DIVISION 23: HEATING, VENTILATING, AND AIR-CONDITIONING

23 0500 COMMON WORK RESULTS FOR HVAC

23 2000 HVAC PIPING AND PUMPS

23 5000 CENTRAL HEATING EQUIPMENT

END OF TABLE OF CONTENTS

SECTION 23 0501

COMMON HVAC REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Includes But Not Limited To:
1. Common requirements and procedures for HVAC systems.
2. Responsibility for proper operation of electrically powered equipment furnished under this Division.
3. Furnish and install sealants relating to installation of systems installed under this Division.
4. Furnish and install Firestop Penetration Systems for HVAC system penetrations as described in Contract Documents.
5. Furnish and install sound, vibration, and seismic control elements.

B. Products Furnished But Not Installed Under This Section:
1. Sleeves, inserts, and equipment for mechanical systems installed under other Sections.

C. Related Requirements:
1. Section 07 8400: 'Firestopping' for quality of Penetration Firestop Systems to be used on Project and submittal requirements.
2. Section 07 9213: 'Elastometric Joint Sealant' for quality of sealants used at building exterior.
3. Section 07 9219: 'Acoustical Joint Sealants' for quality of acoustical sealants.
4. Sections Under 09 9000 Heading: Painting of mechanical items requiring field painting.
5. Section 26 2913: 'Enclosed Controllers' for magnetic starters and thermal protective devices (heaters) not factory mounted integral part of mechanical equipment.
6. Division 26: Raceway and conduit, unless specified otherwise, line voltage wiring, outlets, and disconnect switches.
7. Slots and openings through floors, walls, ceilings, and roofs provided under other Divisions in their respective materials.

1.2 SUBMITTALS

A. Action Submittals:
1. Product Data:
   a. Manufacturer's catalog data for each manufactured item.
      1) Provide section in submittal for each type of item of equipment. Include Manufacturer's catalog data of each manufactured item and enough information to show compliance with Contract Document requirements. Literature shall show capacities and size of equipment used and be marked indicating each specific item with applicable data underlined.
      2) Include name, address, and phone number of each supplier.
2. Shop Drawings:
   a. Schematic control diagrams for each separate fan system, heating system, control panel, etc. Each diagram shall show locations of all control and operational components and devices. Mark correct operating settings for each control device on these diagrams.
   b. Diagram for electrical control system showing wiring of related electrical control items such as firestats, fuses, interlocks, electrical switches, and relays. Include drawings showing electrical power requirements and connection locations.

c. Drawing of each temperature control panel identifying components in panels and their function.
d. Other shop drawings required by Division 23 trade Sections.

B. Informational Submittals:
1. Qualification Statement:
a. HVAC Firm:
1) Provide Qualification documentation if requested by Architect or Owner.
b. Installer:
1) Provide Qualification documentation if requested by Architect or Owner.

C. Closeout Submittals:
1. Include following in Operations And Maintenance Manual specified in Section 01 7800:
a. Operations and Maintenance Data (Modify and add to requirements of Section 01 7800):
1) At beginning of HVAC section of Operations And Maintenance Manual, provide master index showing items included.
a) Provide name, address, and phone number of Architect, Architect's Mechanical Engineer, General Contractor, and HVAC, Sheet Metal, Refrigeration, and Temperature Control subcontractors.
b) Identify maintenance instructions by using same equipment identification used in Contract Drawings. Maintenance instructions shall include:
(1) List of HVAC equipment used indicating name, model, serial number, and nameplate data of each item together with number and name associated with each system item.
(2) Manufacturer's maintenance instructions for each piece of HVAC equipment installed in Project. Instructions shall include name of vendor, installation instructions, parts numbers and lists, operation instructions of equipment, and maintenance and lubrication instructions.
(3) Summary list of mechanical equipment requiring lubrication showing name of equipment, location, and type and frequency of lubrication.
(4) Manual for Honeywell T7350 thermostat published by Honeywell.
c) Provide operating instructions to include:
(1) General description of each HVAC system.
(2) Step by step procedure to follow in putting each piece of HVAC equipment into operation.
(3) Provide diagrams for electrical control system showing wiring of items such as smoke detectors, fuses, interlocks, electrical switches, and relays.
b. Warranty Documentation:
1) Include copies of warranties required in individual Sections of Division 23.
c. Record Documentation:
1) Manufacturers documentation:
a) Copies of approved shop drawings.

1.3 QUALITY ASSURANCE

A. Regulatory Agency Sustainability Approvals:
1. Perform work in accordance with applicable provisions of Gas Ordinances applicable to Project. Provide materials and labor necessary to comply with rules, regulations, and ordinances.
2. In case of differences between building codes, laws, local ordinances, utility company regulations, and Contract Documents, the most stringent shall govern. Notify Architect in writing of such differences before performing work affected by such differences.
3. Identification:
a. Motor and equipment name plates as well as applicable UL / ULC and AGA / CGA labels shall be in place when Project is turned over to Owner.

B. Qualifications: Requirements of Section 01 4301 applies, but not limited to following:
1. Company:
   a. Company specializing in performing work of this section.
      1) Minimum five (5) years experience in HVAC installations.
      2) Minimum five (5) satisfactorily completed installations in past three (3) years of projects similar in size, scope, and complexity required for this project before bidding.
   b. Upon request, submit documentation.
2. Installer:
   a. Licensed for area of Project.
   b. Designate one (1) individual as project foremen who shall be on site at all times during installation and experienced with installation procedures required for this project.
   c. Upon request, submit documentation.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Delivery And Acceptance Requirements:
1. Accept valves on site in shipping containers with labeling in place.

