SECTION 23 05 00
COMMON WORK RESULTS FOR HVAC

PART 1 - GENERAL

1.1 STIPULATIONS

A. The specifications sections "General Conditions to the Construction Contract", "Special Conditions" and "Division 01 - General Requirements" form a part of this Section by this reference thereto, and shall have the same force and effect as if printed herewith in full.

1.2 ADDITIONAL RELATED DOCUMENTS

A. In the event of a direct conflict with the requirements of this Section and of those contained in Divisions 01, 02, 03, 05, 07, 08, 09, or 26, the requirements of those other Divisions shall take precedence, but only if they are more demanding or restrictive.

1.3 SUMMARY

A. This Section includes provisions that apply to Division 23 work in its entirety.

B. This Section includes the following:

1. General Project Requirements

    a. Definitions
    b. General Project Coordination and Planning
    c. Client Agency Instruction
    d. Delivery, Storage, and Handling
    e. Sequencing and Scheduling
    f. Temporary Shutdown of Existing Systems
    g. Interpretation of the Documents
    h. Basis of Design Products and Substitutions
    i. Submittals - General Requirements
    j. Warranties

2. Coordination Drawings
3. Extra Materials
4. Piping materials and installation instructions common to most piping systems
5. Indoor concrete housekeeping base construction requirements
6. Escutcheons
7. Fire- and smoke-stopping materials and systems
8. Dielectric fittings
9. Flexible connectors
10. Mechanical sleeve seals
11. Non-shrink grout for base mounted equipment installations
12. Field-fabricated metal equipment supports
13. Equipment installation requirements common to equipment specification sections
14. Ceiling, wall, and shaft access panels

15. Coordination of communications between factory mounted equipment controls and the building automation system
16. Motor controllers and disconnect switches
17. Construction during occupancy
18. HVAC demolition
19. Cutting and patching
20. Excavating and backfilling
21. Cleaning and protection
22. Painting and finishing

1.4 DEFINITIONS

A. Atmosphere: Outside the exterior walls and roof of a building.

B. Finished Spaces: Areas where drywall is hung or installed with wall coverings and/or painted; or where floors are polished or coverings are installed on the floor; or where the ceiling is plaster/gypsum board and/or suspended acoustic ceiling tile.

C. Unfinished Space: Spaces other than finished spaces. Typical examples include mechanical and electrical equipment rooms, furred spaces, pipe and duct shafts, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, attics, crawl spaces, garages, and tunnels.

D. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.

E. Exposed, Exterior Installations: Exposed to view outdoors, or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.

F. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and in duct shafts.

G. 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 or inside equipment enclosures.

H. Conditioned Space: Spaces within the insulated envelope of the building and provided with both mechanical heating and air conditioning, either directly or indirectly.

1. Ceiling and floor plenums and ceiling spaces (areas between the finished ceiling and the structural floor or roof slab/deck above) are considered (indirectly) conditioned spaces.

I. Unconditioned Space: Spaces lacking either mechanical heating or air conditioning, or both, and are outside of the insulated envelope of the building. Examples: Outdoor-air-ventilated crawlspaces and attics.

1. Mechanical and electrical rooms, and similar spaces, that are only heated and outdoor-air-ventilated, or are only outdoor-air-ventilated, shall be considered unconditioned spaces.

J. Contractor: The contractor performing the work of the trade drawings or specification division where the use of the term appears, unless a more specific indication is made.

K. Furnish: Purchase and deliver to project site, ready for unloading, unpacking, assembly, installation, and similar subsequent requirements.

L. Install: Operations at project site required to place furnished materials and equipment into use, including unloading, unpacking, assembly, erection, placing, anchoring, applying, working to dimension, connecting, finishing, curing, protecting, cleaning, adjusting, commissioning, and similar requirements.

M. Provide: Both furnish and install.

N. Reinstall: Remove items indicated; clean, service, and otherwise prepare them for reuse; store and protect against damage. Install items in the same locations or in locations indicated.

O. Relocate: Same meaning as "reinstall".

P. Remove: Remove items from their current installed condition and legally dispose of those items, except those indicated to be reinstalled/relocated or salvaged or to remain the Client Agency's property as indicated.

Q. Demolish: Same meaning as "remove".

R. Replace: Remove items indicated as defined under "remove" herein and provide new items with matching dimensions, capacities, and all other features in the same location as the items removed, unless explicitly indicated otherwise.

S. Salvage (and similar terms and phrases such as "Turn Over to Client Agency"): Items indicated to be salvaged shall remain the Client Agency's property. Remove, clean, and pack or crate items to protect against damage. Identify contents of containers and deliver to Client Agency's designated storage area.

T. Indicated: The term "indicated", "shown," "noted," "scheduled," and "specified" refers to graphic representations, notes, schedules, or other indications on the Drawings; or to other paragraphs or schedules in the Specifications and other similar requirements in the Contract Documents.

U. May: Indicative of a Contractor's Option, or that which the Contractor is permitted to do, but not required to do.

V. Shall: Indicative of a mandatory contract requirement, or that which the Contractor has a duty to perform.

W. Must: Same meaning as "shall".

X. Will: Unless explicitly identified as associated with the work of, or performed by, another contractor or under a separate contract, or to be future work also outside this contract, "will" shall be taken to mean the same as "shall", (i.e. representative of a mandatory requirement of this contract).

Y. The terms "approved", "equal", "acceptable", or "proper" and words of a similar meaning shall be understood to mean "meeting the design intent as determined by the Architect or Engineer".

Z. The terms "Engineer" and "Architect" used in these specifications are used interchangeably, and refer to the same entities - the design professionals of record.

AA. "Approved": When used to convey Architect's or Engineer's action on Contractor's submittals, applications, and requests, "approved" is limited to Architect's or Engineer's duties and responsibilities as stated in the Conditions of the Contract.

BB. "Directed": A command or instruction by Architect or Engineer. Other terms including "requested," "authorized," "selected," "required," and "permitted" have the same meaning as "directed."

CC. "Indicated": Requirements expressed by graphic representations or in written form on Drawings, in Specifications, and in other Contract Documents. Other terms including "shown," "noted," "scheduled," and "specified" have the same meaning as "indicated."

DD. References to "GC", "General Contractor" shall refer to the .1 Contractor.

EE. References to "Substantial Completion" shall be taken to mean the date of the Final Inspection by the Professional.

FF. References to "Architect", "Engineer", "Architect / Engineer" and similar terms shall be taken to mean the Professional.

GG. References to "Client Agency" shall be taken to mean the Department and Client Agency, as applicable.

HH. References to "HC", "Heating Contractor", "HVAC Contractor", and "Mechanical Contractor" on the drawings depicting the HVAC system work shall refer to the .2 Contractor performing the work of Division 23.

II. References to "PC", "Plumbing Contractor" shall refer to the .3 Contractor performing the work of Division 22.

JJ. References to "FC", "FPC", "Sprinkler Contractor", and "Fire Protection Contractor" shall refer to the .3 Contractor performing the work of Division 21.

KK. References to "EC" and "Electrical Contractor" on the drawings depicting the HVAC system work shall refer to the .4 Contractor performing the work of Divisions 26, 27, and 28.

LL. Withstand, Resist: With respect to wind resistance ratings, "withstand" and "resist" shall mean to be without permanent deformation of components, fasteners and anchors, and be able to continue to function normally without excessive water or air leakage, without excessive vibration, and meeting all scheduled functional performance requirements, after being subjected to the design wind speed from any direction.

MM. Low Voltage: As defined in NFPA 70 for circuits and equipment operating at less than 50 V or for remote-control, signaling power-limited circuits.

1.5 ACTION SUBMITTALS

A. Product Data: Provide for the following:

1. Dielectric fittings
2. Flexible connectors
3. Mechanical sleeve seals
4. Fire- and smoke-stopping materials

B. Shop Drawings: Detail fabrication and installation for metal supports and anchorage for HVAC materials and equipment.

1.6 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Coordination drawings shall be prepared as specified in this Section and as defined in Division 01. Note that the requirements of this Section may be more restrictive and create additional requirements.

1. Refer to the coordination article(s) elsewhere in this Section.
2. No installation of permanent systems shall proceed until the coordination drawings are reviewed by the Architect / Engineer. No additional compensation shall be allowed for changes required to accommodate installation of systems provided under other Divisions of this Contract.
3. Coordination drawings shall be developed from individual system shop drawings and contractor fabrication drawings. Electronic or other reproduced engineering design drawings used as coordination drawings are not acceptable.
4. Coordination drawings shall be initiated by the Contractor responsible for the ductwork installation. That Contractor shall indicate, on the plans, equipment and duct locations and dimensions drawn to scale, taking into consideration and incorporating proper service and access clearances. The drawing shall then be given to the Contractors installing piping, conduit for the inclusion of their work on the coordination drawing. All discrepancies and conflicts with the architectural layout of the building shall be noted on the coordination drawings. The Contractors of the various Divisions shall meet as required to resolve discrepancies with ductwork, piping, and conduit prior and to coordinate those elements on the coordination drawings. The Contractor who initiated the coordination drawings shall submit them for review to the Architect and Engineer. Coordination and installation of work not indicated on the coordination drawing shall be the responsibility of the Contractor responsible for that equipment. Any modifications required by any Contractor for equipment to be installed that is not shown on the coordination drawing shall be the responsibility of the Contractor who failed to indicate that equipment.

    a. Coordination drawings shall be prepared for each general area, floor level, and roof level and shall be of a scale not less than 1/4 inch per 1 foot. Mechanical and electrical rooms and areas with similar levels of congestion shall be prepared at 1/2 inch per foot.
    b. Plans and elevations shall be prepared for shafts and chases containing more than one duct or the work of multiple trades at 1/4" per foot.
    c. Electronic Format: As required by Division 01.

