, prepare reports that comply with recommendations in NFPA 99.
   3. Test Instruments: Use instruments that comply with UL 1436.
   4. 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 105V to 132V.
   2. Percent Voltage Drop under 15A Load: A value of 5 percent or higher is not acceptable.
   3. Ground Impedance: Values of up to 2 ohms are acceptable.
   4. GFCI Trip: Test for tripping values specified in UL 1436 and UL 943.
   5. Using the test plug, verify that the device and its outlet box are securely mounted.
   6. The tests shall be diagnostic, indicating damaged conductors, high resistance at the circuit breaker, poor connections, inadequate fault current path, defective devices, or similar problems. Correct circuit conditions, remove malfunctioning units and replace with new ones, and retest as specified above.

END OF SECTION
SECTION 262813

FUSES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Cartridge fuses rated 600-V ac and less for use in control circuits, enclosed switches and enclosed controllers.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

1.3 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

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. Comply with NEMA FU 1 for cartridge fuses.

C. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   1. Cooper Bussmann, Inc.
   2. Edison Fuse, Inc.
   3. Ferraz Shawmut, Inc.
   4. Littelfuse, Inc.
2.2 CARTRIDGE FUSES

A. Characteristics: NEMA FU 1, nonrenewable cartridge fuses with voltage ratings consistent with circuit voltages.

PART 3 - EXECUTION

3.1 FUSE APPLICATIONS

A. Motor Branch Circuits: Class RK1, time delay.
B. Other Branch Circuits: Class RK1, time delay.
C. Control Circuits: Class CC, fast acting.

3.2 INSTALLATION

A. Install fuses in fusible devices. Arrange fuses so rating information is readable without removing fuse.

3.3 IDENTIFICATION

A. Install labels complying with requirements for identification specified in Division 26, Section "Identification for Electrical Systems" and indicating fuse replacement information on inside door of each fused switch and adjacent to each fuse block and holder.

END OF SECTION
SECTION 262816
ENCLOSED SWITCHES AND CIRCUIT BREAKERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Fusible switches.
   2. Non-fusible switches.
   3. Receptacle switches.
   4. Shunt trip switches.
   5. Molded-case circuit breakers (MCCBs).

1.2 DEFINITIONS

A. NC: Normally closed.
B. NO: Normally open.
C. SPDT: Single pole, double throw.

1.3 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Enclosed switches and circuit breakers shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
   1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."

1.4 ACTION SUBMITTALS

A. Product Data: For each type of enclosed switch, circuit breaker, accessory, and component indicated.
B. Shop Drawings: For enclosed switches and circuit breakers.
   1. Wiring Diagrams: For power, signal, and control wiring.
1.5 INFORMATIONAL SUBMITTALS

A. Seismic Qualification Certificates: For enclosed switches and circuit breakers, accessories, and components, from manufacturer.

1.6 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

1.7 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. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 FUSIBLE SWITCHES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
4. Square D; a brand of Schneider Electric.

B. Type GD, General Duty, Single Throw, 240-V ac, 800 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, with cartridge fuse interiors to accommodate indicated fuses, lockable handle with capability to accept two padlocks, and interlocked with cover in closed position.

C. Type HD, Heavy Duty, Single Throw, 240-V ac, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, with clips or bolt pads to accommodate fuses, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.

D. Accessories:

1. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.
2. Neutral Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.
3. Class R Fuse Kit: Provides rejection of other fuse types when Class R fuses are specified.
4. Lugs: Suitable for number, size, and conductor material.
5. Service-Rated Switches: Labeled for use as service equipment.

2.2 NONFUSIBLE SWITCHES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
4. Square D; a brand of Schneider Electric.

B. Type GD, General Duty, Single Throw, 600 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, lockable handle with capability to accept two padlocks, and interlocked with cover in closed position.

C. Type HD, Heavy Duty, Single Throw, 240-V ac, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.

D. Accessories:

1. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.
2. Neutral Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.
3. Lugs: Suitable for number, size, and conductor material.

2.3 MOLDED-CASE CIRCUIT BREAKERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Westinghouse.
2. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
5. Square D; a brand of Schneider Electric.