B. Storage And Handling Requirements:
1. In addition to requirements specified in Division 01:
   a. Stored material shall be readily accessible for inspection by Architect until installed.
   b. Store items subject to moisture damage, such as controls, in dry, heated spaces.
   c. Provide temporary protective coating on cast iron and steel valves.
   d. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.
2. Protect bearings during installation. Thoroughly grease steel shafts to prevent corrosion.

1.5 WARRANTY

A. Manufacturer Warranty:
1. Provide certificates of warranty for each piece of equipment made out in favor of Owner. Clearly record 'start-up' date of each piece of equipment on certificate.

B. Special Warranty:
1. Guarantee HVAC systems to be free from noise in operation that may develop from failure to construct system in accordance with Contract Documents.
2. If HVAC sub-contractor with offices located more than 150 miles (240 km) from Project site is used, provide service / warranty work agreement for warranty period with local HVAC sub-contractor approved by Architect. Include copy of service / warranty agreement in warranty section of Operation And Maintenance Manual.

PART 2 - PRODUCTS

2.1 COMPONENTS

A. Components shall bear Manufacturer's name and trade name. Equipment and materials of same general type shall be of same make throughout work to provide uniform appearance, operation, and maintenance.

B. Pipe And Pipe Fittings:
1. Use domestic made pipe and pipe fittings on Project.
2. Weld-O-Let and Screw-O-Let fittings are acceptable.

C. Sleeves:
1. In Framing: Standard weight galvanized iron pipe, Schedule 40 PVC, or 14 ga (2 mm) galvanized sheet metal two sizes larger than bare pipe or insulation on insulated pipe.
2. In Concrete And Masonry: Sleeves through outside walls, interior shear walls, and footings shall be schedule 80 black steel pipe with welded plate.

D. Valves:
1. Valves of same type shall be of same manufacturer.

PART 3 - EXECUTION

3.1 INSTALLERS

A. Acceptable Installers:
1. Meet Quality Assurance Installer Qualifications as specified in Part 1 of this specification.

3.2 EXAMINATION

A. Drawings:
1. HVAC Drawings show general arrangement of piping, ductwork, equipment, etc. Follow as closely as actual building construction and work of other trades will permit.
2. Consider Architectural and Structural Drawings part of this work insofar as these drawings furnish information relating to design and construction of building. These drawings take precedence over HVAC Drawings.
3. Because of small scale of Drawings, it is not possible to indicate all offsets, fittings, and accessories that may be required. Investigate structural and finish conditions affecting this work and arrange work accordingly, providing such fittings, valves, and accessories required to meet conditions.

B. Verification Of Conditions:
1. Examine premises to understand conditions that may affect performance of work of this Division before submitting proposals for this work. Examine adjoining work on which mechanical work is dependent for efficiency and report work that requires correction.
2. No subsequent allowance for time or money will be considered for any consequence related to failure to examine site conditions.
3. Ensure that items to be furnished fit space available. Make necessary field measurements to ascertain space requirements including those for connections and furnish and install equipment of size and shape so final installation shall suit true intent and meaning of Contract Documents. If approval is received by Addendum or Change Order to use other than originally specified items, be responsible for specified capacities and for ensuring that items to be furnished will fit space available.
4. Check that slots and openings provided under other Divisions through floors, walls, ceilings, and roofs are properly located. Perform cutting and patching caused by neglecting to coordinate with Divisions providing slots and openings at no additional cost to Owner.

3.3 PREPARATION

A. Changes Due To Equipment Selection:
1. Where equipment specified or otherwise approved requires different arrangement or connections from that shown in Contract Documents, submit drawings, if requested by Architect, showing proposed installations.
2. If proposed changes are approved, install equipment to operate properly and in harmony with intent of Contract Documents. Make incidental changes in piping, ductwork, supports, installation, wiring, heaters, panelboards, and as otherwise necessary.
3. Provide any additional motors, valves, controllers, fittings, and other additional equipment required for proper operation of system resulting from selection of equipment.

4. Be responsible for the proper location of roughing-in and connections provided under other Divisions.

3.4 INSTALLATION

A. Interface With Other Work:
1. Furnish sleeves, inserts, supports, and equipment that are to be installed by others in sufficient time to be incorporated into construction as work proceeds. Locate these items and see they are properly installed.
2. Electrical: Furnish exact location of electrical connections and complete information on motor controls to installer of electrical system.
3. Testing And Balancing:
   a. Put HVAC systems into full operation and continue their operation during each working day of testing and balancing.
   b. Make changes in pulleys, belts, fan speeds, and dampers or add dampers as required for correct balance as recommended by Testing And Balancing Agency and at no additional cost to Owner.

B. Cut carefully to minimize necessity for repairs to previously installed or existing work. Do not cut beams, columns, or trusses.