5. Detail major elements, components, and systems of HVAC equipment and materials in relationship with other systems, installations, and building components. Show space requirements for installation and access. Indicate if sequence and coordination of installations are important to efficient flow of the Work. Include the following:

    a. Planned ductwork layout, including all duct accessories (dampers, silencers, access doors, etc.) and control devices (airflow measuring stations, sensors, etc.).
    b. Planned piping layout, including valve and specialty locations, meters and gauges, control devices (control valves, flow meters, sensors, etc.), and valve-stem movement.
    c. Clearances for installing and maintaining insulation.
    d. Clearances for servicing and maintaining equipment, accessories, and specialties, including space for disassembly required for periodic maintenance.
    e. Hangers and supports for ductwork, piping, and equipment, including the size and magnitude of all point loads.
    f. Access paths through mechanical rooms and on roofs.
    g. Methods for maintaining required roof slope and roof drainage around rooftop installations.
    h. Equipment and accessory service connections and support details.
    i. Sizes and locations of access panels in ceilings, shafts, walls, etc.
    j. Exterior wall and foundation penetrations.

k. Fire- and smoke-rated wall and floor penetrations. Indicate UL directory file number for the fire/smoke stopping system proposed at each penetration.
l. Sizes and location of required concrete pads and bases.
m. Scheduling, sequencing, movement, and positioning of large equipment into building during construction.
n. Floor plans, elevations, and details to indicate penetrations in floors, walls, and ceilings and their relationship to other penetrations and installations.
o. Reflected ceiling plans to coordinate and integrate installation of air outlets and inlets, light fixtures, communication system components, sprinklers, and other ceiling-mounted items.
p. Requirements for coordination drawings indicated in other Division 23 Sections.

6. Access Panel Schedule: List of sizes, types, locations, and required purpose for all access panels in ceilings, shafts, walls, etc. Coordinate locations of any access panels not indicated on the Architectural Drawings with the Architect prior to installation.

1.7 CLOSEOUT INFORMATIONAL SUBMITTALS

A. Operations and Maintenance Manuals: Comply with requirements in Division 01 and requirements detailed elsewhere in other Division 23 Sections. Manuals shall be provided no later than 90 days after Substantial Completion, unless an earlier date is required by Division 01.

1. Copies of manufacturer's operation and maintenance manuals for each piece of equipment provided under this Project. Required routine maintenance actions shall be clearly identified.
2. Parts and material lists, including contact information for product representative or other place to purchase.
3. List of normally replaced items, such as filters, fuses, belts, seals, gaskets, etc., indicating style, rating, size, etc., and contact information for product representative or other place to purchase.
4. Installation, servicing, maintenance, and operating instructions for all systems and components with the place of original purchase and name and contract information of the person who can service the system.
5. System and equipment startup, seasonal changeover, and seasonal shutdown with prestart checklists and precautions.
6. System and equipment troubleshooting guides.
7. Copies of manufacturers' and Contractor's guarantees and warranties.
8. Copies of approved submittals incorporating all comments and corrections noted during the final engineer review and reflecting field changes to systems and equipment:

    a. Product data and shop drawings for all equipment.
    b. Final, approved balancing report(s).
    c. ATC product data and shop drawings, including component wiring diagrams, ATC wiring diagrams.

9. Schedule of all motors, starters, and controllers under this Division with the following information included:

    a. Location
    b. All nameplate data
    c. Overload rating and manufacturer's number
    d. Actual full-load amperes
    e. Overcurrent protection

10. Spreadsheets that identify all boilers and pressure vessels that require Pennsylvania Department of Labor and Industry certificates. Include such information as identification number, type of equipment, location, PA L&I number, etc.
11. Copies of all inspection certificates and approvals from all inspection agencies.

1.8 EXTRA MATERIALS

A. Unless otherwise specified, extra materials (e.g. maintenance material submittals), wherever required by other Division 23 Sections, shall be stored in accordance with the provisions of this paragraph.

1. Spare parts shall be tagged by project equipment number and identified as to part number, equipment manufacturer, and subassembly component (if appropriate).
2. Include copies of relevant installation and operating manuals and contact information for the supplier. Documentation shall be placed in the packaging / storage box.
3. Spare parts subject to deterioration such as ferrous metal items and electrical components shall be properly protected by lubricants or desiccants and encapsulated in sealed plastic wrapping.
4. Spare parts with individual weights less than 5 pounds and dimensions less than 2 feet wide, or 18 inches high, or 3 feet in length shall be furnished in cardboard boxes. A neatly type inventory of spare parts shall be placed in a plastic sleeve and taped to the outside of the box.

1.9 QUALITY ASSURANCE

A. Code Compliance: All aspects of the Contractor's work shall comply with applicable codes.

B. Steel Support Welding: Qualify processes and operators according to AWS D1.1, "Structural Welding Code--Steel."

C. 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.

D. Factory Fabricated HVAC Equipment: Of the type, design, and size that manufacturers currently offer for sale and appears in the manufacturer's current catalogue. Equipment shall be new and fabricated from new materials, and shall be free from defects in materials and workmanship.

E. Electrical Characteristics for HVAC Equipment: Equipment of higher electrical characteristics may be furnished provided such proposed equipment is approved in writing and connecting electrical services, circuit breakers, and conduit sizes are appropriately modified. If minimum energy ratings or efficiencies are specified, equipment shall comply with requirements.

F. Minimum Energy Efficiency: Compressor-containing, fuel fired, and absorption refrigeration equipment shall meet the minimum efficiency requirements listed in the 2018 International Energy Conservation Code and ASHRAE 90.1-2016.

1.10 GENERAL PROJECT COORDINATION AND PLANNING

A. Prior to the ordering of materials or installation of work, coordinate and pre-plan the work to the extent necessary to permit the work to be installed satisfactorily, in accordance with the Contract Documents, and with the least possible interference or delay.

B. When work is installed without the required coordination and/or planning, changes to the work deemed necessary by the Architect shall be made to correct the conditions without additional cost to the Client Agency.

C. The Contractor is advised to furnish complete Contract Documents to all suppliers, sub-contractors, and other agents. Information required by those entities for the proper completion of their work in a coordinated fashion with the work of others will typically appear in multiple places in the Contract Documents.

1. Any failure on the part of a suppliers, sub-contractors, and other agents to improperly interpret the Contractor Documents or to understand other requirements made necessary by the coordination and planning process, is the full responsibility of the Contractor.

D. Due to the limited space available in mechanical rooms for HVAC equipment, no individual submittals for equipment in these mechanical areas will be approved in isolation. The Contractor shall submit for approval all equipment to be located in these areas in a single submittal, along with the coordination drawings of that same area and the spaces immediately below, above, and adjacent it showing piping, ductwork, conduit, roof structural framing, and any other related structural and architectural elements. Any equipment submitted in isolation or an equipment submittal package submitted which lacks the above described partial coordination drawings may be rejected at the discretion of the Engineer and will not be reviewed until it is deemed complete.

1.11 CLIENT AGENCY INSTRUCTION

A. Comply with the demonstration and instruction requirements indicated in other Division 23 Sections.

B. Instruction Time: Some Division 23 specification Sections indicate a minimum allowance for instruction time. The length of instruction time will be measured by actual time spent performing demonstration and training in required location. Time spent assembling educational materials, setting up, or cleaning up shall be counted against the time allotment.

C. Operations and Maintenance Manuals shall be distributed to the Client Agency no less than one (1) week prior to the instruction periods unless Division 01 stipulates a greater length of time.

D. Forward to the Architect / Engineer the signatures of all those who attended the instruction sessions.

E. Refer to Division 01 for additional Client Agency instruction requirements.

1.12 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and handle products, using means and methods that will prevent damage, deterioration, and loss, including theft and vandalism. Comply with manufacturer's written instructions.

B. Delivery and Handling:

1. Schedule delivery to minimize long-term storage at Project site and to prevent overcrowding of construction spaces.
2. Coordinate delivery with installation time to ensure minimum holding time for items that are flammable, hazardous, easily damaged, or sensitive to deterioration, theft, and other losses.
3. Deliver products to Project site in an undamaged condition in manufacturer's original sealed container or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting, and installing.
4. Inspect products on delivery to determine compliance with the Contract Documents and that products are undamaged and properly protected.

C. Storage:

1. Provide a secure location and enclosure at Project site for storage of materials and equipment.
2. Store products to allow for inspection and measurement of quantity or counting of units.
3. Store materials in a manner that will not endanger Project structure.
4. Store products that are subject to damage by the elements under cover in a weathertight enclosure above ground, with ventilation adequate to prevent condensation and with adequate protection from wind.
5. Comply with product manufacturer's written instructions for temperature, humidity, ventilation, and weather-protection requirements for storage.
6. Protect stored products from damage and liquids from freezing.

D. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and prevent entrance of dirt, debris, and moisture.

E. Protect stored pipes and tubes from moisture and dirt. Elevate above grade. Do not exceed structural capacity of floor, if stored inside.

F. Protect flanges, fittings, and piping specialties from moisture and dirt.

G. Store plastic pipes protected from direct sunlight. Support to prevent sagging and bending.

1.13 SEQUENCING AND SCHEDULING

A. Coordinate HVAC equipment and systems installation with other building components.

B. Arrange for pipe spaces, chases, slots, and openings in building structure during progress of construction to allow for HVAC installations.

C. Coordinate installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components, as they are constructed.

D. Sequence, coordinate, and integrate installations of HVAC materials and equipment for efficient flow of the Work.

E. Coordinate connection of HVAC systems with exterior underground utilities and services. Comply with requirements of governing regulations, franchised service companies, and controlling agencies.

F. Coordinate requirements for access panels and doors if HVAC items such as dampers, valves and other equipment requiring access are concealed behind finished surfaces where no other

means of access is available. Provide security type access panels and doors meeting the applicable requirements of Division 08. Coordinate locations of any access panels not indicated on the Architectural Drawings with the Architect prior to installation.

1.14 TEMPORARY SHUTDOWN OF EXISTING SYSTEMS

A. Plan installation of new work and connections to existing work to insure minimum interference with regular operation of existing systems. Some temporary shutdown of existing systems may be required to complete the work.

B. Submit to the Client Agency in writing for approval, proposed date schedule, time, and duration of necessary temporary shutdowns of existing systems. Shutdowns shall be made at such times as shall not interfere with regular operation of existing facilities and only after written approval of Client Agency. The Client Agency reserves the right to cancel shutdowns at any time prior to the shutdowns. To minimize conflict with Client Agency's operation, shutdowns shall be planned to occur on weekends. To insure continuous operation, make necessary temporary connections between new and existing work. The Contractor shall bear costs resulting from temporary shutdowns and temporary connections. No additional charges shall be allowed for Client Agency-canceled shutdowns that must be rescheduled.