B. General Requirements: Comply with UL 489, NEMA AB 1, and NEMA AB 3, with interrupting capacity to comply with available fault currents.

D. Electronic Trip Circuit Breakers: Field-replaceable rating plug, rms sensing, with the following field-adjustable settings:
   1. Instantaneous trip.
   2. Long- and short-time pickup levels.
   3. Long- and short-time time adjustments.
   4. Ground-fault pickup level, time delay, and I²t response.

E. Current-Limiting Circuit Breakers: Frame sizes 400 A and smaller, and let-through ratings less than NEMA FU 1, RK-5.

F. Features and Accessories:
   1. Standard frame sizes, trip ratings, and number of poles.
   2. Lugs: Suitable for number, size, trip ratings, and conductor material.
   3. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HID for feeding fluorescent and high-intensity discharge lighting circuits.
   4. Ground-Fault Protection: Comply with UL 1053; integrally mounted, self-powered type with mechanical ground-fault indicator; relay with adjustable pickup and time-delay settings, push-to-test feature, internal memory, and shunt trip unit; and three-phase, zero-sequence current transformer/sensor.
   5. Shunt Trip: Trip coil energized from separate circuit, with coil-clearing contact.
   6. Auxiliary Contacts: One SPDT switch with "a" and "b" contacts; "a" contacts mimic circuit-breaker contacts, "b" contacts operate in reverse of circuit-breaker contacts.

2.4 ENCLOSURES

A. Enclosed Switches and Circuit Breakers: NEMA AB 1, NEMA KS 1, NEMA 250, and UL 50, to comply with environmental conditions at installed location.

   1. Indoor, Dry and Clean Locations: NEMA 250, Type 1.
   2. Outdoor Locations: NEMA 250, Type 3R.
   4. Other Wet or Damp, Indoor Locations: NEMA 250, Type 4.
   5. Indoor Locations Subject to Dust, Falling Dirt, and Dripping Noncorrosive Liquids: NEMA 250, Type 12.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install individual wall-mounted switches and circuit breakers with tops at uniform height unless otherwise indicated.

B. Comply with mounting and anchoring requirements specified in Division 26, Section "Vibration and Seismic Controls for Electrical Systems."
C. Install fuses in fusible devices.

D. Comply with NECA 1.

3.2 IDENTIFICATION

A. Comply with requirements in Division 26, Section "Identification for Electrical Systems."
   1. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs.
   2. Label each enclosure with engraved metal or laminated-plastic nameplate.

3.3 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Acceptance Testing Preparation:
   1. Test insulation resistance for each enclosed switch and circuit breaker, component, connecting supply, feeder, and control circuit.
   2. Test continuity of each circuit.

C. Tests and Inspections:
   1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
   2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.

D. Enclosed switches and circuit breakers will be considered defective if they do not pass tests and inspections.

E. Prepare test and inspection reports, including a certified report that identifies enclosed switches and circuit breakers and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

END OF SECTION
DRAWINGS
HEATING SYSTEM RENOVATION
AT PORT ADMINISTRATION BUILDING
3460 N. DELAWARE AVENUE
PHILADELPHIA, PA  19134
PROJECT 19-048.2

PROJECT TEAM

PHILADELPHIA REGIONAL PORT AUTHORITY
3460 North Delaware Avenue
Philadelphia, PA 19134
Tel: (215) 381-6732
Fax: (215) 381-6755
Mark Washington, PE
Camden, NJ  08102
Tel: (856) 320-8100
Mark Ulrick Engineers, Inc.
622 Cooper Street, 2nd Fl
Camden, NJ  08102
Tel: (856) 320-8100

M801 MECHANICAL DETAILS
M800 MECHANICAL DETAILS
E100 ELECTRICAL NEW WORK BOILER RM. PART PLANS
ED100 ELECTRICAL DEMOLITION BOILER RM. PART PLANS
E000 ELECTRICAL LEGEND, ABBREVIATIONS AND NOTES
M500 BOILER ROOM PLANS
M100 FIRST FLOOR PLAN
M000 NOTES, SYMBOLS & ABBREVIATIONS

