SECTION 23 05 00
COMMON WORK RESULTS FOR HVAC

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Mechanical / HVAC work shall include all final connections and flexible connections to the mechanical / HVAC system and to related equipment by others, as well as, connections to external systems and mechanical / HVAC systems (site connections, make-up water connections, indirect waste connections, etc.).

1.2 RELATED REQUIREMENTS

A. Division 01 - General Requirements.
B. Division 05 - Metals.
C. Section 07 84 00 - Firestopping.
D. Section 08 31 00 - Access Doors and Panels.
E. Section 09 90 00 - Painting.

1.3 REFERENCE STANDARDS

A. ASHRAE 15 - American Society of Heating Refrigeration and Air-Conditioning Engineers.
B. ASHRAE 34 - American Society of Heating Refrigeration and Air-Conditioning Engineers.
C. ASME (BPV) - Boiler and Pressure Vessel Code; American Society of Mechanical Engineers; 2013.
D. NFPA 72 - National Electric Code, National Fire Protection Association.
E. UL (FPED) - Fire Protection Equipment Directory; Underwriters Laboratories Inc.; current edition.

1.4 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
B. Product Data: Provide manufacturer's most current catalog data sheet for equipment indicating rough-in size, finish, and accessories. Manufacturer's data sheets on each item of equipment and device, shall be clearly marked up to identify the items, accessories and options to be used on the project.
C. Coordination Drawings: Indication locations for products and resolve conflicts with other trades.
D. Project Record Documents: Record actual installed locations of components and tag numbering.
E. Operation and Maintenance Data: Include installation instructions and spare parts lists.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.
    1. Submittal of documented experience, submitted upon request by Architect.
B. Installer Qualifications: Company specializing in performing work of the type specified this section.
    1. Minimum three years experience. Submittal of documented experience, submitted upon request by Architect.
    2. Approved by manufacturer. Submittal of approval, submitted upon request by Architect.
C. Conform to UL, FM, and Warnock Hersey requirements.
D. Products Requiring Electrical Connection: Listed and classified as suitable for the purpose specified and indicated.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store products in shipping containers, with labeling in place.
B. Provide temporary protective coating on products.
C. Provide temporary end caps and closures on duct, piping, equipment and fittings. Maintain in place until installation.
D. Protect products from weather and construction traffic, dirt, water, chemical, and mechanical damage.
E. Protect installed fixtures and equipment from damage by securing areas and by leaving factory packaging in place to protect equipment and fixtures and prevent use of equipment and fixtures.

1.7 CODES AND STANDARDS

A. Work is subject to provisions of the International Building Code and has been designed to be in compliance with the Code. Design aspect of the Project shall not be altered regarding building envelope or selection of HVAC, service water heating systems and equipment. Supplemental data published by equipment and system manufacturers to substantiate energy conservation efficiencies throughout the Project shall be furnished at request of Architect.
B. Work shall meet requirements of the FM Global, National Fire Protection Association, all Federal, State, and Municipal authority's laws, rules and regulations applicable to the Work and public utilities having jurisdiction over systems specified herein.
C. Boiler, Domestic Water Heater(s), Heating Equipment, and Pressure Vessels shall be constructed and tested in accordance with recommendations of the National Fire Protection Association, Pennsylvania Department of Labor and Industry - Boiler Inspection Division, and ASME BPV code.
    1. Equipment shall be stamped with the ASME symbol and National Board number and shall be inspected during construction by an inspector who has been commissioned by the Pennsylvania Department of Labor and Industry to perform such service. Equipment shall be prepared for initial inspection in accordance with Department of Labor and Industry regulations.
D. Plumbing Work shall be installed in conformity with applicable portions of the ASME Plumbing Code, International Plumbing Code, Pennsylvania Department of Environmental Protection, State Plumbing Codes, and Local Ordinances and shall be approved as project progresses by local authority having jurisdiction.
E. Contractor shall certify domestic water systems for compliance with Pennsylvania Plumbing System Lead Ban & Notification Act (No. 33-1989).
F. Nothing in the Specifications shall be construed to permit deviation from requirements of any governing code(s).
G. Fuel oil storage tank shall be installed in accordance with recommendations of the National Fire Protection Association and requirements of the Pennsylvania State Police - Fire Marshal's Division, Pennsylvania Department of Environmental Resources, Pennsylvania Storage Tank and Spill Prevention Act (no. 32-1989), and Code of Federal Regulation Title 40. Obtain required permits and inspections by respective agencies on behalf of Owner.
H. Installation of all gas piping and gas burning equipment shall conform to recommendations of the American Gas Association, Factory Mutual Engineering Corporation, and local utility.
I. The handling and use of CFC and HCFC refrigerants, whether leaking, venting, recovering, etc., shall be in accordance with US Environmental Protection Agency regulations CFR 58 FR 28660, ASHRAE 15-1994-Safety Code for Mechanical Refrigeration, and ANSI/ASHRAE 34-1997-Number Designation and Safety Classification of Refrigerants.