C. Refer to Division 01 for additional requirements.

1.15 INTENT AND REQUIRED INTERPRETATION OF THE CONSTRUCTION DOCUMENTS

A. Refer to the Article titled "Basis of Design Products and Substitutions" located elsewhere in this Section.

B. Provide complete and functional systems for the project. The systems shall conform to the details stated in these Specifications and shown on the Drawings. Items or work not shown or specified, but required for complete systems, shall be provided and conform to accepted trade practices.

C. The Drawings and Specifications are presented to define specific system requirements and serve to expand on the primary contract requirements of providing complete and functional systems. The drawings are diagrammatic and indicate the general arrangement and routing of the systems included in this Contractor's work.

D. Drawings and Specifications are intended to be complementary to each other, and contract required work only may be indicated in one of these two sources. Inclusion of a scope element in either alone, or both, obligates the Contractor to provide the indicated work.

1. References in specific Specification sections to other Sections or to the Drawings are made for the Contractor's convenience only, and the omission of a potential reference shall not be interpreted by the Contractor as invalidating the other (unreferenced) provisions.

E. All work indicated in the documents shall be completed using new equipment and materials, unless explicitly indicated otherwise.

F. The Architect / Engineer shall not be responsible for design changes or modifications except as set forth by the Architect / Engineer in writing. The Contractor shall comply with the Contract Documents except as directed in writing or as required by an applicable code or product/equipment manufacturer's instructions. The Contractor shall not proceed based on verbal responses by the Architect / Engineer to questions posed by the Contractor.

G. Do not scale the Drawings. Because of the small scale and diagrammatic nature of the Drawings, it is not possible to indicate offsets, fittings, valves, piping and duct accessories and appurtenances, or similar items which may be required to provide complete operating systems. Carefully investigate conditions affecting the work associated with this project. Check and verify dimensions and existing conditions at the site. Install systems in such a manner that interferences between pipes, conduit, ducts, equipment, architectural and structural features are avoided. Provide items required to meet the project conditions without additional cost to the Client Agency.

H. Where the Contractor has been furnished with electronic PDF files of the Drawings or a 3D model that contains layering information (e.g. the PDF has not been 'flattened'), that layering information shall be ignored by the Contractor. Obtaining information from the Drawings for purposes of preparing a bid price (i.e. "take offs") shall be performed by inspection of the as-printed presentation of the Drawings information. Any inconstancies in the layering information that causes the Contractor using such layering information to prepare a faulty bid shall be considered to be at the Contractor's risk.

I. The Contractor's use of electronic copies of the Contract Documents shall constitute implicit acknowledgement and acceptance of the following conditions:

1. The electronic data is transferred for a specific, limited purpose; any use of the data for other than its originally intended purpose is prohibited.
2. The Architect / Engineer is the author of the data and retains full rights of authorship in the data and all other rights not specifically conveyed. The electronic data is transferred for the sole benefit of the client for whom the design services have been performed. The recipient may not transmit the information to other parties except for purposes of bidding this project. Use of this material for any other purpose is prohibited without the written permission of the Architect / Engineer.
3. The recipient acknowledges that the data is being transmitted in electronic form for convenience only and that the signed and sealed hard copies are the only true Contract Documents of record.
4. The recipient is solely responsible for verifying that the information contained in the electronic data file is identical in all material aspects to the Contract Documents of record.
5. Use of the electronic data is at the sole risk of the recipient, who acknowledges that the electronic data is subject to undetectable alteration or electronic corruption or degradation.
6. The recipient is solely responsible for confirming that the information is current and for updating the information to reflect any changes in the design subsequent to the date of receipt of the information.
7. The recipient indemnifies and holds harmless the Architect for all claims and losses resulting from unauthorized or improper use of the data.
8. Transfer of the information in electronic form does not convey to the recipient a license to use the software that was used to create the information, nor does it create an obligation on the author’s part to provide the software to the recipient.
9. The Architect / Engineer makes no representation or warranty and shall have no liability concerning the operation or performance of the templates or programs, or concerning the accuracy of the data as delivered, or in connection with hardware or any software, any changes made to the electronic materials as delivered, any viruses contained in the materials as delivered, or any other defect or error or alleged defect or error in the materials as delivered.

J. These documents may not explicitly disclose all final details required for a complete systems installation; however, Contractors shall possess the expertise to include the necessary appointments of complete operating systems in their bid price.

K. The Contractor shall include in his bid price the cost of all work that is an obvious, logical, or reasonably foreseeable consequence of other work explicitly indicated in the documents.

L. Damper Quantities: Damper quantities indicated on the Drawings are not explicit. In each location where a life safety damper (e.g. fire, smoke, or combination fire/smoke damper), backdraft damper, or motorized damper is indicated, the Contractor shall provide the quantity of dampers required to meet the indicated performance requirements and completely fill the associated duct, plenum, or opening size. Provide an actuator or operator for each damper, as applicable.

M. Interpretation of Flow Diagrams and Piping Connection Details:

1. Unless there are explicit notes to the contrary on piping system flow diagrams, piping system flow diagrams are generally not intended to establish the quantity, type, and orientation of pipe elbows, tees, and caps, as the diagrams are schematic in nature and are not drawn to scale. In the event of a conflict between the graphical depictions on piping floor plans and flow diagram(s) with respect to pipe elbows, tees, and caps, the piping floor plan(s) shall take precedence.
2. Many of the required piping appurtenances, valves, small or minor piping, control devices, sensors, and similar items are omitted from floor plans and sections for clarity purposes only. Refer to piping system flow diagrams, control diagrams, details, and specifications for additional required work (appurtenances) not shown on the floor plans and/or sections. The Contractor shall include in his bid price all devices shown on any one (or more) portion of the documents, as if they were shown in all locations (e.g. section, diagram, and floor plan).
3. The normal (e.g. spring return or fail) position of mixing and diverting valves shall be as described in the sequences of operation or as noted on the Drawings. The graphical representation on details and flow diagrams shall not be construed to indicate otherwise. Mixing and diverting valves hall be piped to produce the normal position described or indicated.
4. The Contractor shall connect water inlets and outlets to the connection locations required or as labeled by the equipment manufacturer to affect proper performance and heat transfer of the equipment. The graphical representation on flow diagrams and piping connection details on the Drawings shall not be construed to indicate otherwise.

N. Should a bidding Contractor find conflicts or discrepancies in, or omissions from, the Drawings or Specifications, or should he be in doubt as to their meaning, the bidding Contractor should at once notify the Architect, who will send written instructions to all bidders. If these are ignored by the bidding Contractor, the bidding Contractor will be responsible for furnishing the proper or workable equipment as deemed necessary by the Architect / Engineer. The same shall apply to conflicts or discrepancies between different drawings or between different specification sections.

O. Should some portion of the work appearing on the HVAC Drawings and/or the Division 23 Specifications also be addressed in part or whole on the Drawings of another trade, or in the specifications of another Division, the cost of the work indicated on the HVAC / Division 23 documents shall be included with the Division 23 Contractor's bid price, unless explicitly clarified otherwise during the bidding period by the Architect / Engineer. During the construction period, prior to submitting the relevant materials and equipment for review, coordinate with the other affected trades and obtain clarification from the Architect / Engineer.

P. Details shown on the Drawings shall apply to all instances of such item or condition indicated elsewhere on the Drawings, with or without an explicit reference thereto.

Q. The Drawings and Specifications primarily indicate the work that is required by the contract. In selected instances, an indication of work that is NOT acceptable may be made in the Contract Documents in order to provide additional emphasis or clarity. The omission of a similar statement elsewhere in the Documents shall not be construed by the Contractor to mean that unspecified or unindicated work will be accepted or is permitted under this contract.

R. Where a code, standard, or other reference document is referenced, unless explicitly indicated otherwise, it shall be taken to refer to the most recent published version / edition at the time of bidding.

1. Exception: For standards referenced by applicable building codes, comply with dates of standards as listed in building codes.

S. In cases where equipment and materials are specified in the singular or plural number, it is intended that such reference shall apply to as many such items as are required to complete the installation.

T. In these Specifications, the words "shall," "shall be,", "shall include," or "shall comply with," depending on the context, are implied where a colon (:) is used within a sentence or phrase.

U. Hypertext: Text used in the Specifications may contain hyperlinks. Hyperlinks may allow for access to linked information that is not residing in the Specifications. Unless otherwise indicated, linked information is not part of the Contract Documents.

V. Compliance with requirements and performance of the work described in the Contract Documents are the responsibility of the Contractor unless specifically stated otherwise.

1.16 BASIS OF DESIGN PRODUCTS AND SUBSTITUTIONS

A. Basis of Design: Throughout the project specifications and drawings, materials and equipment may be indicated as the "basis of design" material or equipment. If the bidding Division 23 Contractor desires to furnish equipment of a manufacturer other than that which is indicated to be the "basis of design", even if that alternative manufacturer and/or product name are also listed, it is the full burden of the bidding Division 23 Contractor to verify, prior to submitting a bid price, that the proposed product meets all of the project requirements and specifications. The cost of any additional changes to the work, including changes to the work of other trades / Divisions, that are associated with the Division 23 Contractor's use of a product other than the "basis of design" product, shall be borne by the Division 23 Contractor at no additional cost to the Client Agency, and the proposed additional changes shall be subject to the approval of the Architect / Engineer.

B. Listing of Product and Manufacturer Names: Where names of manufacturers of products are listed in the Specifications, the mere listing of a manufacturer's name, or of a specific product name does not relieve the Contractor of the obligation to meet all provisions of the Contract Documents. All proposed products, even of those of manufacturers listed in the Specifications, are subject to the requirements of the Contract, and therefore are only acceptable provided that they meet the requirements of the Contract, as interpreted by the design professionals (Architect and Engineer).

1. Where a manufacturer or product list is proceeded by "subject to compliance with requirements, provide products by one of the following:", or similar language, the Contractor shall interpret this to mean that products or manufacturers not contained within the list are not acceptable and shall not be submitted for approval without conforming to Division 01 substitution requirements.
2. Where a manufacturer or product list is proceeded by "subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:", or similar language, the Contractor shall interpret this to mean that products or manufacturers other than those listed may be submitted for review and possible approval by the Architect / Engineer.