ARCHITECTURAL

FIRST FLOOR CLASSIC WINDOW
17082 PRPA

MECHANICAL

17082 PRPA

ELECTRICAL

17082 PRPA

ABBREVIATION LIST

MECHANICAL DETAILS

ARCHITECTURAL

LOCATION MAP

FIRST FLOOR KEY PLAN

Project Description

Renovations to the building heating systems located on the first floor.
HEATING SYSTEM RENOVATION

B1 4" HEADER

EXIST. BACKFLOW PREVENTER & SPRINKLER PIPING

(M) 1 1/2" HWR

(R) 1 1/2" HWR

(E) 2" HWS

(E) 1 1/4" HWS

(E) 2 1/2" HWR

(E) FD

(R) CONTROL PANEL & APPURTENANCE

EXIST. BACKFLOW PREVENTER & SPRINKLER PIPING

70-200 SCALE: 1/2" = 1'-0"
HEATING SYSTEM RENOVATION
AT PORT ADMINISTRATION BUILDING
PHILADELPHIA, PA 19134
PROJECT 19-048.2

MARK BRIAN WASHINGTON
PROFESSIONAL REGISTERED ENGINEER
LIC. #: PE-034881-E

1. VENTS THROUGH EXISTING CHIMNEY DETAIL
2. IMAGE OF VENT PIPE THRU EXISTING CHIMNEY
3. IMAGE OF INTAKE PIPE THRU EXTERIOR WALL

STAINLESS STEEL CLAMPS
PIPE CLAMPS
EDPM BOOT CAP SUITABLE FOR EXTERIOR INSTALLATION SECURELY ATTACHED TO CHIMNEY WALLS.

BOOT CAP SUITABLE FOR EXTERIOR INSTALLATION SECURELY ATTACHED TO CHIMNEY WALLS.

EXISTING MASONRY CHIMNEY
6" SCH. 80 CPVC BOILER VENTS
MIN. 18" ABOVE CHIMNEY TOP

APPROXIMATE LOCATION OF INTAKES

IMAGE OF 6" SCH. 80 CPVC VENT PIPE THRU EXISTING CHIMNEY

NOT TO SCALE

IMAGE OF VENT PIPE THRU EXISTING CHIMNEY

NOT TO SCALE

IMAGE OF INTAKE PIPE THRU EXTERIOR WALL

NOT TO SCALE
### BOILER SCHEDULE

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**Remarks:**
- SPECIFICATIONS FOR ALL BOILER ACCESSORIES AND OPERATING REQUIREMENTS.
- REFER TO NOTE 1 & 2

### PUMP SCHEDULE

| No. | Location/Space | Type | Mfr./Model | Vol. (Gallons) | Flow (GPM) | Min. Pressure (PSIG) | Max. Pressure (PSIG) | Pressure Drop (PSIG) | Head (FT.WC) | Flow Range (GPM) |
|-----|----------------|------|------------|---------------|------------|---------------------|---------------------|----------------------|--------------|----------------|-------------|
| 1   | FIRST FLOOR / 3 | 1    | TACO VR20-3 | 43            | 40         | 10                  | 10                  | 10                   | 75           | 40 - 150       |

### AIR SEPARATOR SCHEDULE

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**Remarks:**
- SPECIFICATIONS FOR ALL BOILER ACCESSORIES AND OPERATING REQUIREMENTS.
- REFER TO NOTE 1 & 2

### EXPANSION TANK SCHEDULE

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</table>

**Remarks:**
- SPECIFICATIONS FOR ALL BOILER ACCESSORIES AND OPERATING REQUIREMENTS.
- REFER TO NOTE 1 & 2

### notes:
- 1. ECM MOTOR WITH VARIOUS OPERATING MODES, CP, VDP, PPC, CAST IRON, STAINLESS STEEL IMPELLER & SHAFT, 150 PSI WORK PRESSURE MINIMUM.
- 2. UNDER 1 FTHD PRESSURE DROP AT SCHEDULED GPM.
- 3. ASME, BLADDER IS HEAVY DUTY BUTYL, VERTICAL MOUNT, SIGHT GLASS, ANCHOR CLIPS.
GENERAL DEMOLITION NOTES:

- All existing mechanical, electrical, and plumbing systems associated with the demolition of mechanical equipment shall remain in place unless otherwise specified.