C. Locating Equipment:
1. Arrange pipes, ducts, and equipment to permit ready access to valves, cocks, unions, traps, filters, starters, motors, control components, and to clear openings of doors and access panels.
2. Adjust locations of pipes, ducts, switches, panels, and equipment to accommodate work to interferences anticipated and encountered.
3. Install HVAC work to permit removal of equipment and parts of equipment requiring periodic replacement or maintenance without damage to or interference with other parts of equipment or structure.
4. Determine exact route and location of each pipe and duct before fabrication.
   a. Right-Of-Way:
      1) Lines that pitch shall have right-of-way over those that do not pitch. For example, steam, steam condensate, and drains shall normally have right-of-way.
      2) Lines whose elevations cannot be changed shall have right-of-way over lines whose elevations can be changed.
   b. Offsets, Transitions, and Changes in Direction:
      1) Make offsets, transitions, and changes in direction in pipes and ducts as required to maintain proper head room and pitch of sloping lines whether or not indicated on Drawings.
      2) Furnish and install all traps, air vents, sanitary vents, and devices as required to effect these offsets, transitions, and changes in direction.

D. Piping:
1. Furnish and install complete system of piping, valved as indicated or as necessary to completely control entire apparatus.
   a. Pipe drawings are diagrammatic and indicate general location and connections. Piping may have to be offset, lowered, or raised as required or directed at site. This does not relieve this Division from responsibility for proper erection of systems of piping in every respect.
   b. Arrange piping to not interfere with removal of other equipment, ducts, or devices, or block access to doors, windows, or access openings.
      1) Arrange so as to facilitate removal of tube bundles.
      2) Provide accessible flanges or ground joint unions, as applicable for type of piping specified, at connections to equipment and on bypasses.
         a) Make connections of dissimilar metals with di-electric unions.
         b) Install valves and unions ahead of traps and strainers. Provide unions on both sides of traps.

3) Do not use reducing bushings, street elbows, bull head tees, close nipples, or running couplings.
4) Install piping systems so they may be easily drained. Provide drain valves at low points and manual air vents at high points in hot water heating and cooling water piping.
5) Install piping to insure noiseless circulation.
6) Place valves and specialties to permit easy operation and access. Valves shall be regulated, packed, and glands adjusted at completion of work before final acceptance.

c. Do not install piping in shear walls.

2. Properly make adequate provisions for expansion, contraction, slope, and anchorage.
   a. Cut piping accurately for fabrication to measurements established at site. Remove burr and cutting slag from pipes.
   b. Work piping into place without springing or forcing. Make piping connections to pumps and other equipment without strain at piping connection. Remove bolts in flanged connections or disconnect piping to demonstrate that piping has been so connected, if requested.
   c. Make changes in direction with proper fittings.
   d. Expansion of Thermoplastic Pipe:
      1) Provide for expansion in every 30 feet (9 meters) of straight run.
      2) Provide 12 inch (300 mm) offset below roof line in each vent line penetrating roof.
3. Provide sleeves around pipes passing through concrete or masonry floors, walls, partitions, or structural members. Do not place sleeves around soil, waste, vent, or roof drain lines passing through concrete floors on grade. Seal sleeves with specified sealants.
   a. Sleeves through floors shall extend 1/4 inch (6 mm) above floor finish in mechanical equipment rooms above basement floor. In other rooms, sleeves shall be flush with floor.
   b. Sleeves through floors and foundation walls shall be watertight.
4. Provide spring clamp plates (escutcheons) where pipes run through walls, floors, or ceilings and are exposed in finished locations of building. Plates shall be chrome plated heavy brass of plain pattern and shall be set tight on pipe and to building surface.
5. Remove dirt, grease, and other foreign matter from each length of piping before installation.
   a. After each section of piping used for movement of water or steam is installed, flush with clean water, except where specified otherwise.
   b. Arrange temporary flushing connections for each section of piping and arrange for flushing total piping system.
   c. Provide temporary cross connections and water supply for flushing and drainage and remove after completion of work.

E. Penetration Firestops: Install Penetration Firestop System appropriate for penetration at HVAC system penetrations through walls, ceilings, roofs, and top plates of walls.

F. Sealants:
1. Seal openings through building exterior caused by penetrations of elements of HVAC systems.
2. Furnish and install acoustical sealant to seal penetrations through acoustically insulated walls and ceilings.

3.5 REPAIR / RESTORATION

A. Each Section of this Division shall bear expense of cutting, patching, repairing, and replacing of work of other Sections required because of its fault, error, tardiness, or because of damage done by it.
1. Patch and repair walls, floors, ceilings, and roofs with materials of same quality and appearance as adjacent surfaces unless otherwise shown.

2. Surface finishes shall exactly match existing finishes of same materials.

3.6 FIELD QUALITY CONTROL

A. Field Tests:
   1. Perform tests on HVAC piping systems. Furnish devices required for testing purposes.

B. Non-Conforming Work:
   1. Replace material or workmanship proven defective with sound material at no additional cost to Owner.
   2. Repeat tests on new material, if requested.

3.7 SYSTEM START-UP

A. Off-Season Start-up:
   1. If Substantial Completion inspection occurs during heating season, schedule spring start-up of cooling systems. If inspection occurs during cooling season, schedule autumn start-up for heating systems.
   2. Notify Owner seven days minimum before scheduled start-up.
   3. Time will be allowed to completely service, test, check, and off-season start systems. During allowed time, train Owner's representatives in operation and maintenance of system.
   4. At end of off-season start-up, furnish Owner with letter confirming that above work has been satisfactorily completed.