C. Specification by Product Name: Whenever an item of material or equipment is specified or described in the Contract Documents by using the name of a proprietary item or the name of a particular supplier, without the listing of additional product or supplier name(s), the Contractor shall interpret the documents to mean that no other product or supplier may be used. However, where the phrase "or-equal" follows the product or supplier name, the name reference is intended to establish the type, function, appearance, and quality required. Other items of material or equipment or material or equipment of other suppliers may be submitted to Architect / Engineer for review under the circumstances described below.

1. "Or-Equal" Items: If, in the Architect / Engineer's sole discretion, an item of material or equipment proposed by Contractor is functionally equal to that named and sufficiently similar so that no change in related work will be required, it may be considered by Engineer as an "or-equal" item. For the purposes of this Paragraph, a proposed item of material or equipment will be considered functionally equal to an item so named if:

    a. In the exercise of reasonable judgment the Architect / Engineer determines that:

        1) It is at least equal in materials of construction, quality, durability, appearance, strength, and design characteristics;
        2) It will reliably perform at least equally well the function and achieve the results imposed by the design concept of the completed Project as a functioning whole; and
        3) It has a proven record of performance and availability of responsive service.

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

        1) There will be no increase in cost to the Client Agency or increase in contract times; and
        2) It will conform substantially to the detailed requirements of the item named in the Contract Documents.

D. Product Availability:

1. Where a product name or model number is indicated on the drawings or specifications and that product model is no longer available, the bid price shall include the currently available product model with the equal or greater quality, capacity, features, and warranty as the unavailable model listed.
2. The Contractor is responsible for confirming that all specified products will be available in a timely manner to meet the contract schedule. Should the delivery time schedule of any specified product be an issue that could adversely affect the project schedule, the Contractor shall notify the Architect, in writing, within 14 days following the award of the contract. Documentation as to when specified products were ordered and anticipated delivery dates will be required to be submitted to the Architect at this time.

1.17 SUBMITTALS - GENERAL REQUIREMENTS

A. Refer to Division 01 for basic requirements.

B. The Contractor shall provide product data and shop drawings for all equipment, systems, products, and materials proposed for installation under this contract, and as directed in other Division 23 Sections and Division 01.

C. Deviations and Additional Information: On each submittal, clearly indicate deviations from requirements in the Contract Documents, including minor variations and limitations; include

relevant additional information and revisions, other than those requested by Architect / Engineer on previous submittals. Indicate by highlighting on each submittal or noting on attached separate sheet. Submittals lacking this information may be rejected solely on these grounds.

D. Provide manufacturer's performance curves showing all available performance characteristics with submittals for all fans and pumps utilized on the project.

1.18 WARRANTIES

A. Defective equipment, materials or workmanship, including damage to the work provided under other Divisions of this contract, shall be replaced or repaired at no additional cost to the Client Agency for the duration of the stipulated guarantee periods.

B. General Project Warranty: Refer to Divisions 00 and 01.

C. Special Warranties: Special manufacturers' warranties that extend beyond the general warranty period are specified in other Division 23 Sections. Special warranties shall not deprive Client Agency of other rights Client Agency may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.

1. Where the duration of a manufacturer's standard warranty exceeds that specified for the special warranty, the manufacturer's warranty shall take precedence.
2. Where the duration of a manufacturer's standard warranty is less than that specified, the manufacturer shall provide a special warranty extension as required, and shall provide a certificate attesting to that extension with the equipment submittal. Failure to include that certificate with the submittal shall be grounds for rejection of the submittal.
3. Special warranties shall defined be interpreted to be non-pro-rated and shall begin on the date of Substantial Completion, unless noted otherwise.

    a. The manufacturer’s warranty time periods may coincide with the Contractor’s time period of obligation, but where the manufacturer’s warranty contains an expiration date based upon the equipment shipping date, startup date, or some other criteria, the Contractor shall not be relieved of responsibility for covering the full warranty time periods specified.

4. Special warranties and their obligations to the Client Agency which have been violated by the Contractor's actions (e.g. method of handling, installation, storage, operation, etc.) shall become the responsibility of the Contractor for the original factory warranty duration and coverage. In such cases, the Contractor shall issue written documentation to the Client Agency attesting to the Contractor's acknowledgement of this responsibility.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Transition Pipe Fittings (Metal to Plastic):

    a. Charlotte Pipe and Foundry

b. Ipex USA LLC
c. NIBCO, Inc.; Chemtrol Div.
d. Uponor
e. Viega LLC
f. Or equal as approved by the Professional.

2. Dielectric Flanges:

a. Capitol Manufacturing Co.
b. Central Plastics Co.
c. Epco Sales Inc.
d. Watts Industries, Inc.; Water Products Div.
e. Zurn Industries, LLC
f. Or equal as approved by the Professional.

3. Dielectric-Flange Isolation Kits (Water / Hydronic):

a. Advance Products & Systems (APS), Inc.
b. Calpico, Inc.
c. Central Plastics Co.
d. Or equal as approved by the Professional.

4. Dielectric-Flange Isolation Kits (Steam):

a. GPT; an EnPro Industries Company
b. Advance Products & Systems (APS), Inc.
c. Central Plastics Co.
d. Or equal as approved by the Professional.

5. Dielectric Nipples:

a. Grinnell Mechanical Products
b. Perfection Corp.
c. Victaulic Co.
d. Or equal as approved by the Professional.

6. Mechanical Sleeve Seals:

a. Advance Products and Systems Inc.
b. Calpico, Inc.
c. Flexicraft Industries
d. Metraflex Co.
e. GPT, an EnPro Industries Company
f. Proco Products Inc.
g. Or equal as approved by the Professional.

7. Fire- and Smoke-Stopping Materials and Assemblies:

a. As indicated in Division 07.

8. Fire-Stop Pipe Sleeves:

a. Hilti, Inc.
b. Holdrite
c. Pro-Set Systems Inc.

d. Or equal as approved by the Professional.

9. Motor Controllers and Disconnect Switches:

a. ABB
b. Allen-Bradley
c. Eaton
d. Schneider-Electric
e. Siemens
f. Or equal as approved by the Professional.

2.2 PIPE AND PIPE FITTINGS

A. Refer to individual Division 23 piping Sections for pipe and fitting materials and joining methods.

B. Pipe Threads: ASME B1.20.1 for factory-threaded pipe and pipe fittings.

2.3 JOINING MATERIALS

A. Refer to individual Division 23 piping Sections for special joining materials not listed below.

B. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.

1. Full-Face Type: For flat-face, Class 150 flanges.
2. Narrow-Face Type: For raised-face, Class 300 flanges.
3. Hydronic / Water Applications: ASME B16.21, nonmetallic, flat, asbestos-free, 1/8-inch maximum thickness.
4. Steam System Applications: Use only serrated metal-core type gaskets for steam system applications. Gaskets shall be "Flexpro Series" as manufactured by Flexitallic Corp., or approved equal by Bostic Engineering or EPM, Inc.

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.

1. Alloy Sb5: 95 percent tin and 5 percent antimony, with 0.20 percent maximum lead content.
2. Flux: ASTM B 813, non-self-cleaning type.

F. Brazing Filler Metals: AWS A5.8.

1. Use Type BCuP (copper-phosphorus) alloy meeting AWS 'BCuP-3' specification (e.g. Sil-Fos 5, or approved equal) for joining copper socket fittings with copper pipe.
2. Use Type BAg (cadmium-free silver) alloy for joining copper with bronze or steel, with a compatible flux.

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: Manufacturer's standard solvent cements for the following:

1. CPVC Piping: ASTM F 493.
2. PVC Piping: ASTM D 2564. Include primer according to ASTM F 656.

2.4 TRANSITION FITTINGS

A. Plastic-to-Metal Transition Fittings: One-piece fitting with manufacturer's Schedule 80 equivalent dimensions; one end with threaded brass or copper insert, and one solvent-cement-joint end.

B. Plastic-to-Metal Transition Unions: MSS SP-107, four-part union. Include brass or copper end, solvent-cement-joint end, rubber gasket, and union nut.

2.5 DIELECTRIC FITTINGS

A. General: Assembly or fitting with insulating material isolating joined dissimilar metals, to prevent galvanic action and stop corrosion.

B. Description: Combination of copper alloy and ferrous steel; threaded, solder, plain, and weld-neck end types and matching piping system materials.

C. Insulating Material: Suitable for system fluid, pressure, and temperature.

D. Dielectric Flanges: ASSE 1079. Factory-fabricated, companion-flange assembly, for 150-psig minimum working pressure as required to suit system pressures.

E. Dielectric-Flange Isolation Kits (Hydronic): Field-assembled, companion-flange assembly, full-face or ring type. Components include neoprene or phenolic gasket, phenolic or polyethylene bolt sleeves, phenolic washers, and steel backing washers.

1. Provide separate companion flanges and steel bolts and nuts for 150-psig minimum working pressure as required to suit system pressures.

F. Dielectric-Flange Isolation Kits (Steam): Field-assembled, companion-flange assembly with insulating material for isolating piping systems. Insulating material shall be suitable for steam system pressure and temperature to 450 deg. F.

1. Components include full-face Teflon® gasket, Nomex® bolt sleeves, high temperature silicon glass washers, and steel backing washers.
2. Provide separate companion flanges and steel bolts and nuts for 150-psig minimum working pressure as required to suit system pressures.

G. Dielectric Nipples: IAPMO PS 66. Electroplated steel nipple complying with ASTM F 1545 with inert and noncorrosive, thermoplastic lining; plain, threaded, or grooved ends; and 150-psig minimum working pressure at 225 deg. F.

H. Dielectric unions are strictly prohibited. Use dielectric nipples on threaded connections.

2.6 FLEXIBLE CONNECTORS

A. General: Fabricated from materials suitable for system fluid and that will provide flexible pipe connections. Include 150-psig minimum working-pressure rating, to match system working pressure, and ends according to the following:

1. 2-Inch NPS and Smaller: Threaded.
2. 2-1/2-Inch NPS and Larger: Flanged.