DEMO LE VENTILATOR NOTES:

1. All contractor's equipment shall remain in place and shall be made available to the Contractor for use during the demolition.
2. All materials and equipment shall be removed from the site.
3. All subcontractors shall be made aware of the demolition plans and shall be responsible for removing their equipment.
4. All materials and equipment shall be removed from the site.

PARTIAL FIRST FLOOR PLAN - DEMOLITION - ELECTRICAL

PARTIAL FIRST FLOOR PLAN - DEMOLITION - ELECTRICAL
ASBESTOS INSPECTION REPORT
An asbestos investigation was performed within the Boiler Room of 3460 N Delaware Ave.

★ Investigator must be on site during demolition!

Asbestos Containing Material Present? ☒ Yes (List Below)  ☐ No

List Asbestos Containing Material (ACM) located in the planned renovation/demolition area(s). Damaged ACM must be listed and then repaired or removed prior to renovation. You (Investigator) must label all ACM that may be left in the work area.

<table>
<thead>
<tr>
<th>Location</th>
<th>Description</th>
<th>Type (Code 1)</th>
<th>Amount</th>
<th>Condition (Code 2)</th>
<th>Action (Code 3)</th>
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<tr>
<td>Boiler Room</td>
<td>Boiler Rope Gasket</td>
<td>NF1</td>
<td>5</td>
<td>DD</td>
<td>REM</td>
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<tr>
<td>Boiler Room</td>
<td>Boiler Sealant</td>
<td>NF1</td>
<td>10</td>
<td>DD</td>
<td>REM</td>
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</tbody>
</table>

**Code 1**

- FRI - Friable
- NF1 - Non-Friable, Cat. 1
- NF2 - Non-Friable, Cat. 2

**Code 2**

- DD - Deteriorated or Delaminated
- ND - Non-Damaged

**Code 3**

- REM - Removal necessary prior to Demo/Reno
- NRN - No removal necessary, label ACM
- REP - Repair & Label ACM, removal not necessary

I hereby certify that the foregoing statements are true and the information contained in this report is true. This certification is made subject to the penalties set forth in 18 PA. C.S. S4904 relating to unsworn falsification to authorities. Furthermore I certify that the inspection, sampling, and labeling requirements of section X of the Asbestos Control Regulation (ACR) have been met. The building owner has been notified of the ACR requirements and given a copy of this report. If the inspection has revealed ACM which will be disturbed by the proposed work or if it has revealed ACM in bad condition, the building owner has been notified to remove or repair the ACM in accordance with the ACR prior to renovation or demolition activity.

Signature of Licensed Asbestos Investigator:  

Date:  5/22/19  

Signature of Building Owner:  

Date:  

Scope of Work: (include all locations)
Boiler Rope Gasket
25% Chrysotile

Boiler Sealant
70% Chrysotile
# Test Report: Asbestos Analysis of Bulk Materials via EPA 600/R-93/116 Method using Polarized Light Microscopy

<table>
<thead>
<tr>
<th>Sample</th>
<th>Description</th>
<th>Appearance</th>
<th>% Fibrous</th>
<th>% Non-Fibrous</th>
<th>Asbestos % Type</th>
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<tbody>
<tr>
<td>PAB-1-TSI</td>
<td>Boiler Room - 24&quot; TSI</td>
<td>Gray Fibrous</td>
<td>30% Min. Wool</td>
<td>70% Non-fibrous (Other)</td>
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<td>Homogeneous</td>
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<tr>
<td>PAB-1-TSI</td>
<td>Boiler Room - 24&quot; TSI</td>
<td>White Fibrous</td>
<td>20% Synthetic</td>
<td>80% Non-fibrous (Other)</td>
<td>None Detected</td>
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<tr>
<td>PAB-1-Wrap</td>
<td>Boiler Room - Wrap</td>
<td>Tan Fibrous</td>
<td>20% Glass</td>
<td>80% Non-fibrous (Other)</td>
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<tr>
<td>PAB-2</td>
<td>Boiler Room - Boiler Rope Gasket</td>
<td>White Fibrous</td>
<td>50% Cellulose</td>
<td>25% Non-fibrous (Other)</td>
<td>25% Chrysotile</td>
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<tr>
<td>PAB-3</td>
<td>Boiler Room - Boiler Sealant</td>
<td>Brown/White Fibrous</td>
<td>30% Non-fibrous (Other)</td>
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**Analyst(s)**