B. Preparations that are to be completed before start up and operation include, but are not limited to, following:
   1. Dry out electric motors and other equipment to develop and properly maintain constant insulation resistance.
   2. Make adjustments to insure that:
      a. Equipment alignments and clearances are adjusted to allowable tolerances.
      b. Nuts and bolts and other types of anchors and fasteners are properly and securely fastened.
      c. Packed, gasketed, and other types of joints are properly made up and are tight and free from leakage.
      d. Miscellaneous alignings, tightenings, and adjustings are completed so systems are tight and free from leakage and equipment performs as intended.
   3. Motors and accessories are completely operable.
   4. Inspect and test electrical circuitry, connections, and voltages to be properly connected and free from shorts.
   5. Adjust drives for proper alignment and tension.
   6. Make certain filters in equipment for moving air are new and of specified type.
   7. Properly lubricate and run-in bearings in accordance with Manufacturer's directions and recommendations.

3.8 CLEANING

A. Clean exposed piping, ductwork, and equipment.

B. No more than one week before Final Inspection, flush out bearings and clean other lubricated surfaces with flushing oil. Provide best quality and grade of lubricant specified by Equipment Manufacturer.

C. Replace filters in equipment for moving air with new filters of specified type no more than one week before Final Inspection.

3.9 CLOSEOUT ACTIVITIES

A. Instruction Of Owner:
   1. Instruct building maintenance personnel and Stake Physical Facilities Representative in operation and maintenance of mechanical systems utilizing Operation And Maintenance Manual when so doing:
      a. Minimum Instruction Periods:
         1) HVAC: Four (4) hours.
         2) Temperature Control: Two (2) hours.

3.10 PROTECTION

A. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system. Cap or plug open ends of pipes and equipment to keep dirt and other foreign materials out of system. Do not use plugs of rags, wool, cotton waste, or similar materials.

B. Do not operate pieces of equipment used for moving supply air without proper air filters installed properly in system.

C. After start-up, continue necessary lubrication and be responsible for damage to bearings while equipment is being operated up to Substantial Completion.

END OF SECTION

SECTION 23 0529

HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Includes But Not Limited To:
1. Common hanger and support requirements and procedures for HVAC systems.

B. Related Requirements:
1. Section 07 8400: 'Firestopping' for quality of Penetration Firestop Systems to be used on Project and submittal requirements.
2. Sections Under 09 9000 Heading: Painting of mechanical items requiring field painting.
3. Slots and openings through floors, walls, ceilings, and roofs provided under other Divisions in their respective materials.

1.2 SUBMITTALS

A. Action Submittals:
1. Product Data:
   a. Manufacturer's catalog data for each manufactured item.

PART 2 - PRODUCTS

2.1 ASSEMBLIES

A. Manufacturers:
1. Class Two Quality Standard Approved Manufacturers. See Section 01 6200:
   a. Anvil International, Portsmouth, NH www.anvilintl.com.
   b. Cooper B-Line, Highland, IL www.cooperbline.com.
   c. Erico International, Solon, OH www.erico.com.
   d. Hilti Inc, Tulsa, OK www.hilti.com.
   e. Minerallac, Hampshire, IL www.minerallac.com.
   f. Thomas & Betts, Memphis, TN www.superstrut.com.
   g. Unistrut, Wayne, MI www.unistrut.com.

B. Performance:
1. Design Criteria:
   a. Support rods for single pipe shall be in accordance with following table:

Rod Diameter	Pipe Size	Rod Diameter	Pipe Size
3/8 inch	2 inches and smaller	10 mm	50 mm and smaller
1/2 inch	2-1/2 to 3-1/2 inches	13 mm	63 mm to 88 mm
5/8 inch	4 to 5 inches	16 mm	100 mm to 125 mm
3/4 inch	6 inches	19 mm	150 mm
7/8 inch	8 to 12 inches	22 mm	200 mm to 300 mm

   b. Support rods for multiple pipes supported on steel angle trapeze hangers shall be in accordance with following table:

c.

Rods		Number of Pipes per Hanger for Each Pipe Size						
No.	Diameter	2 Inch	2.5 Inch	3 Inch	4 Inch	5 Inch	6 Inch	8 Inch
2	3/8 Inch	Two	0	0	0	0	0	0
2	1/2 Inch	Three	Three	Two	0	0	0	0
2	5/8 Inch	Six	Four	Three	Two	0	0	0
2	5/8 Inch	Nine	Seven	Five	Three	Two	Two	0
2	5/8 Inch	Twelve	Nine	Seven	Five	Three	Two	Two

Rods		Number of Pipes per Hanger for Each Pipe Size						
No.	Diameter	50mm	63mm	75mm	100mm	125mm	150mm	200mm
2	10 mm	Two	0	0	0	0	0	0
2	13 mm	Three	Three	Two	0	0	0	0
2	16 mm	Six	Four	Three	Two	0	0	0
2	19 mm	Nine	Seven	Five	Three	Two	Two	0
2	22 mm	Twelve	Nine	Seven	Five	Three	Two	Two

1) Size trapeze angles so bending stress is less than 10,000 psi (69 Mpa).

C. Materials:

1. Hangers, Rods, Channels, Attachments, And Inserts:
   a. Galvanized and UL approved for service intended.
   b. Support horizontal piping from clevis hangers or on roller assemblies with channel supports, except where trapeze type hangers are explicitly shown on Drawings. Hangers shall have double nuts.
   c. Class Two Quality Standards:
      1) Support insulated pipes with clevis hanger equal to Anvil Fig 260 or roller assembly equal to Anvil Fig 171 with an insulation protection shield equal to Anvil Fig 167. Gauge and length of shield shall be in accordance with Anvil design data.
      2) Except uninsulated copper pipes, support uninsulated pipes from clevis hanger equal to Anvil Fig 260. Support uninsulated copper pipe from hanger equal to Anvil Fig CT-65 copper plated hangers and otherwise fully suitable for use with copper tubing.
   d. Riser Clamps For Vertical Piping:
      1) Class Two Quality Standard: Anvil Figure 261.
   e. Furnace / Fan Coil Support Channel:
      1) Class One Quality Standard: Unistrut P1000.
      2) Acceptable Manufacturers: Hilti, Thomas & Betts.
      3) Equal as approved by Architect before installation. See Section 01 6200.
   f. Swivel Attachment:
      1) Class One Quality Standard: Unistrut EM3127.
      2) Acceptable Manufacturers: Hilti, Thomas & Betts.
      3) Equal as approved by Architect before installation. See Section 01 6200.