J. Electrical Work shall meet requirements of the National Electrical Code and all Federal, State, and Municipal authority's laws, rules and regulations applicable to the Work.
K. Where applicable, materials and equipment shall bear the label of approval of Underwriters Laboratories, Inc.
L. Reference to codes and standards listed herein shall constitute minimum acceptable requirements. Where Drawings and Specification requirements exceed those of codes listed, Drawings and Specifications shall take precedence for Work of this Project.
M. If Contractor, during the course of work, observes the existence of hazardous materials in the structure or on the project site, Contractor shall promptly notify Owner and Architect. Contractor shall not perform any work pertinent to the hazardous material prior to receipt of special instructions from Owner. "Hazardous materials", for the purpose of this Specification, are defined as but not limited to asbestos, PCB's, petroleum, radioactive material, or any substance classified as hazardous waste substances.

1.8 COORDINATION - GENERAL

A. Work shall be governed by requirements set forth in the conditions of the Contract.
B. Provide all labor, materials, and equipment required by the Contract Documents necessary for completion of the Work.
C. Bidders shall visit the project site to determine actual conditions which will be encountered in completing the work of this project.
D. Drawings are generally indicative of work to be installed but may not indicate all bends, fittings, elbows, etc., required to meet conditions. Where items shown on the Drawings, or herein described, are not clearly understood, Bidders shall confer with Architect.
E. Coordinate Work of Division 23 with that of other trades so that work will be installed in the most direct manner and so that interference between piping, ducts, conduits, equipment, and architectural or structural features will be avoided. Work installed in an arbitrary manner without regard for work of other trades or equipment servicing requirements will be rejected in any situation where an undesirable condition or an unfair hardship for other trades, or Owner, results. Removal of installed work and installation of re-work will not be charge to owner, Work shall be at the expense of Contractor.
F. Provide sufficient scaffolding and hoist or rig material and equipment into place, or arrange for rigging by others. In any case, rigging or hoisting for Work shall be at the expense of Contractor.
G. Unless otherwise indicated on the Drawings, provide structural steel members as required for support of equipment and materials furnished under Division 23. Provide all hangers and supports, as specified, detailed, or in accordance with accepted industry standards.
H. Equipment shall be installed in accordance with equipment manufacturer's installation instructions unless otherwise required by code or specific instructions. Obtain manufacturer's installation instructions prior to roughing-in.

1.9 COORDINATION - NEW CONSTRUCTION

A. Openings and recesses, including cutting, patching and finishing, necessary for installation of Work of this Contract in new construction will be provided by General Contractor. Coordinate locations, dimensional data, and scheduling of Work with General Contractor.
B. Where piping is run concealed in concrete masonry unit (block) walls, Contractor shall be responsible for installing his work in cores of block for mason to wall-in as he carries up wall. Coordinate locations

and scheduling of Work with General Contractor.

C. Provide concrete foundation pads for mechanical equipment installed under Division 23. Foundations for base mounted pumps, water heaters, boilers and equipment shall be installed on floor slab. Unless noted otherwise, foundations shall be 6 inches above finished floor and extend a minimum of 6 inches beyond base or bed plate. Inserts and anchor bolts shall be poured into foundation according to equipment manufacturer's instructions. Method of setting, aligning, and anchoring shall be as recommended by equipment manufacturer.

1.10 COORDINATION - DUCT SMOKE DETECTORS

A. Electrical Contractor will furnish duct smoke detector and accessories.
B. Mechanical Contractor will install duct smoke detector duct mounted accessories.
C. HVAC unit associated with duct smoke detector shall have combination motor start with contact for duct smoke detector / fire alarm shut down of unit.