Christina Maiorana (5)

Benjamin Ellis, Laboratory Manager

or Other Approved Signatory

EMSL maintains liability limited to cost of analysis. The above analyses were performed in general compliance with Appendix E to Subpart E of 40 CFR (previously EPA 600/M4-82-020 "Interim Method"), but augmented with procedures outlined in the 1993 ("final") version of the method. This report relates only to the samples reported above, and may not be reproduced, except in full, without written approval by EMSL. EMSL bears no responsibility for sample collection activities or analytical method limitations. Interpretation and use of test results are the responsibility of the client. All samples received in acceptable condition unless otherwise noted. This report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST or any agency of the federal government. EMSL recommends gravimetric reduction for all non-friable organically bound materials prior to analysis. Estimation of uncertainty is available on request.

Samples analyzed by EMSL Analytical, Inc. Cinnaminson, NJ NVLAP Lab Code 101048-0, AIHA-LAP, LLC-IHLAP Lab 100194, NYS ELAP 10872, NJ DEP 03036, PA ID# 68-00367, LA #04127

Initial report from: 05/22/2019 07:46:59

Printed: 5/22/2019 7:46 AM
**Asbestos Bulk Building Material Chain of Custody**

**EMSL Order Number (Lab Use Only):**

<table>
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<tr>
<th>Company</th>
<th>EMSL-Bill to:</th>
<th>Same</th>
<th>Different</th>
</tr>
</thead>
<tbody>
<tr>
<td>Urban Engineers</td>
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</tbody>
</table>

**Street:** S30 Walnut Street 14th Floor  
**City:** Philadelphia  
**State/Province:** PA  
**Zip/Postal Code:** 19106  
**Telephone #:** 2159228081  
**Fax #:**  
**Email:** ajwaters@urbanengineers.com  
**Project Name/Number:** PAB Boiler Room  
**U.S. State Samples Taken:** PA  
**Please Provide Results:** Fax  
**Purchase Order:**  
**CT Samples:**  
**Third Party Billing Requires Written Authorization from Third Party**

**Turnaround Time (TAT) Options** — Please Check

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<th>3 Hour</th>
<th>6 Hour</th>
<th>24 Hour</th>
<th>48 Hour</th>
<th>72 Hour</th>
<th>96 Hour</th>
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<td>□ PLM EPA NOB (&lt;1%)</td>
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**Check For Positive Stop — Clearly Identify Homogenous Group**  
**Date Sampled:**

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<thead>
<tr>
<th>Samplers Name:</th>
<th>Samplers Signature:</th>
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<table>
<thead>
<tr>
<th>Sample #</th>
<th>HA #</th>
<th>Sample Location</th>
<th>Material Description</th>
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<tr>
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<td></td>
<td>Boiler Room</td>
<td>24&quot; TSI</td>
</tr>
<tr>
<td>PAB-2</td>
<td></td>
<td>Boiler Room</td>
<td>Boiler Rope Gasket</td>
</tr>
<tr>
<td>PAB-3</td>
<td></td>
<td>Boiler Room</td>
<td>Boiler Sealant</td>
</tr>
</tbody>
</table>

**Client Sample # (s):**

<table>
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<th>Client Sample # (s):</th>
<th>Total # of Samples:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>PAB-1</td>
<td>3</td>
</tr>
</tbody>
</table>

**Received (Lab):**

<table>
<thead>
<tr>
<th>Date:</th>
<th>Time:</th>
</tr>
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<tbody>
<tr>
<td>5/20/15</td>
<td>9:51</td>
</tr>
</tbody>
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**Comments/Special Instructions:**