PART 3- EXECUTION

3.1 INSTALLATION

D. Piping:

1. Properly support piping and make adequate provisions for expansion, contraction, slope, and anchorage.
   a. Except for underground pipe, suspend piping from roof trusses or clamp to vertical walls using support channels and clamps. Do not hang pipe from other pipe, equipment, or ductwork. Laying of piping on any building element is not allowed.
   b. Supports For Horizontal Piping:
      1) Support metal piping at 96 inches (2 400) mm on center maximum for pipe 1-1/4 inches (32 mm) or larger and 72 inches (1 800 mm) on center maximum for pipe 1-1/8 inch (28 mm) or less.

2) Support thermoplastic pipe at 48 inches (1 200 mm) on center maximum.
3) Provide support at each elbow. Install additional support as required.

c. Supports for Vertical Piping:
1) Place riser clamps at each floor or ceiling level.
2) Securely support clamps by structural members, which in turn are supported directly from building structure.
3) Provide clamps as necessary to brace pipe to wall.

d. Insulate hangers for copper pipe from piping by means of at least two layers of Scotch 33 plastic tape.

e. Expansion of Thermoplastic Pipe:
1) Provide for expansion in every 30 feet (9 meters) of straight run.
2) Provide 12 inch (300 mm) offset below roof line in each vent line penetrating roof.

END OF SECTION

SECTION 23 0553

IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Includes But Not Limited To:
1. Furnish and install identification of HVAC equipment and piping as described in Contract Documents.

B. Products Furnished But not Installed Under This Section:
1. Paint identification for gas piping used in HVAC equipment.

C. Related Requirements:
1. Section 22 0529: 'Hangers And Supports For Plumbing' for installation of paint identification for gas piping used with HVAC equipment.

PART 2 - PRODUCTS

2.1 SYSTEMS

A. Description:
1. Abbreviations for Pipe Stencils and Equipment Identification and Band Colors for Pipe Identification:
   a. Apply stenciled symbols and continuous painting as follows:

Pipe Type	Pipe Color	Symbol
Gas	Yellow	GAS

B. Materials:
1. Paint:
   a. Paints specified are from Pittsburgh Paint & Glass (PPG), Pittsburgh, PA www.ppgaf.com or PPG Canada Inc, Mississauga, ON (800) 263-4350 or (905) 238-6441.
   b. One Coat Primer:
      1) 6-2 Quick Drying Latex Primer Sealer over fabric covers.
      2) 6-205 Metal Primer under dark color paint.
      3) 6-6 Metal Primer under light color paint.
   c. Finish Coats: Two coats 53 Line Acrylic Enamel.
   d. Class Two Quality Standard. See Section 01 6200.
      1) Paint of equal quality from other Manufacturers may be used.
      2) Maintain specified colors, shades, and contrasts.
2. Labels:
   a. Equipment Identification:
      1) Black formica, with white reveal when engraved.
      2) Lettering to be 3/16 inch (5 mm) high minimum.

PART 3 - EXECUTION

3.1 APPLICATION

A. Labels:
1. Identify following items with specified labels fastened to equipment with screws (unless noted otherwise):
   a. Boilers and hot water heating specialties.
   b. Pumps.
2. Engrave following data from Equipment Schedules on Drawings onto labels:
   a. Equipment mark.
   b. Area served.
   c. Thermostat zone number, when different from equipment mark.
   d. Panel and breaker from which unit is powered.

B. Painting:
1. Leave equipment in like-new appearance.
2. Only painted legends, directional arrows, and color bands are acceptable.
3. Locate identifying legends, directional arrows, and color bands at following points on exposed piping of each piping system:
   a. Adjacent to each item of equipment.
   b. At point of entry and exit where piping goes through wall.
   c. On each riser and junction.
   d. Every 25 feet (7.620 m) on long continuous lines.
   e. Stenciled symbols shall be one inch (25 mm) high and black.

END OF SECTION

SECTION 23 0768

STEAM SUPPLY AND CONDENSATE RETURN PIPING INSULATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings, General Provisions of Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, and Section 15055 apply to this Section.

1.2 SUMMARY

A. Furnish and install insulation on piping mains, branches, risers, fittings, and valves, pump bodies and flanges as described in Contract Documents.

PART 2 - PRODUCTS

2.1 MATERIAL

A. 6 lb./cu.ft. heavy density fiberglass with fire retardant vapor barrier jacket with self sealing laps. Thickness shall be 1-1/2 inches on heating supply and return lines.

B. Approved Manufacturers:
1. Owens-Corning Fiberglass heavy density with ASJ-SSL jacket
2. Equals by Johns-Manville or CTM.
3. Zeston covers for valves and fittings.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Pipes:
1. Install in accordance with manufacturer's directions on clean dry pipes.
2. Butt joints firmly together.
3. Seal vapor barrier longitudinal seam overlap with vapor barrier adhesive.
4. Wrap butt joints with four inch strip of vapor barrier jacket material cemented with vapor barrier adhesive.
5. Finish with bands applied at mid-section and at each end of insulation.