1.11 COORDINATION - DISCONNECTS STARTERS AND VFD DRIVES.

A. Disconnect starters and VFD drives shall be provided as indicated on the contract documents.
B. Disconnects shall be suitable for use as an OSHA lockout/tagout disconnect when applied in accordance with part IV, Department of Labor OSHA 29 CFR part 1910.
C. Disconnect handles can be padlocked in the "off" position with up to three padlocks. Switch mechanism can be directly padlocked in the "off" position when the door is open.

1.12 COORDINATION - EXISTING CONSTRUCTION

A. Cut all openings required in existing construction for installation of equipment and material. Perform all cutting, patching, and refinishing as required to match surroundings, whether or not specifically noted on Drawings.
B. Existing Ceilings: Remove existing ceiling tile where required for installation of mechanical Work. Replace ceiling tiles as Work is completed. All damaged or broken ceiling tile caused by Contractor's workers shall be replaced by Contractor at no cost to Owner.

1.13 PAINTING

A. Furnished equipment that is pre-painted or pre-finished by manufacturer shall have all nicks, scratches, blemishes, and rust spots cleaned, primed, and refinished prior to final acceptance by Owner.
B. Painting shall be in accordance with the section 09 90 00 - Painting and Coating.

1.14 COORDINATION DRAWINGS

A. Refer to section 01 00 00 - General Requirements.
B. Coordination Drawings: Plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:
    1. Products installed in spaces, indicating coordination with general construction, building components, structural elements, architectural features and other building services. Include the following:
        a. Ductwork.
        b. Piping greater than 1 inch.
        c. Electrical conduit greater than 2 inches.
        d. Structural bracing and supports.
        e. Equipment.

f. Fixtures.
2. Ceiling components.
3. Structural members.
   a. Foundations.
   b. Footings.
   c. Piers.
4. Size and location of access panels.
5. Penetrations of smoke barriers and fire-rated construction.
6. Items penetrating finished ceiling including the following:
   a. Lighting fixtures.
   b. Air outlets and inlets.
   c. Speakers.
   d. Grilles, registers and diffusers.
   e. Access panels.
   f. Perimeter moldings.
   g. Fire Sprinklers.

C. Show clearance for installing, servicing and maintaining equipment.
D. Prepare drawings specifically for this project; marked up or over-drawn plumbing, electrical, HVAC, or other drawings are not acceptable, except for floor plans.
E. Use drawing scale of 1/4 inch to 1 foot or larger.
F. Include a complete equipment list, identifying manufacturer's model numbers and quantities, cross-referenced to product data submittal.
G. Include wiring diagrams for control panels and all electrical equipment, showing terminations and termination identifications.
H. Drawings shall be submitted in both PDF format and paper copy on sheet size that matches the construction bid documents. Drawings shall be submitted as both a submittal for the engineer to review and a final copy given to the owner with the PDF files burned onto a CD or hard drive / USB accessible memory stick. Hard drive / USB accessible memory stick and CD provided by Contractor.

1.15 PERMIT AND FEES

A. Refer to Section 01 00 00 - General Requirements.
B. Secure all permits and inspections required by applicable authorities and utilities and pay all costs in connection with the Work.
C. Schedule all inspections required by applicable authorities and utilities. Certificates shall be in triplicate and shall be delivered to Owner.
D. Piping work, specialties, or equipment shall not be concealed or covered until same have been tested and inspected by municipal inspector(s) and observed by the professional. Municipal inspector(s) record of inspections shall be delivered to Owner. The professional and municipal inspector's witnessing of tests shall not relieve Contractor of his responsibility for concealed piping work and specialties, nor for equipment to perform in accordance with Contract Documents.

PART 2 PRODUCTS

2.1 MATERIALS

A. Refer to Section 01 00 00 - General Requirements.

B. All materials and equipment shall be new, without imperfections or blemishes, and shall be protected from the elements prior to installation.
C. Maintain ambient temperatures and conditions required by manufacturers of products for the installation of materials. Including but limited to the following: Adhesives, mastics, cements, paints and plastics.

2.2 PIPE PORTALS

A. Construction: 18 gage galvanized steel, unitized construction with integral base plate.
B. Standard Features:
   1. 12" tall above finished roof surface.
   2. Built in raised cant.
   3. Wood nailer.
   4. 3 lb. density insulation.
   5. Acrylic clad ABS plastic cover, fastening screws, graduated step boots with stainless steel clamps.

