

SECTION 15105

HVAC PIPING

PART 1 –GENERAL

1.1 SUMMARY

- A. Section includes pipe and pipe fittings for: heating water, chilled water, steam and steam condensate, condenser water, glycol, refrigerant and engine exhaust.
- B. Related Sections:
 - 1. Section 09050 - Paints and Coatings: Product requirements Painting for placement by this section.

1.2 REFERENCES

- A. ASME (American Society of Mechanical Engineers) - Boiler and Pressure Vessel Codes, SEC IX - Qualification Standard for Welding and Brazing Procedures, Welders, Brazers, and Welding and Brazing Operators.
- B. ASME B16.3 (American Society of Mechanical Engineers) - Malleable Iron Threaded Fittings Class 50 and 300
- C. ASME B16.18 (American Society of Mechanical Engineers) - Cast Copper Alloy Solder Joint Pressure Fittings.
- D. ASME B16.22 (American Society of Mechanical Engineers) - Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.
- E. ASME B16.26 (American Society of Mechanical Engineers) - Cast Copper Alloy Fittings For Flared Copper Tubes.
- F. ASME B31.5 (American Society of Mechanical Engineers) - Refrigeration Piping.
- G. ASME B31.9 (American Society of Mechanical Engineers) - Building Services Piping.
- H. ASTM A53 - Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
- I. ASTM A234 - Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and Elevated Temperatures.
- J. ASTM B32 - Solder Metal.
- K. ASTM B88 - Seamless Copper Water Tube.

- L. ASTM B280 - Seamless Copper Tube for Air Conditioning and Refrigeration
- M. ASTM D1785 - Poly (Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120.
- N. ASTM D2235 - Solvent Cement for Acrylonitrile-Butadiene-Styrene (ABS) Plastic Pipe and Fittings.
- O. ASTM D2241 - Poly (Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR-Series).
- P. ASTM D2310 - Machine-Made Reinforced Thermosetting Resin Pipe.
- Q. ASTM D2466 - Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40.
- R. ASTM D2467 - Socket-Type Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80.
- S. ASTM D2680 - Acrylonitrile-Butadiene-Styrene (ABS) and Poly (Vinyl Chloride) (PVC) Composite-Sewer Piping.
- T. ASTM D2683 - Socket-Type Polyethylene Fittings for Outside Diameter-Controlled Polyethylene Pipe and Tubing.
- U. ASTM D2751 - Acrylonitrile-Butadiene-Styrene (ABS) Sewer Pipe and Fittings.
- V. ASTM D2855 - Making Solvent-Cemented Joints with Poly (Vinyl Chloride) (PVC) Pipe and Fittings.
- W. ASTM D3309 - Polybutylene (PB) Plastic Hot-and Cold-Water Distribution Systems.
- X. ASTM F477 - Elastomeric Seals (Gaskets) for Joining Plastic Pipe.
- Y. ASTM F708 - Design and Installation of Rigid Pipe Hangers.
- Z. ASTM F845 - Plastic Insert Fittings for Polybutylene (PB) Tubing.
- AA. ASTM F876 – Cross linked Polyethylene (PEX) Tubing.
- BB. ASTM F877 – Cross linked Polyethylene (PEX) Plastic Hot - and Cold - Water Distribution Systems.
- CC. AWS A5.8 (American Welding Society) - Brazing Filler Metal.
- DD. AWS D1.1 (American Welding Society) - Structural Welding Code.

- EE. AWWA C105 (American Water Works Association) - Polyethylene Encasement for Ductile Iron Piping for Water and Other Liquids.
- FF. AWWA C110 (American Water Works Association) - Ductile - Iron and Grey -Iron Fittings 3 in. through 48 in., for Water and Other Liquids.
- GG. AWWA C111 (American Water Works Association) - Rubber-Gasket Joints for Ductile Iron and Grey-Iron Pressure Pipe and Fittings.
- HH. AWWA C151 (American Water Works Association) - Ductile-Iron Pipe, Centrifugally Cast in Metal Molds or Sand-Lined Molds, for Water or Other Liquids.
- II. MSS SP58 (Manufacturers Standardization Society of the Valve and Fittings Industry) - Pipe Hangers and Supports - Materials, Design and Manufacture.
- JJ. MSS SP69 (Manufacturers Standardization Society of the Valve and Fittings Industry) - Pipe Hangers and Supports - Selection and Application.
- KK. MSS SP89 (Manufacturers Standardization Society of the Valve and Fittings Industry) - Pipe Hangers and Supports - Fabrication and Installation Practices.

1.3 SYSTEM DESCRIPTION

- A. Where more than one piping system material is specified, ensure system components are compatible and joined to ensure the integrity of the system is not jeopardized. Provide necessary joining fittings. Ensure flanges, union, and couplings for servicing are consistently provided.
- B. Use unions, flanges, and couplings downstream of valves and at equipment or apparatus connections. Use brass connections whenever jointing dissimilar metals in open systems. Do not use direct welded or threaded connections to valves, equipment or other apparatus.
- C. Flexible Connectors: Utilize at or near compressors where piping configuration does not absorb vibration.