B. Valves & Fittings:
1. Insulate and finish by one of following methods -
2. With hydraulic setting insulating cement, or equal, to thickness equal to adjoining pipe insulation.
3. With segments of molded insulation securely wired in place.
4. With prefabricated covers made from molded pipe insulation finished with vapor barrier adhesive.
5. With Zeston covers and factory supplied insulation diapers.
6. Finish fittings and valves with four ounce canvas and coat with vapor barrier adhesive or Zeston covers.

END OF SECTION 23 0768

SECTION 23 0800

DEMOLITION AND REPAIR

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings, General Provisions of Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, and Section 23 0501 apply to this Section.

1.2 SUMMARY

A. Under this section remove obsolete piping and mechanical equipment and relocate, reconnect or replace existing piping affected by demolition or new construction. Remove concealed piping abandoned due to demolition or new construction, or cap piping flush with existing surfaces.

1.3 DRAWINGS AND EXISTING CONDITIONS

A. All relocations, reconnections and removals are not necessarily indicated on the drawings. As such, the Contractor shall make adequate allowance in his proposal for this work as no extra charges will be allowed for these items.

PART 2 - PRODUCTS – Not Used

PART 3 - EXECUTION

3.1 TEMPORARY CONNECTIONS

A. Where existing piping must remain in service to supply occupied areas during construction, provide temporary piping, connections, and equipment to maintain service to such areas. All shall be performed in a neat and safe manner to prevent injury to the building or its occupants.

3.2 DRILLING, CUTTING, PATCHING

A. All Required drilling, cutting, block-outs and demolition work required for the removal and/or installation of the mechanical system is the responsibility of this Contractor.

B. No joists, beams, girders, trusses or columns shall be cut by any Contractor without written permission from the Architect.

C. The patching, repair, and finishing to existing or new surfaces is the responsibility of this Contractor, unless specifically called for under sections of specifications covering these materials.

D. Disconnect all equipment that is to be removed or relocated. Relocate any existing equipment that obstructs new construction.

3.3 EXISTING PIPING TO REMAIN IN USE

A. Where affected by demolition or new construction, relocate, replace, extend, or repair piping and equipment to allow continued use of same. Use methods and materials as specified for new construction.

3.4 MATERIALS AND EQUIPMENT REMOVED

A. All obsolete materials, piping, and equipment shall become the property of the Contractor and be removed from the site promptly.

END OF SECTION

SECTION 23 2213

STEAM AND STEAM CONDENSATE PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Includes But Not Limited To:
1. Furnish and install steam and condensate piping and specialties as described in Contract Documents.

B. Related Requirements:
1. Section 23 0501: Common HVAC Requirements.
2. Section 23 0719: HVAC Piping Insulation.

1.2 REFERENCES

A. Reference Standards:
1. ASTM International
   a. ASTM A53/A53M-07, 'Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless'.
   b. ASTM A234/A234-10, 'Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service'.

1.3 SUBMITTALS

A. Informational Submittals:
1. Certificates:
   a. Following completion of cleaning, submit certificate signed by Water Treatment Consultant confirming cleaning operations to Architect for approval before use of cleaned system.

PART 2 - PRODUCTS

2.1 SYSTEM

A. Manufacturers:
1. Manufacturer List:
   a. Armstrong International, Three Rivers, MI www.armstrong-intl.com.
   b. Barnes & Jones Inc, Randolph, MA www.barnesandjones.com.
   c. ConBraCo Industries Inc, Matthews, NC www.conbraco.com or ConBraCo / Honeywell Ltd, Scarborough, ON (416) 293-8111.
   d. Federal Pump Corp, Brooklyn, NY www.abcelectriccorp.com/federalpump.
   e. Hammond Valve Co, New Berlin, WI www.hammondvalve.com.
   f. Mepco, Grand Rapids, MI www.mepcollc.com or Mepco / EFI Systems Group, Etobicoke, ON (616) 246-1431.
   g. Nibco Inc, Elkhart, IN www.nibco.com.
   h. Roth Pump Co, Rock Island, IL www.rothpump.com.
   i. Shipco Pumps, Shippensburg, PA www.shipcopumps.com.
   j. Skidmore, Benton Harbor, MI www.skidmorepump.com.
   k. Spirax - Sarco, Blythewood, SC www.spiraxsarco.com/us/ or Spirax Sarco Canada Ltd, Concord, ON (905) 660-5510.

l. Watts Regulator Co, North Andover, MA www.wattsreg.com or Watts Industries (Canada) Inc, Burlington, ON (888) 208-8927.