2.3 VENT FLASHING

A. Flash vent penetrating roofs with 6 lb. seamless sheet lead of sufficient size to extend a minimum of 10 inches into roofing felts and for membrane roofing systems.

2.4 ANCHORS

A. Bolts and Nuts: ASME B18.10 or ASTM A 183, steel hex head.
B. Washers: ASTM F 844, steel, plain, flat washers.
C. Mechanical Fasteners: Insert-wedge-type stud with expansion plug anchor for use in hardened portland cement concrete, with tension and shear capacities appropriate for application.
   1. Stainless-steel studs are available.
   2. Stud: Threaded, zinc-coated carbon steel.
   3. Expansion Plug: Zinc-coated steel.
   4. Washer and Nut: Zinc-coated steel.
D. Chemical Fasteners: Insert-type-stud, bonding-system anchor for use with hardened portland cement concrete, with tension and shear capacities appropriate for application.
   1. Bonding Material: ASTM C 881/C 881M, Type IV, Grade 3, two-component epoxy resin suitable for surface temperature of hardened concrete where fastener is to be installed.
   2. Stainless-steel studs are available.
   3. Stud: ASTM A 307, zinc-coated carbon steel with continuous thread on stud unless otherwise indicated.
   4. Washer and Nut: Zinc-coated steel.

2.5 STEEL

A. Steel Shapes and Plates: ASTM A 36/A 36M.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install work according to the following:
   1. Federal, State and Local codes.
   2. Manufacturer's recommendations.

B. Work shall be installed by mechanics skilled in the trade involved.
C. Inserts:
   1. Provide inserts for placement in concrete formwork.
   2. Provide inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.
   3. Provide hooked rod to concrete reinforcement section for inserts carrying pipe over 4 inches.
   4. Where concrete slabs form finished ceiling, locate inserts flush with slab surface.
   5. Where inserts are omitted, drill through concrete slab from below and provide through-bolt with recessed square steel plate and nut above slab.
D. Coordinated Installation:
   1. All equipment and materials shall be installed to allow access to and to facilitate service, maintenance, repair, replacement, etc., of components to all equipment furnished and installed under this Contract, furnished and installed under all other Divisions of the specifications, and, where applicable, Owner furnished and installed and Owner's existing equipment.
   2. Ductwork, piping, equipment, etc., shall be installed in such a manner as to preserve access to equipment.
   3. Route ductwork and piping in orderly manner, plumb and parallel to building structure. Maintain gradient.
   4. Install ductwork and piping to conserve building space, to not interfere with use of space and other work.
   5. Group ductwork and piping whenever practical at common elevations.
   6. Do not penetrate building structural members unless indicated.
E. Provide sleeves when penetrating footings, floors, and walls. Seal pipe and sleeve penetrations to achieve fire resistance equivalent to fire separation required.
   1. Install per UL listing.
F. Pipe Portals:
   1. Pipe portals provided as Work of this Section shall be coordinated with roof type. Shop drawing submittals for pipe portals, with, or without cants will be considered compatible with existing roof type.
   2. Pipe portals provided as Work of this Section shall be coordinated with requirements of roofing subcontractor. Shop drawing submittals for pipe portals, with or without cants will be considered in compliance with roofer's requirements.
G. Concrete and Grout:
   1. Construct concrete equipment bases of dimensions indicated, but not less than 6 inches larger than supported unit in both directions and minimum of 6 inches in thickness unless otherwise indicated. Follow supported equipment manufacturer's setting templates for anchor bolt and tie locations.
   2. Place grout on concrete bases to provide a smooth bearing surface for equipment.
   3. Place grout around anchors.
   4. Cure placed grout according to manufacturer's printed instructions.
H. Erection of Metal Supports and Anchorage:
   1. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor mechanical materials and equipment.
   2. Field Welding: Comply with AWS D1.1 - Structural Welding Code--Steel.

3. Comply with the requirements specified in Division 05.
4. Provide security bars as noted on drawings.

3.2 CLEAN-UP

A. Upon completion of Work, remove all dirt, foreign materials, markings, stains, fingerprints, etc., from all parts and equipment.
B. Remove all construction debris and vacuum interior spaces of all compartmental equipment.
C. Conduct cleaning and disposal operations to comply with codes, ordinances, regulations and anti-pollution laws.