B. Flexible Hose Piping Connectors: Minimum 18" long flexible hose constructed of EPDM liner or a corrugated type 304 or 321 stainless steel tube with outer stainless steel reinforcing braid. Rated for a maximum continuous working temperature 230 deg. F. Rated for minimum continuous working pressure of 150 psi in sizes up to 1-1/4". Steel, threaded end connections.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Belimo
    b. Flow Design Inc. (FDI); a Div. of IMI
    c. Griswold Controls LLC
    d. HCI Inc.
    e. Nexus
    f. Bell and Gossett, a Div. of Xylem Inc.
    g. Or equal as approved by the Professional.

C. Stainless-Steel Flexible Connectors: Corrugated, stainless-steel, inner tubing covered with stainless-steel wire braid. Include steel nipples or raised face flanges, welded to hose. One fixed and one floating flange required on flanged models. Grooved ends are also acceptable. Rated for no less than 150 psig at a maximum continuous working temperature 250 deg. F. Connectors shall tolerate no less than 3/4" lateral offset.

1. Minimum Length: 8" long for connectors sized 2" and smaller, and 12" long for connectors sized 2-1/2" and larger.
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Flexicraft Industries
    b. Flex-Hose Co. Inc.
    c. Hyspan
    d. Mason Industries
    e. Minnesota Flexible Corp.
    f. Metraflex 'SST and 'SLP'
    g. Or equal as approved by the Professional.

D. Applications:

1. Provide flexible hose piping connectors on piping connections to the rotating equipment provided with external vibration isolation, other than pumps, with piping connections 1-1/4" and smaller.
2. Hydronic Pumps: Stainless steel flexible connectors.

    a. Exception: Line-mounted pumps do not require flexible connectors.

3. Provide stainless steel flexible connectors on piping connections to motor-containing or vibrating equipment with hydronic connections larger than 1-1/4", unless that equipment is not required to have, and has not been provided with, vibration isolation.

2.7 MECHANICAL SLEEVE SEALS

A. Description: Modular sealing element unit, designed for field assembly, to fill annular space between pipe and sleeve. Concentric or eccentric types to suit field conditions.

1. Sealing Elements: EPDM interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
2. Pressure Plates: Stainless steel. Include two for each sealing element.
3. Connecting Bolts and Nuts: Stainless steel of length required to secure pressure plates to sealing elements. Include one for each link.
4. Pressure Rating: Designed for up to 20 psig differential, with a 4x safety factor.

2.8 PIPING SPECIALTIES

A. Sleeves: The following materials are for wall, floor, slab, and roof penetrations:

1. Steel Sheet Metal: 0.0336-inch minimum thickness (22 gauge), galvanized, round tube closed with welded longitudinal joint.
2. Steel Pipe: ASTM A 53, Type E, Grade A, Schedule 40, galvanized, plain ends.
3. Cast Iron: Cast or fabricated "wall pipe" equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.
4. Stack Sleeve Fittings: Manufactured, cast-iron sleeve with integral clamping flange. Include clamping ring and bolts and nuts for membrane flashing.

    a. Underdeck Clamp: Clamping ring with set screws.

B. Escutcheons: Manufactured wall, ceiling, and floor plates; deep-pattern type if required to conceal protruding fittings and sleeves.

1. ID: Closely fit around pipe, tube, and insulation of insulated piping.
2. OD: Completely cover opening.
3. Cast Brass: One piece, with set screw. Polished chrome-plated finish.-
4. Cast Brass: Split casting, with concealed hinge and set screw. Polished chrome-plated finish.
5. Stamped Steel: One piece, with set screw and chrome-plated finish.
6. Stamped Steel: One piece, with spring clips and chrome-plated finish.
7. Stamped Steel: Split plate, with concealed hinge, set screw, and chrome-plated finish.
8. Stamped Steel: Split plate, with concealed hinge, spring clips, and chrome-plated finish.
9. Cast-Iron Floor Plate: One-piece casting.

2.9 GROUT

A. Nonshrink, Nonmetallic Grout: ASTM C 1107, Grade B.

1. Characteristics: Post-hardening, volume-adjusting, dry, hydraulic-cement grout, nonstaining, noncorrosive, nongaseous, and recommended for interior and exterior applications.
2. Design Mix: 5000-psig, 28-day compressive strength.
3. Packaging: Premixed and factory packaged.

2.10 FIRE AND SMOKE -STOPPING MATERIALS

A. General Requirements for Fire-and Smoke Stopping Materials: Provide --listed fire-stopping and smoke-stopping systems and assemblies for filling openings around duct, conduit, low-voltage cable, and piping penetrations of Division 23 work through walls, partitions, slabs, and floors as required by the International Building Code and any local amendments. Comply with the provisions of Division 07.

B. Fire-Stop Pipe Sleeves: At the option of the Contractor, and if approved by local codes, prefabricated fire-stop pipe sleeves also may be utilized. Pipe sleeves shall be UL 1479 or UL 263 Listed, and tested in accordance with ASTM E 814 or ASTM E 119. Sleeves shall be adjustable and shall be filled with ceramic fiber material to provide insulation and fire stopping. Sleeves shall provide a 2-hour fire rating.

2.11 MOTOR CONTROLLERS AND DISCONNECT SWITCHES

A. Throughout this specification, where mechanical equipment is specified to be factory furnished with disconnect switches and/or motor starters, the equipment provided shall be furnished with combination full voltage magnetic starters and fused disconnect switches. All starters and disconnect switches provided under Division 23 shall conform to applicable Division 26 specifications.

B. Where factory-mounted disconnect switches or motor controllers (magnetic starters or VFDs) are specified in Division 23 Sections, and the equipment manufacturer does not offer such a switch or motor controller as factory equipment, a loose switch or motor controller shall be furnished by the Division 23 Contractor to the Division 26 Contractor for field installation. Switch and motor controller installation and additional wiring costs shall be borne by the Division 23 Contractor.

C. The short circuit rating of starters, switches, and equipment mounted power distribution and control panels shall be no less than 10,000 AIC, or as elsewhere specified in Division 23 or 26, whichever value is highest.

D. Starters shall have three (3) current overload relays and low-voltage release. Starters shall be furnished with "Hand-Off-Automatic" switch, red-run light, overload reset, a full set of extra interlocks with provisions for additional sets and a control transformer of ample capacity with 120 volt fused control circuit.

E. Enclosures shall be NEMA 1 or 12 indoors, and NEMA 3R or 4X where outdoors / exposed to weather.

F. Where single phase motors are designated to be factory furnished with disconnect switches, the motor shall incorporate a NEMA KS 1, Type HD disconnect switch, with lockable handle.

G. Disconnect switches shall be horsepower rated to match the horsepower of the motors plus 1.15 service factors.

2.12 SECURITY TYPE CEILING, WALL, AND SHAFT ACCESS PANELS

A. The Division 23 Contractor shall provide factory-fabricated access panels for access to concealed dampers, valves and other equipment provided under Division 23 where no other means of access is available. Unless more restrictive requirements are referenced in Division 08, comply with the following:

1. Access panels shall be of appropriate size but not less than 20x20 inches, flush type, hinged to drop down and out, lock and key-operated, stainless steel in tile work and prime

coated sheet steel in drywall, plaster or acoustical tile. Exact locations and sizes of panels shall be determined by the Contractor, but panels shall be located for a symmetrical appearance. Locations for access panels in finished areas must be approved by the Architect / Engineer.

2. In addition, at locations where access panels are installed in fire-rated construction, access panels shall contain the 1-1/2-hour fire-rated "B" label.

B. Access panels shall be security type. Acceptable manufacturers / products are specified in Division 08.

2.13 AC CONDENSATE OVERFLOW PROTECTION

A. Suspended indoor equipment, rooftop equipment, and floor mounted equipment outside of mechanical rooms that generates AC condensate shall be provided with a water level switch complying with UL 508 to provide protection against drain pan overflow by sensing a high condensate level in the drain pan, in conformance with the 2015 International Mechanical Code. The sensor shall de-energize the compressors upon detection of a high water level.

1. Unless indicated otherwise:

a. The switch shall be a Rectorseal Model 'SS3' mounted in the primary drain pan, or approved equal.

b. Drains sized at 3/4-inch NPT may also use a Rectorseal Model 'SS1' mounted in the primary drain line, except where equipment is installed in a return air plenum, the sensor shall be approved for use in plenums per UL 2043. The plenum rated switch shall be a Rectorseal Model 'SS2AP' or approved equal installed in the drain pan's auxiliary overflow connection or as otherwise detailed on the Drawings.

PART 3 - EXECUTION

3.1 HVAC DEMOLITION

A. Refer to Division 01 and Division 02 for general demolition requirements and procedures.

B. 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. Existing work is not permitted to be abandoned in place unless explicitly indicated. Piping shall be tagged as "Abandoned in Place" with the date of abandonment at the points of disconnection as well as along its length at maximum 20-foot intervals, where accessible.
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. Existing work is not permitted to be abandoned in place unless explicitly indicated on the Drawings. Ducts shall be tagged as "Abandoned in Place" with the date of abandonment at the points of disconnection as well as along its length at maximum 20-foot intervals, where accessible.
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 Client Agency.

C. If pipe, ductwork, insulation, wiring, 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.

D. The disposal of all demolished materials shall be in accordance with all applicable laws, and all costs shall be borne by the Contractor.

E. Recover refrigerant in demolished systems in accordance with all applicable laws.

F. Disconnect and remove existing systems and equipment no longer required.

G. Demolished items shall be cut into sizes small enough to fit though existing building passageways and openings.

H. Only where explicitly permitted by the Client Agency and Architect / Engineer, existing ductwork and piping no longer required and concealed in walls, below slabs on grade, or above fixed ceilings and not interfering with new construction or remodeled work may remain in place. Such work shall be capped, abandoned and rendered "dead". Provide labels or other form of identification on the work that identifies it as "abandoned in place", along with the month/year of abandonment.

I. Where work is to be performed above existing ceilings, the Contractor will be responsible for removing ceiling tiles, storing tiles and reinstalling tiles after work is complete. The Contractor shall also be responsible for restoring the existing ceilings to their present condition where they are damaged or where the surfaces are dirtied or marred by the work included under this contract. New matching ceiling tiles and supports shall be furnished and installed under this contract where necessary. Existing ceiling tiles shall be kept as clean as possible.

J. No demolition shall occur which leaves the building interior without weather protection. All demolition of exterior surfaces shall be followed immediately by protective construction, either permanent or temporary.