B. Materials:
1. Piping:
a. Piping over 2-1/2 inches (64 mm) shall be welded with full weld fittings.
b. Supply Piping:
1) Schedule 40 black carbon steel pipe meeting requirements of ASTM A53/A53M, Type E or F.
2) Fittings shall be standard weight 150 lb (68 kg) malleable iron screwed pattern up to 2-1/2 inches (64 mm).
c. Condensate Piping:
1) Schedule 80 black steel pipe meeting requirements of ASTM A53/A53M, Type E or F.
d. Fittings shall be standard weight 300 lbs (136 kg) malleable iron screwed pattern up to 2-1/2 inches (64 mm).
2. Drip Traps And Steam Coil Traps:
a. Combination float and thermostatic type. Thermostatic element shall form automatic air vent and conform to applicable requirements of thermostatic radiator traps.
b. Main trap body, float, and valve mechanism shall be capable of withstanding constant steam pressure of 15 psi (103 kPA).
c. Traps shall delivery rated capacity called for on Drawings at 1/2 pound (0.23 kg) differential pressure.
d. Category Four Approved Products. See Section 01 6200 for definitions of Categories.
1) Armstrong.
2) Barnes & Jones Inc.
3) Mepco.
4) Spirax / Sarco.
3. Thermostatic Traps:
a. Rugged brass construction with union inlet.
b. Duplex phosphor bronze diaphragm.
c. Stainless steel valve cone and seat.
d. Diaphragms and seats both replaceable.
e. Rated for 25 psig (172 kPA) to 25 inches (635 mm) vacuum.
f. Category Four Approved Products. See Section 01 6200 for definitions of Categories.
1) Armstrong.
2) Barnes & Jones Inc.
3) Mepco.
4) Spirax / Sarco.
4. Valves:
a. Cutoff Service: Three-piece, full port, bronze ball valves rated at 400 psig (2 758 kPa) WOG and 150 psig (1 034 kPa) saturated steam.
b. Category Four Approved Products. See Section 01 6200 for definitions of Categories.
1) ConBraCo Apollo 82-100 Series.
2) Hammond Series 8600.
3) Nibco Series 595.
4) Watts Series B-6800.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Piping:
1. Ream out pipe ends and remove burrs before making up into fittings. Use graphite and oil applied to male threads only in making pipe joint fittings.
2. Install unions where necessary and on both sides of equipment and drip traps.
3. Start main piping runs as high as possible.
a. Keep as close to ceiling as possible.

b. Make sufficient allowance for grade downward and for branches to be taken off top at 45 degree angles.

4. Grade steam and return mains downward in direction of flow one inch (25 mm) in 20 feet (6.1 meters). Grade runouts and branches that grade against flow of steam at 1/4 inch (6 mm) per foot.
5. Install float and thermostatic drip traps in sizes shown on Drawings.
   a. Install at ends and on raises of steam mains.
   b. Install dirt strainer and gate valve ahead of each drip trap.

B. Specialties:
1. Install check valve and ball valve on pump discharge.
2. Run vent line from receivers and terminate as high as possible with return bends.
3. Use eccentric reducers where changes in pipe sizes occur in steam mains. Locate reducers approximately 18 inches (450 mm) beyond branch from steam main causing reduction.

3.2 FIELD QUALITY CONTROL

A. Field Tests:
1. When directed by Architect, conduct operating test on any piece of equipment to demonstrate its capacity and operating characteristics.

B. Field Inspections:
1. Do not cover or conceal piping system until tested at 50 psi (345 kPA) in excess of maximum working pressure, 100 psi (690 kPA) minimum, and inspected and approved by Architect and local inspector having jurisdiction.

3.3 CLEANING

A. Thoroughly clean equipment, piping, and other material provided under this Section. Remove rust, scale, and other dirt before painting or covering and before operating system.

B. Operate heating system at 10 psi (69 kPA for 6 hours minimum, then:
1. Fill boiler to top with water to wash film, oil, and grease over top.
2. Drain boiler and refill to proper level with fresh water.
3. Use one pound tri-sodium phosphate for every 100 gallons (379 liters) of water during cleaning operation.

C. Chemical Cleaning of Steam And Condensate System Piping:
1. Give Architect seven days written notice of date of cleaning procedures. Perform initial cleaning of piping systems under supervision of local representative of chemical treatment supplier.
2. Condenser Water System: Thoroughly flush with fresh water before initial start-up.
3. Steam Boiler:
   a. After it has been determined system is tight and has been flushed, add cleaner to boiler as it is filled with water and run to normal operating pressure with steam header closed.
   b. Boil out for eight hours. After eight hours, blow down all valves and add fresh water intermittently until blow downs are clear.
   c. Cool and drain boiler.
   d. Refill with fresh water, drain, and inspect.
4. Steam And Condensate Piping System:
   a. After it has been determined system is tight and has been flushed, add cleaner at rate of 13 oz (369 grams) of cleaner per gallon of water and operate boiler and system for 24 hours. Return condensate to drain.
   b. After 24 hour period listed above, clean traps and strainers.

END OF SECTION

SECTION 23 5134

FLUES

PART 1 - GENERAL

1.1 SUMMARY

A. Includes But Not Limited To:
1. Furnish and install flues as described in Contract Documents.

B. Related Requirements:
1. Sections Under 09 9000 Heading: Painting.
2. Section 23 0501: 'Common HVAC Requirements'.

PART 2 - PRODUCTS

2.1 ASSEMBLIES

A. Manufacturers:
1. Manufacturer Contact List:
   a. Acme Engineering & Manufacturing Corp, Muskogee, OK www.acmefan.com.
   b. AMPCO, Holland, MI www.americanmetalproducts.com.
   c. Breidert Air Products, Jacksonville, FL www.breidert.com.
   d. Metal-Fab Inc, Wichita, KS www.mtlfab.com.
   e. Metlvent by Hart & Cooley, Holland, MI www.hartandcooley.com.
   f. Selkirk Metalbestos, Logan, OH www.selkirkusa.com.
   g. Simpson Dura-Vent Co, Vacaville, CA www.duravent.com.