1.4 SUBMITTALS

- A. Section 01330 - Submittal Procedures: Submittal procedures.
- B. Shop Drawings: Indicate schematic layout of refrigeration system, including equipment, critical dimensions, and sizes.
- C. Product Data: Submit data on pipe materials and fittings. Provide manufacturers catalogue information.

- D. Design Data: Indicate pipe size. Indicate load carrying capacity of trapeze, multiple pipe, and riser support hangers.
- E. Test Reports: Indicate results of refrigerant leak test and acid test
- F. Manufacturer's Installation Instructions: Submit hanging and support methods, joining procedures and isolation
- G. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
- H. Welders' Certificate: Include welders' certification of compliance with ASME/SEC 9 and AWS D1.1.

1.5 QUALITY ASSURANCE

- A. Perform Work in accordance with ASME B31.9 code for installation of piping systems and ASME SEC 9 for welding materials and procedures.
- B. Maintain one copy of each document on site.

1.6 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.
- B. Installer: Company specializing in performing Work of this section with minimum three years documented experience.
- C. Design under direct supervision of a professional engineer experienced in design of this work and licensed at the place where the Project is located.

1.7 PRE-INSTALLATION MEETING

- A. Section 01330 -Administrative Requirements: Pre-installation meeting.
- B. Convene minimum one week prior to commencing Work of this section.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Store and protect equipment.
- B. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.

- C. Protect piping from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.
- D. Dehydrate and charge refrigeration components such as piping, seal prior to shipment, until connected into system.

1.9 ENVIRONMENTAL REQUIREMENTS

- A. Store and protect equipment.
- B. Do not install underground piping when bedding is wet or frozen.

1.10 FIELD MEASUREMENTS

- A. Verify field measurements prior to fabrication.

1.11 MAINTENANCE MATERIALS

- A. Section 01770 - Execution Requirements.

PART 2 –PRODUCTS

2.1 HEATING WATER AND GLYCOL PIPING, BURIED

- A. Copper Tubing: ASTM B88, Type K, annealed.
 - 1. Fittings: ASME B16.22, wrought copper.
 - 2. Joints: Braze, AWS A5.8 BCuP silver/phosphorus/copper alloy with melting range 1190 - 1480 degrees F.
 - 3. Casing: Drytherm

2.2 HEATING WATER AND GLYCOL PIPING, ABOVE GROUND

- A. > 2.5” Steel Pipe: ASTM A53, Schedule 40, black.
 - 1. Fittings: ASTM B16.3, malleable iron or ASTM A234, forged steel welding type fittings.
 - 2. Joints: Threaded, or AWS D1.1, welded.
- B. < 2” Copper Tubing: ASTM B88, Type L, hard drawn.
 - 1. Fittings: ASME B16.18, cast brass, or ASME B16.22 solder wrought copper.
 - 2. Tee Connections: Mechanically extracted collars with notched and dimpled branch tube.
 - 3. Joints: Braze, AWS A5.8 BCuP silver/phosphorus/copper alloy with melting range 1190 - 1480 degrees F, or 95/5 soft solder is acceptable.

2.3 CHILLED WATER PIPING, BURIED

- A. Steel Pipe: ASTM A53, Schedule 80, black.
 - 1. Fittings: ASTM A234 forged steel welding type.
 - 2. Joints: AWS D1.1, welded.
 - 3. Casing: Closed glass cell insulation, or Polyurethane insulation with high density polyethylene jacket and heat shrink sleeves.
- B. Copper Tubing: ASTM B88, Type K annealed.
 - 1. Fittings: ASME B16.22, wrought copper
 - 2. Joints: Braze, AWS A5.8 BCuP silver/phosphorus/copper alloy with melting range 1190 - 1480 degrees F.
 - 3. Casing: Closed glass cell insulation, or Polyurethane insulation with high density polyethylene jacket and heat shrink sleeves.
- C. Ductile Iron Pipe: AWWA C151.
 - 1. Fittings: AWWA C110, ductile iron and standard thickness.
 - 2. Joints: AWWA C111, rubber gasket with $\frac{3}{4}$ inch diameter rods.
- D. PVC Pipe: ASTM D1785, Schedule 80 for all sizes.
 - 1. Fittings: ASTM D2466, or ASTM D2467, PVC.
 - 2. Joints: ASTM D2855, solvent weld.
- E. FRP Pipe: ASTM D2310, fiberglass reinforced thermosetting resin plastic.
 - 1. Fittings: Fiberglass reinforced epoxy.
 - 2. Joints: **[Hub-and-spigot with rubber gasket.] [Non-threaded, union or flanged coupling.]**

2.4 CHILLED WATER PIPING, ABOVE GRADE

- A. > 2.5" Steel Pipe: ASTM A53, Schedule 40, black.
 - 1. Fittings: ASTM B16.3, malleable iron or ASTM A234, forged steel welding type.
 - 2. Joints: Threaded or AWS D1.1 welded.
- B. < 2" Copper Tubing: ASTM B88, Type L, hard drawn.
 - 1. Fittings: ASME B16.18, cast brass, or ASME B16.22, solder wrought copper.
 - 2. Tee Connections: Mechanically extracted collars with notched and dimpled branch tube.
 - 3. Joints: Braze, AWS A5.8 BCuP silver/phosphorus/copper alloy with melting range 1190 - 1480 degrees F, or 95/5 soft solder is acceptable.