K. Review the construction documents, to determine the affected areas of the existing structure. Remove systems in the affected areas not to be reused including equipment, piping, ductwork, controls, hangers, supports, etc.

L. Schedule demolition work with the Client Agency.

M. All existing piping shall be saw-cut, not broken, at point where piping connects to existing.

N. Where the project requires demolition of existing piping, ductwork, mechanical equipment, and similar services, all such systems shall be terminated in an approved manner to allow affected systems to remain in operation. Provide temporary caps on piping and ductwork at all points of connection between new and existing until new/modified systems are completed in the renovation area. Duct caps shall not be removed until all dust and dirt generating construction activities are complete and the renovation area has been cleaned.

O. The draining of existing piping systems, and subsequent filling, venting of air, and chemical treatment required to perform the demolition and/or new piping system connections to existing systems shall be provided under this contract.

P. Repair ductwork and associated insulation and jacketing where control devices and other work installed on or in existing to remain ductwork was removed.

Q. The Contractor shall, at his own expense, repair, replace and maintain in service, any utilities, facilities or services (underground, over ground, interior or exterior) damaged, broken or otherwise rendered inoperative during the course of construction. The method used by the Contractor in repairing, replacing or maintaining the services shall be approved by the Architect and the Client Agency.

R. When demolishing existing equipment, all control wiring or pneumatic tubing serving that equipment shall be properly terminated in an approved manner to allow affected systems to remain in operation. Remove pneumatic tubing back to risers and plug.

S. Where ductwork systems serve both areas under construction and areas not affected by the construction, all branch ducts in the construction area shall be capped, and fans shall be rebalanced for new air quantities.

T. Demolition on the Roof: Where existing curb- and roof rail-mounted rooftop equipment, ductwork, or piping is removed / demolished, the associated curb and/or rails shall also be removed, and the roofing system and insulation patched with matching materials.

1. Curb Caps: If the Drawings specifically indicate that existing curbs may remain, provide a curb cap to maintain the integrity of the building envelope. The cap shall be fashioned from minimum 22 gauge 304 stainless steel sheet, and secured to the existing curb with matching fasteners. Provide soft neoprene gasket between the cap and the top of the curb. The sides of the cap shall be no less than 3-inches long or as required to overlap the base flashing by 2 inches, whichever is larger. Caps shall be sloped minimum 1/8"/ft. to shed water. For caps with both plan dimensions larger than 24", provide angle reinforcements of the cap with using matching materials to prevent permanent deformation when subjected to the weight of a 250 lbs. person walking on the cap. The underside of the cap shall be insulated with minimum 2" thick 3 PCF density fiberglass board insulation with a foil-scrim-kraft jacket secured with weld pins and washers as specified in Division 23 Section "HVAC Duct Insulation"**.**

3.2 CUTTING AND PATCHING

A. The Division 23 Contractor shall include in his bid all cutting and patching work required for the installation of HVAC work performed under Division 23. Any damage incident to cutting or other causes in the performance of the contract work shall be made good by replacement or repairs in a manner satisfactory to the Architect/ Engineer.

B. Where piping, ducts, or other equipment pass through fire or smoke rated construction, furnish and install sleeves and thoroughly seal openings around sleeves, pipes, ducts, etc. With fire and smoke resistant materials. Materials shall be provided to maintain the fire rating of the adjacent construction in accordance with the requirements of NFPA and other applicable codes.

C. No structural members shall be cut without prior approval of the Architect.

D. Cut, channel, chase, and drill floors, walls, partitions, ceilings, and other surfaces necessary for mechanical installations. Perform cutting by skilled mechanics of trades involved.

E. Repair cut surfaces to match adjacent surfaces.

3.3 EXCAVATING AND BACKFILLING

A. Excavate and backfill as required for the installation of Division 23 work.

B. Comply with the work of this Article unless more restrictive requirements are present in Division 31.

C. Trenches for underground piping shall be excavated to required depths. Where rock is encountered, excavate to a grade 6 inches below the lowest part of the pipe and refill the excavation below pipe grade with sand and gravel. Trenches shall have uniform grade as specified hereafter or shown on the Drawings.

D. Pipe trenches shall not be wider than 4 inches on each side of the pipe but not less than 12 inches wide.

E. Excavations shall be done on an unclassified basis. No additional compensation shall be allowed regardless of type or hardness of material encountered.

F. No backfilling shall be done on any mechanical system requiring testing or inspection until such testing or inspection has been completed satisfactorily.

G. Shore and brace as required to maintain banks of excavation and avoid cave-ins and make good any damages to adjoining property or work in place caused by failure to properly shore excavations. Shoring shall conform to OSHA and PA Department of Labor and Industry requirements.

H. Backfilling shall be made in 8 inch layers (maximum), mechanically tamped. Wood, old forms, shoring, etc., shall be removed before backfilling. Backfill shall not contain any frozen material, ashes, slag, combustible material, rocks over 6 inches in the largest dimension, or any other material which the Architect considers unsuitable for the purpose. Particular care shall be exercised in backfilling areas where construction shall be placed above the backfill.

I. Satisfactory soil materials for backfill where contaminated soil is removed whether surplus from the existing site or trucked-in new shall meet the following requirements:

    1. ASTM D 2487 soil classification groups GW, GP, GM, SW, SP, and SM free from rock or gravel larger than 2 inches in any dimension, debris, waste, frozen materials, vegetation, and other deleterious matter.

J. Compaction of soil and backfill shall be as follows:

    1. Soil and backfill shall be compacted in 8 inch layers (maximum) with each layer of soil or backfill compacted at 95 percent maximum dry density according to ASTM D 1557.

K. Shoring shall be removed after equipment and piping have been installed and tested.

L. Keep available at all times pumping equipment which shall be used to pump any or water from pipe trenches and excavation under this contract.

M. Remove from the site surplus excavated materials resulting from work. Surplus excavated materials include materials not suitable for use as backfill.

N. Notify utility companies and state "one-call" system for verification of underground utilities before any excavation takes place. PA ONE CALL telephone number: 1-800-242-1776.

3.4 FIRESTOPPING AND SMOKESTOPPING INSTALLATION

A. During bidding, the Division 23 Contractor shall thoroughly review the architectural documents to determine the location and hour rating of fire resistance rated construction (e.g. walls, shafts, floors, etc.), and shall include in his bid the costs of providing all fire and smoke stopping of Division 23 work required by the 2018 International Building Code and Mechanical Code.

B. Comply with Division 07 provisions.

3.5 PIPING SYSTEMS - COMMON REQUIREMENTS

A. General: Install piping as described below, unless piping Sections specify otherwise. Individual Division 23 piping Sections specify unique piping installation requirements.

B. General Locations and Arrangements: 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. Due to the small scale of the Drawings, it is not practical to indicate offsets, fittings, valves or similar items, to make a complete operating system. The Drawings are generally diagrammatic and indicative of the work to be installed. The Contractor shall carefully investigate conditions affecting his work and shall install his work in such a manner that interference between pipes, conduit, ducts, equipment, architectural and structural features will be avoided and shall furnish and install such offsets or fittings to meet the conditions at the building, so as to avoid interference without additional cost to the Client Agency.

C. Supporting suspended piping and associated components from the underside of the roof and floor decking in steel framed buildings is prohibited. All suspended piping and associated components shall be supported from the building steel structural system.

D. Install piping at indicated or required slope.

E. Install components with pressure rating equal to or greater than system operating pressure.

F. Install piping in concealed locations, except in equipment rooms and service areas, or where explicitly indicated otherwise on the Drawings.

G. Install piping free of sags and bends.

H. Install exposed and concealed interior and exterior piping at right angles or parallel to building walls. Diagonal runs are prohibited, unless otherwise indicated.

I. Install piping tight to slabs, beams, joists, columns, walls, and other building elements. Allow sufficient space above removable ceiling panels to allow for ceiling panel removal.

J. Install piping to allow application of insulation plus 1-inch clearance around insulation.

K. Locate groups of pipes parallel to each other, spaced to permit valve servicing.

L. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

M. Elbows: Install factory-fabricated elbows for changes in direction. Long radius elbows shall be used, and changes in elevation shall be performed with two (2) 22.5 deg. elbows in lieu of 45 or 90 degree elbows.

N. Tee Fittings and Branch Connections: Install branch connections to mains using factory-fabricated tee fittings in main with takeoff out bottom of main, except for up-feed risers with takeoff out top of main line or where space constraints do not permit.

1. The only exceptions to the 'factory-fabricated tee fittings' requirement are as follows:

    a. The use of "fish-mouth" type fittings for branch connection to mains is only permitted when the size of the branch connection is two (2) nominal pipe sizes or smaller than the size of the main, and the main is size 5" or larger.
    b. The use of weld-o-lets for branch connection to mains is only permitted when the size of the branch connection is three (3) or more nominal pipe sizes smaller than the size of the main pipe. Furthermore, weld-o-lets shall not be used for branches larger than 2".

2. Swing Connections: Branch connections to mains on heating hot water andsteam and steam condensate piping shall be made with swing connections.

    a. Swing connections shall be made with at least five pipe fittings, including tee in main. Swing connections are generally not indicated on the piping floor plans for clarity purposes only.

3. "T-drill and similar piping system tee forming techniques are <u>not</u> permitted. Use tee fittings.
4. Converging and diverging "bull-head" tees will not be permitted in piping systems; only branch-tee connections are permitted.

O. Install couplings according to manufacturer's written instructions.

P. Piping Escutcheons: Provide for pipe penetrations of walls, floors, and ceilings. Install escutcheons with ID to closely fit around pipe, tube, and insulation of piping and with OD that completely covers opening.

1. Select escutcheon types according to the following:

    a. Uninsulated Piping: Cast brass or stamped steel, with set screw or spring clips, and chrome-plated finish.. Hinged type for existing piping; one-piece for new piping.
    b. Floor Penetrations in Utility / Equipment Room Areas: Cast-iron floor plates. One piece for new piping; split-casting type for existing piping.
    c. Insulated Piping: Cast brass or stamped steel; with concealed hinge, spring clips, and chrome-plated finish.