3.3 DUST AND DEBRIS

A. During construction all openings in piping shall be kept closed except when actual work is being performed on those items. Closures shall be plugs, caps, blind flanges, or other items specifically intended for this purpose. Exercise all necessary care to prevent foreign objects from entering material.
B. During construction all equipment shall be kept closed except when actual work is being performed on those items. Closures shall be plugs, caps, blind flanges, or other items specifically intended for this purpose. Exercise all necessary care to prevent foreign objects from entering material.
C. During construction all ducts shall be kept closed except when actual work is being performed on those items. Closures shall be plugs, caps, blind flanges, or other items specifically intended for this purpose. Exercise all necessary care to prevent foreign objects from entering material.
D. During patching above ceiling, etc., maintain cloths or suitable covers to protect surfaces. Protective measures (drop cloths, protective covers, etc.) shall be placed and sealed over all furniture and equipment to keep items clean and protected against dirt, dust, and debris from entering furniture and equipment that the Owner has not removed.
E. Protect insulation from weather and construction traffic, dirt, water, chemical, and mechanical damage, by storing in original wrapping.

3.4 START-UP

A. Submit proposed start-up checklist and proposed start-up dates for Owner and Architect review 14 days prior to start-up.
    1. Start-up shall be included for all equipment that is scheduled and has either an electrical connection or fuel connection.
B. Start-up shall be provided for all equipment and systems.
    1. Start-up for equipment shall be performed by:
        a. Installing Contractor:
            1) For equipment with 120 volt and less than 20 amp load electrical connection or less than 100 MBH fuel connection.
        b. Factory Authorized Personnel:
            1) For equipment with 120 volt electrical connections or less than 400 MBH fuel connection.
        c. Factory Field Personnel:
            1) For equipment greater than 120 volt electrical connection or greater than 400 MBH fuel connection.
    2. Start-up for systems shall be performed by:
        a. Installing Contractor:

1) For all systems not listed under 1.b and 1.c above.

b. Factory Authorized Personnel:

1) Regulator manufacturer shall start-up all gas systems above 7 psi.

C. Report:

1. Submit report to Owner within 10 days of completion of start-up.
2. Report shall include:
   a. Location / System / Equipment Tag.
   b. Names of Technicians performing Start-up.
   c. Indicate if Technicians are factory Authorized Personnel or Factory Field Personnel.
   d. Names of Witnesses.
   e. Start-up Checklist / Information in each start-up section.
   f. List of all set points and initial settings.
   g. Pressure test results.

3.5 TRAINING

A. Owner-Personnel Training: Owner will designate personnel to be trained in operation and maintenance of the systems.

1. Obtain Owner's approval of training dates.
2. Training sessions will be scheduled by Owner.
3. Submit proposed training agenda for Owner's review and approval at least 30 days prior to start of training.

B. Training Agenda: Include the following:

1. Overview of system operation.
2. Overview of system equipment and device locations.
3. Manual controls.
4. Manual operation, testing and maintenance of devices.
5. Location of safety devices and resets.
6. User operation of control panel (alarm acknowledgement, alarm silence, reset, alarm resound).
7. Draining and filling procedures for the system.
8. Review of the Operation and Maintenance Manual.
9. Detailed maintenance procedures.
10. Periodic testing procedures.

C. Training Instructor:

1. The following persons are authorized to provide training:
   a. Installing Contractor.
   b. Factory Authorized Technician.
   c. Factory Start-Up and Training Personnel.

3.6 EXTENDED WARRANTIES

A. Where extended warranties beyond the normal one year warranty are, as specified herein, to be applied to a particular item of equipment or system, furnish to Owner a description of the warranty along with any required registration and signature of manufacturer’s authorized personnel.

B. Contractor shall be responsible for coordinating with and having the manufacturer administer these warranties for the full extent of time the warranty will be in effect.

C. Contractor shall be responsible for administering and servicing all extended warranties for the life of each extended warranty at no additional cost to Owner. Owner's responsibility will be for additional costs for parts associated with warranties that are warranted on a pro-rated basis. All labor for administering and servicing the extended warranty, including actual replacement of parts, will be the responsibility of the Contractor for the extended warranty period. All unwarranted shipping and handling costs for parts and equipment will be the responsibility of the Owner.

END OF SECTION 23 05 00