B. Materials:
1. Flues:
   a. Double wall, factory-fabricated sectional type 'B', of aluminum construction designed to handle combustion products of fuel being used. Provide with inspection cap as required by local code, roof flashing, and clean-out.
   b. Size flues according to local codes except:
      1) No vertical flue shall have an area of less than 12-1/2 sq inches (80.65 sq cm), 4 inches (100 mm) in diameter.
      2) In no case shall vent connector be smaller than outlet collar provided by Manufacturer.
   c. Horizontal flue connectors shall be double wall.
   d. Fittings shall be pre-fabricated double wall.
   e. Category Four Approved Products. See Section 01 6200 for definitions of Categories:
      1) Ameri-Vent by AMPCO.
      2) Metal-Fab Inc.
      3) Metlvent by Hart & Cooley.
      4) Selkirk Metalbestos.
      5) Simpson Dura-Vent.
2. Vent Caps:
   a. Non-backdraft type for installation on top of flue, aluminum construction.
   b. Category Four Approved Products. See Section 01 6200 for definitions of Categories:
      1) Masterven Type MVR by Acme Engineering & Manufacturing.
      2) Ameri-cap by AMPCO.
      3) Type L by Breidert Air Products.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Height of flue above roof shall be as shown on Drawings unless local code requires it be higher.

B. Every portion of flue connector shall have rise of one inch (25 mm) per 1 foot (300 mm) minimum from appliance to vertical flue.

C. Length of horizontal flues or flue connectors shall not be longer than 75 percent of height of vertical flue between point at which horizontal flue enters vertical flue to top of vertical flue. In no case shall horizontal run exceed 15 feet (4.57 m).

D. When two or more flue connections enter common vertical flue, smaller flue connector shall enter at higher level. Do not enter flue connectors in same horizontal plane.

E. Every gas appliance flue shall have a 'backdraft preventer' installed at top of flue.

END OF SECTION

SECTION 23 5227 – CAST IRON GAS FIRED STEAM BOILER

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings, General Provisions of Contract, including General and Supplementary Conditions and Section 23 0501 apply to this Section.

1.2 SUMMARY

A. Furnish and install cast iron gas fired steam boiler as described in Contract Documents.

1.3 QUALITY ASSURANCE

A. Boiler shall be constructed in accordance with provisions of Section IV of ASME Boiler and Pressure Vessel Code and shall be stamped with required official ASME symbol.

B. Electrical controls shall be UL and AGA approved.

PART 2 - PRODUCTS

2.1 MANUFACTURED UNITS

A. Low pressure gas fired boiler

B. Cast iron sectional type

C. Capable of developing full AGA gross output capacity when fired at published AGA input capacity.

D. Maximum working pressure of 15 psig for steam.

E. Boiler Special Construction Features:
   1. Assembled with individual draw rods that distribute tension evenly on all sections.
   2. Sections shall not be face ground in order that corrosion protective outer skin will remain intact.
   3. Boiler shall have internal steam separators cast into each section to assure dry steam and maintenance of steady water line.
   4. Cleanout plates shall be furnished for cleanout openings at front of boiler. These cleanout plates shall be readily removable for the purpose of cleaning the flueways between sections of boiler. No bolts, screws, or wing-nuts shall be used for holding cleanout plates in position.
   5. Boiler shall be provided with extended steel jacket with durable baked enamel finish. Jacket shall be insulated with foil-backed fiberglass on end, top, front and back panels. Jacket shall be designed to permit their erection after connection of supply and return piping.

F. Flue Collector Hood Special Construction Features:
   1. Flue collector hoods shall be securely bolted to top of boiler sections and shall be joined to a horizontal to vertical draft hood.
   2. A gas-tight seal shall be maintained between flue collector hood and draft hood shall be made of heavy gauge aluminized steel with aluminized steel curtain walls and shall be protected against high ambient temperatures with 1-inch thick 1900 degrees F. insulation panels.

G. Gas Burners:
   1. Pressure forced draft type.
   2. Arranged for pre-purge, low fire start, high fire run and two position air control.
   3. Packaged control panel with Honeywell RM7895D electronic flame detector and motor starter and motor starter relay.
   4. Supported with a heavy steel insulated base.
   5. Readily accessible for servicing and adjustment.

H. Boiler Standard Controls:
   1. Controls are to be of accepted "quality" manufacture and gas controls shall be pre-assembled at the factory.
   2. Pressure regulator, gas valve with slow opening feature and manual shutoff valve are to be located outside of jacket to provide easy accessibility for service.
   3. Boiler automatic safety pilots shall be of 100 percent shutoff type.
   4. Equipped with two low water cutoffs as standard equipment.
   5. For natural gas, inlet gas pressure to boiler hand valve should be no less than 7 inches water column or no more than 10 inches water column.
   6. Service pressure regulator of adequate size shall be provided by Mechanical Contractor and installed ahead of boiler hand valve if inlet gas pressure exceeds 10 inches water column. Service regulator shall be of 100 percent lockup type and shall not permit lockup pressures in excess of 10 inches water column.

I. Electronic Safeguard Pilot System:
   1. Pre-wired electronic control panel.
   2. Electronic pilot system with electric intermittent ignition system.
   3. 100 percent shutoff.
   4. FM approved controls with high/low gas switches.

J. Provide one Honeywell S7800 keyboard display module to the Owner.

K. Approved Manufacturers:
   1. Weil McLain
   2. Peerless
   3. H.B. Smith

END OF SECTION

END OF DIVISION 23