Q. Interior Piping Penetrations and Roof Slab Piping Penetrations: Provide sleeves for pipes passing through interior, above grade concrete and masonry walls, gypsum-board partitions, and concrete floor and roof slabs. Exception: Core drilled concrete slabs and concrete and solid (fully grouted) masonry walls where the concrete or masonry thickness is at least 4 inches do not require sleeves.

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. Build sleeves into new walls and slabs as work progresses.
3. Provide 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 6-inch NPS.
    b. Steel, Sheet-Metal Sleeves: For pipes 6-inch NPS 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.

        1) Seal space outside of sleeve fittings with nonshrink, nonmetallic grout.

4. Seal annular space between sleeve and pipe or pipe insulation, using elastomeric joint sealants. Use Type S, Grade NS, Class 25, Use O, neutral-curing silicone sealant, unless otherwise indicated.

R. Aboveground, Exterior-Wall, Pipe Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Size sleeve 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 in diameter and larger.

S. Underground, Exterior-Wall, Pipe Penetrations: Install cast-iron "wall pipes" for sleeves. Seal pipe penetrations using mechanical sleeve seals. Size sleeve for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.

T. Mechanical Sleeve Seal System Selection and Installation: Follow the manufacturer's selection and installation instructions. Select type, size, and number of sealing elements required for piping temperatures, material, and size, and for sleeve ID or hole size. Position piping in center of sleeve or core drilled penetration, without eccentricity or axial misalignment. Assemble sleeve-seal system components, and install in annular space between piping and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make a watertight seal. Follow manufacturer's instructions for tightening bolts. The use of split-type wall mounted sealing sleeves and eccentric type sleeve seals to adjust for misalignment conditions will only be permitted with the explicit approval of the Architect / Engineer.

U. Fire-Barrier, Fire-Wall, and Fire-Partition Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and slabs/floors at pipe penetrations. Seal pipe penetrations with firestopping materials. Comply with the provisions of this Section and Division 07.

V. Verify final equipment locations for roughing-in.

W. Refer to equipment specifications in other Sections of these Specifications for roughing-in requirements.

3.6 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.

E. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter.

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 and nut threads, and on the nut and bolt head bearing surface that contacts the flange (or washer, if provided). Flange faces and gaskets shall be clean and dry. Examine flanges for proper alignment prior to making the joint. Comply with ASME PCC-1 “Guidelines for Pressure Boundary Bolted Flange Joint Assembly”.

1. Do not remake joints with a gasket that has been previously been installed in a tightened down joint. Use a new gasket each time the joint is made.
2. Torque fasteners to the proper load to prevent both leaks and excessive gasket stress (i.e. crushing). Re-torque fasters afterwards in accordance width he gasket manufacturer's recommendations to account for 'gasket creep'.
3. When flanges are of dissimilar materials, the fastener torque used shall reflect the softer of the two materials, in order to prevent flange deformation (i.e. creep).
4. Mark bolting sequence numbers and reference bolt locations on the flange OD. Tightening shall proceed in stages (i.e. not to the maximum torque all at one time), using a 'crisscross' bolt tightening sequence in order to ensure uniform gasket compression.
5. Provide steel or copper backing rings for connections involving plastic flanges.

I. Plastic Piping Solvent-Cement Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:

1. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.
2. CPVC Piping: Join according to ASTM D 2846/D 2846M Appendix.
3. PVC Pressure Piping: Join schedule number ASTM D 1785, PVC pipe and PVC socket fittings according to ASTM D 2672. Join other-than-schedule-number PVC pipe and socket fittings according to ASTM D 2855.
4. PVC Nonpressure Piping: Join according to ASTM D 2855.

3.7 PIPING CONNECTIONS

A. Make connections according to the following, unless otherwise indicated:

1. Install unions, in piping NPS 2 and smaller, adjacent to each control 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 other flanged pipeline appurtenances, and at final connection to each piece of equipment.

3.8 DIELECTRIC FITTING INSTALLATION

A. Install dielectric fittings in wet, or intermittently wet, piping systems at connections between dissimilar metallic materials in the system. Exceptions are as follows:

1. Where bronze or stainless steel bodied valves are connected to a black steel piping system.
2. Where the dissimilar metallic materials at the connection are within the same material group, as defined below:

    a. Nickel Group: Nickel, and nickel alloys with greater than 20% nickel (e.g. Monel, Hastelloy, etc.).
    b. Stainless Steel Group: Series 300 (e.g. 304, 316, 316L, 317, etc.) austenitic stainless steels, and type 18-8 stainless steel.
    c. Ferrous Group: Black steel, wrought iron, cast iron, and cast steel.
    d. Copper Group: Copper, brass, aluminum bronze, silicon bronze, 90-10 copper-nickel, and 80-20 copper-nickel.

B. Dielectric Fittings for NPS 2 and Smaller: Use dielectric nipples, or weld-on or thread-on flanges and dielectric flange kits. Dielectric unions are prohibited.

C. Dielectric Fittings for NPS 2-1/2 to NPS 4: Use dielectric flanges or dielectric flange kits.

D. Dielectric Fittings for NPS 5 and Larger: Use dielectric flange kits.

3.9 EQUIPMENT AND PRODUCT INSTALLATION - COMMON REQUIREMENTS

A. Install manufactured equipment, products, and systems in full accordance with the manufacturer's requirements and recommendations. Note that the manufacturer's requirements and recommendations may be more restrictive or require work beyond that explicitly shown on the Contract Documents. If a manufacturer permits but does not explicitly require their product to be installed in a manner that is inconsistent or incompatible with the Contract Documents, the content of the Contract Documents shall take precedence.

B. Install equipment to provide maximum possible headroom, if mounting heights are not indicated.

C. Install equipment according to approved submittal data. Portions of the Work are shown only in diagrammatic form. Refer conflicts to Architect.

D. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.

E. 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.

F. Install equipment giving right of way to piping installed at required slope.

G. Supporting equipment from roof and floor decking in steel framed buildings is prohibited. All equipment shall be supported from building steel structural system.

3.10 COORDINATION OF COMMUNICATIONS BETWEEN FACTORY MOUNTED EQUIPMENT CONTROLS AND THE BUILDING AUTOMATION SYSTEM

A. DDC System Provider / Sub-Contractors Scope and Responsibilities:

1. Provide integration of the factory supplied controls into the Building DDC system. Factory supplied control points shall be programmed into the operator's interface, system applications and graphics software and operate seamlessly with the Building DDC system.
2. Coordinate and resolve incompatibility issues that arise between control products provided under this section and those provided under other sections or divisions of this specification.
3. Communication Gateway Connections: Extend the appropriate / required portion of the DDC system network and connect to all packaged equipment controls, air and water flow meters, and other devices provided with communications gateways.

    a. DDC system graphics shall initially incorporate all 'communication' points available through integration gateways provided with packaged equipment controls, air and water flow meters, and other devices provided with such communications gateways.
    b. Within the warranty period, remove any points obtained through the gateway from the workstation graphics that the Client Agency desires to be removed.

B. Division 23 Contractor's Scope and Responsibilities:

1. The Division 23 Contractor shall ensure that the equipment manufacturer's representative is on-site during the DDC system commissioning process to ensure full integration of factory controls with the DDC System.
2. The Division 23 Contractor shall ensure that the manufacturer's representatives have made all project-specific adjustments and settings during equipment start-up to the factory controllers prior to the joint field-commissioning efforts.
3. All equipment furnished with controls that are furnished and installed by the manufacturer shall have BACnet MS/TP or BACnet IP communication capability from the equipment manufacturer.

    a. Modbus TCP/IP is also acceptable, but only if BACnet MS/TP or BACnet IP is not offered by the equipment manufacturer, and the use of Modbus TCP/IP is fully coordinated between the ATC system supplier and the equipment supplier, and is approved by the Architect / Engineer and the DDC system sub-contractor.
    b. The Division 23 Contractor's equipment supplier shall provide to the DDC system sub-contractor all documentation required for the mapping in of points obtained through communication gateway into the DDC system.

C. Representatives from each manufacturer providing factory mounted controls and the DDC subcontractor shall cooperate in the integration of the individual systems operation prior to bid and during field installation and commissioning / testing.

3.11 CLEANING AND PROTECTION

A. Cleaning: General cleaning requirements are specified in Division 01. Upon completion of the work, clean the exterior surface of equipment, accessories, and trim installed.

B. The Division 23 Contractor shall clean up areas as the work progresses and remove waste and debris produced by performance of the Division 23 work daily or when directed by the Client Agency or Architect / Engineer.

C. Protection of Surfaces:

1. Protect new and existing surfaces from damage during the construction period.
2. Provide plywood or similar material under equipment or materials stored on floors or roofs. Provide protection in areas where construction may damage surfaces.
3. Surfaces damaged during the construction shall be repaired or replaced at the cost of the Contractor at fault. The method of repairing or replacing the surface shall be approved by the Client Agency and Architect/Engineer.

D. Protection of Equipment and Materials:

1. Equipment and materials shall be stored in a manner that shall maintain an orderly, clean appearance. If stored on-site in open or unprotected areas, equipment and material shall be kept off the ground and out of standing water by means of pallets or racks, and covered with tarpaulins.
2. Equipment and material, if left unprotected and damaged or soiled, shall be repainted, repaired, or otherwise refurbished at the discretion of the Architect and Client Agency. Equipment and material is subject to rejection by the Architect, if, in the opinion of the Architect or the manufacturer's engineering department, the equipment has deteriorated or been damaged to the extent that its utility, performance, or life expectancy has been reduced. Rejected materials shall be replaced.
3. During the construction period, protect ductwork, piping and equipment from damage and dirt. Properly cap ductwork and piping. Each system of piping shall be flushed to remove grit, dirt, sand, and other foreign matter for as long a time as required to thoroughly clean the systems.

3.12 TEMPORARY / CONSTRUCTION-PHASE HVAC SERVICES

A. Do NOT utilize the permanent HVAC systems, or any portion thereof, to provide construction-phase heating, cooling, ventilation, exhaust, or dehumidification required by the construction process until the permanent systems are permitted to operate continuously, and outside of the start-up process. Temporary systems shall be provided to meet all HVAC needs prior to that time. Temporary / construction-phase HVAC shall be provided by the General Contractor, unless Division 01 indicates otherwise.

1. Changeover from temporary systems to the use of permanent HVAC system shall not occur prior to system start-up has been completed, subject to the conditions and restrictions placed on system start-up, as described in Division 23 Section "Ductwork". The permanent system may not be capable of accommodating special conditions or loads created by ongoing construction processes (e.g. high latent loads created by painting), so supplemental temporary HVAC equipment shall be provided to meet those special needs and conditions.

B. Refer to Division 23 Section "Ductwork" for requirements related to HVAC system and equipment start-up.

3.13 PAINTING AND FINISHING

A. Painting of HVAC systems, equipment, and components is specified in Division 09. In the event of a direct conflict between the provisions of Division 09, and this Section, Division 09 shall take precedence.

B. Do not paint piping specialties, grooved couplings and fittings, and similar items with factory-applied finish. Do not paint bronze or copper materials. Do not paint fastener threads (except on pipe hangers and threaded rods), nameplates, identification devices and labels, flexible connectors, vibration control devices, meters and gauges, and any items for which the proper function and/or longevity will be compromised by the application of paint.

1. Apply protection / masking to items that shall not receive paint prior to paint surface preparation and painting. Coordinate and schedule this work with the General Contractor who is performing finish painting. Any damage to Division 23 work due to a failure to mask items that should not have been painted shall be replaced and repaired at no additional cost to the Client Agency.

C. Damage and Touchup: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish. Marred finishes on items exposed to view in finished spaces shall be replaced with new items when the severity of the damage or quality of the finish repair is judged to be unacceptable by the Architect or Engineer.

D. At locations where it is necessary to cut and patch existing construction to perform Division 23 work, painting at each location shall be performed by the Division 23 Contractor. New finishes shall match existing finishes. Comply with the provisions of Division 09.

E. Comply with all applicable SSPC-PA standards published by the Society for Protective Coatings.

F. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.

1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.

G. Surface Preparation: Clean substrates of substances that could impair bond of paints, including dust, dirt, oil, grease, and incompatible paints and encapsulants. Follow the referenced SSPC-SP standards published by the Society for Protective Coatings.

1. Remove incompatible primers and re-prime substrate with compatible primers or apply tie coat as required to produce paint systems indicated.
2. Iron and Steel Substrates: Remove rust, loose mill scale, and shop primer, if any. Clean using methods recommended in writing by paint manufacturer; comply with SSPC-SP2 at the minimum.
3. Shop-Primed Steel Substrates: Clean field welds, bolted connections, and areas where shop paint is abraded. Paint exposed areas with the same material as used for shop priming to comply with SSPC-PA 1,"Shop, Field, and Maintenance Painting of Steel", for touching up shop-primed surfaces.
4. Galvanized-Metal Substrates: Remove dust, grease and oil residue from galvanized sheet metal by mechanical methods to produce clean, lightly etched surfaces that promote adhesion of subsequently applied paints. Clean using methods recommended in writing by paint manufacturer; comply with SSPC-SP1 at the minimum.
5. Aluminum Substrates: Remove loose surface oxidation. Clean using methods recommended in writing by paint manufacturer; comply with SSPC-SP1 at the minimum.

H. Exterior Painting Scope and Application: In addition to painting requirements indicated on the Drawings and elsewhere in Division 23, paint exterior equipment that is not factory painted, uninsulated / jacketed ductwork, piping enclosure systems, equipment supports, miscellaneous exterior iron and steel work, and uninsulated exterior piping. Exceptions: Hot dipped galvanized, aluminum, copper, brass, and stainless steel materials.

1. Apply one (1) coat of primer followed by two top coats of satin finish solvent-based polyurethane paint. Primer shall be applied 3.4 mils wet, 0.7 mils dry. Each finish coat shall be no less than 2.0 mils thick (dry). Primer shall be Sherwin Williams DTM wash primer, B71Y1, and finish coats shall be Sherwin Williams 'Corothane II' satin polyurethane, B65-200 series, or approved equal.
2. Finish coat color selection shall be by the Architect or Client Agency.

3.14 CONCRETE EQUIPMENT BASES

A. Indoor Concrete Housekeeping Bases: Anchor equipment to concrete base according to equipment manufacturer's written instructions.

1. Construct concrete bases of dimensions indicated, but not less than 4 inches larger in both directions than supported unit.
2. Base slabs under housekeeping equipment pads shall be cleaned and scarified, then prepared with a bonding agent, before pouring the equipment base.
3. Install epoxy-coated anchor bolts for supported equipment that extend through concrete base, and anchor into structural concrete floor.

    a. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
    b. Anchor bolts for equipment shall be placed when pad is being poured.
    c. Install anchor bolts to elevations required for proper attachment to supported equipment.
    d. Install anchor bolts according to anchor-bolt manufacturer's written instructions.

4. Use 4000-psi, 28-day compressive-strength concrete and reinforcement as specified in the "Concrete Work" Article herein.
5. Edges shall be provided with a 3/4" chamfer.

B. Exterior Concrete Equipment Bases: Top of bases shall extend no less than 6" above the surrounding grade, or the amount indicated on the Drawings, whichever is higher. Refer to the Drawings for exterior concrete base construction details.

3.15 CONCRETE WORK

A. Scope: Provide concrete work related to new and repair work included under this Division. Construct concrete forms and equipment pads / bases for the new floor- or grade-mounted equipment installed under this Division. Pads and forms shall be of suitable dimensions for all equipment.

B. Comply with the provisions of this Section , and the provisions of Division 03, whichever are more demanding. Concrete work shall be constructed subject to the approval of the Architect / Engineer.

C. Concrete shall attain a minimum compressive strength of 4,000 psi at the age of 28 days, unless otherwise indicated on the Drawings. Tests shall be made by an approved laboratory if in the

opinion of the Architect the concrete is not satisfactory. Costs in connection with tests of concrete shall be borne by the Contractor.

D. Materials used for plain and reinforced concrete and the measuring, mixing, handling, placing and curing shall conform to current specifications of the American Concrete Institute (ACI 304 and ACI 318-71). Cement shall be normal Portland cement, Type I or Type II, conforming to ASTM Designation C-150.

E. Aggregates shall consist of sand of approved quality, crushed stone, and washed gravel conforming to ASTM Standard Specification Designation C33 and shall be supplied from a source approved by the Architect. The maximum size of the aggregate shall be no larger than 1/5 of the narrowest dimensions between forms of the members for which the concrete is to be used, no larger than 3/4 of the minimum clear spacing between reinforcing bars. Water for concrete shall be clean and free from injurious amounts of oil, acid, alkali, organic matter, or other deleterious substances.

F. Slag in any form will not be permitted as an aggregate.

G. Proportions shall be in accordance with American Concrete Institute Standard "Recommended Practice for the Design of Concrete Mixes ACI 211.1."

H. Metal reinforcement shall be deformed steel bars, cold-drawn steel wire, or fabricated forms of these materials. Bars shall be deformed, intermediate grade new billet steel. These materials shall conform in quality to latest published standard specifications of the American Society for Testing Materials as follows:

1. Bars:

    a. Billet-Steel Bars for Concrete Reinforcement, ASTM A615.
    b. Rail-Steel Bars for Concrete Reinforcement, ASTM A616.

2. Wire: Cold Drawn Steel Wire for Concrete Reinforcement, ASTM A82.
3. Fabricated Materials:

    a. Steel Bar Mats for Concrete Reinforcement, ASTM A184.
    b. Welded Wire Fabric for Concrete Reinforcement, ASTM A185.

I. Forms shall be of steel or wood and shall conform to the shape, lines, grades and dimensions of the concrete. Formwork shall comply with ACI 347. They shall be sufficiently tight to prevent leakage of mortar and shall be properly braced and tied together so as to maintain the desired position and shape during and after placing concrete. Forms shall be removed in such a manner as to assure the complete safety of the structure. Exposed corners or edges shall be chamfered. Burrs, fins, irregularities of forming, or spillage shall be removed and the surface float or trowel finished to a smooth straight surface.

J. Concrete shall be integrally waterproofed with Aquabar, or approved equal additive.

K. Water stops of plastic as manufactured by Ryerson, or approved equal, shall be installed in concrete joints and between pours.

L. An approved bonding agent shall be utilized where new concrete is to be placed on or against existing concrete.

3.16 ERECTION OF METAL SUPPORTS AND ANCHORAGE

A. Refer to Division 05 for metal fabrications.

B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor HVAC materials and equipment.

C. Furnish and install miscellaneous iron work including, but not limited to, piping hangers, piping anchors and guides, ductwork hangers and supports, and HVAC equipment supports. Additional structural members shall be furnished and installed to support the HVAC equipment without excessive stress or strain on the building construction. Structural beams and other structural members shall be furnished and installed under this Division for anchors and guides where the building steel is not available or of sufficient size or weight to support or anchor pipe lines and equipment.

D. Equipment and materials furnished and installed under this Division which are not mounted on bases or floors shall be securely attached and supported from the main supporting structure of the building by metal hangers, clamps and/or brackets. Metal hangers, clamps and/or brackets shall be of suitable design and of sufficient strength to properly and safely support the materials and equipment involved.

E. Field Welding: Comply with AWS D1.1.

1. Welding shall be done by qualified welders certified as having fully complied with acceptable qualification tests as prescribed by a reputable testing agency using procedures approved by the American Welding Society.

F. Structural steel members installed at the exterior of the building or in damp or wet locations shall be hot dipped galvanized after fabrication. Conform to ASTM A123. Where exterior structural steel members are cut, drilled or welded, or galvanizing is damaged, repair with a cold galvanizing repair compound with dry film containing not less than 93 percent zinc dust by weight, and complying with DOD-P-21035A or SSPC-Paint 20, as manufactured by ZRC Products Company, or equivalent.

3.17 GROUTING

A. Install nonmetallic, nonshrink, grout for mechanical equipment base bearing surfaces, pump and other equipment base plates, and anchors. Mix grout according to manufacturer's written instructions.

B. Clean surfaces that will come into contact with grout.

C. Provide forms as required for placement of grout.

D. Avoid air entrapment during placing of grout.

E. Place grout, completely filling equipment bases.

F. Place grout on concrete bases to provide smooth bearing surface for equipment.

G. Place grout around anchors.

H. Cure placed grout according to manufacturer's written instructions.

END OF SECTION