2.5 CONDENSER WATER PIPING, BURIED

- A. > 2.5" Steel Pipe: ASTM A53, Schedule 80, black.
 - 1. Fittings: ASTM A234 forged steel welding type.

2. Joints: Threaded for pipe 2 inch and under; AWS D1.1, welded for pipe over 2 inch.

B. < 2" Copper Tubing: ASTM B88, Type K annealed.

1. Fittings: ASME B16.22, wrought copper.
2. Joints: Braze, AWS A5.8 BCuP silver/phosphorus/copper alloy with melting range 1190 - 1480 degrees F.

C. PVC Pipe: ASTM D1785, Schedule 80, or ASTM D2241, SDR 21 or 26.

1. Fittings: ASTM D2466 or ASTM D2467, PVC.
2. Joints: ASTM D2855, solvent weld.

D. FRP Pipe: ASTM D2310, fiberglass reinforced thermosetting resin plastic.

1. Fittings: Fiberglass reinforced epoxy.
2. Joints: Hub-and-spigot with rubber gasket or non-threaded, union or flanged coupling.

2.6 CONDENSER WATER PIPING, ABOVE GROUND

A. > 2.5" Steel Pipe: ASTM A53, Schedule 80 black. Galvanized outdoors.

1. Fittings: ASTM B16.3, malleable iron or ASTM A234, threaded.
2. No welding of galvanized pipe for worker health concerns.
3. Joints: Threaded.

B. < 2" Copper Tubing: ASTM B88, Type L, hard drawn.

1. Fittings: ASME B16.18, cast brass, or ASME B16.22 solder wrought copper.
2. Tee Connections: Mechanically extracted collars with notched and dimpled branch tube.
3. Joints: Braze, AWS A5.8 BCuP silver/phosphorus/copper alloy with melting range 1190 - 1480 degrees F. Soft solder is also acceptable.

C. PVC Pipe: ASTM D1785, Schedule 80, or ASTM D2241, SDR 21 or 26.

1. Fittings: ASTM D2466 or ASTM D2467, PVC.
2. Joints: ASTM D2855, solvent weld.

D. FRP Pipe: ASTM D2310, fiberglass reinforced thermosetting resin plastic.

1. Fittings: Fiberglass reinforced epoxy.
2. Joints: Hub-and-spigot with rubber gasket or non-threaded, union or flanged coupling.

2.7 ENGINE EXHAUST

A. Stainless Pipe: ASTM A53, Schedule 40 black.

1. Fittings: ASTM B16.3, malleable iron or ASTM A234, forged steel welding type.

2. Joints: Threaded for pipe 2 inch and under; AWS D1.1 welded for pipe over 2 inch.

2.8 MEDIUM AND HIGH PRESSURE STEAM PIPING (150 PSIG MAXIMUM)

A. Steel Pipe: ASTM A53, Schedule 80 black.

1. Fittings: ASTM B16.3 malleable iron Class 250, or ASTM A234 forged steel welding type, Class 300.
2. Joints: Threaded or AWS D1.1 welded.

2.9 LOW PRESSURE STEAM PIPING (15 PSIG MAXIMUM)

A. Steel Pipe: ASTM A53, Schedule 80 black.

1. Fittings: ASTM B16.3 malleable iron Class 125, or ASTM A234 forged steel Class 125.
2. Joints: Threaded, or AWS D1.1, welded.

2.10 MEDIUM AND HIGH PRESSURE STEAM CONDENSATE PIPING

A. Steel Pipe: ASTM A53, Schedule 80 black.

1. Fittings: ASTM B16.3 malleable iron Class 125, or ASTM A234 forged steel Class 125.
2. Joints: Threaded, or AWS D1.1, welded.

2.11 LOW PRESSURE STEAM CONDENSATE PIPING

A. Steel Pipe: ASTM A53, Schedule 80 black.

1. Fittings: ASTM B16.3 malleable iron Class 125, or ASTM A234 forged steel Class 125.
2. Joints: Threaded, or AWS D1.1, welded.

2.12 REFRIGERANT PIPING

A. Copper Tubing: ASTM B280, Type ACR hard drawn as applicable.

1. Fittings: ASME B16.22 wrought copper
2. Joints: Braze, AWS A5.8 BCuP silver/phosphorus/copper alloy with melting range 1190 to 1480 degrees F.

B. Copper Tubing to 7/8 inch OD: ASTM B88, Type K, annealed.

1. Fittings: ASME B16.26 cast copper.
2. Joints: Flared.

2.13 UNIONS, FLANGES, AND COUPLINGS

- A. Unions for Pipe 2 inches and Under:
 - 1. Ferrous Piping: 150 psig malleable iron, threaded.
 - 2. Copper Pipe: Bronze, soldered joints.
- B. Flanges for Pipe Over 2 inches:
 - 1. Ferrous Piping: 150 psig forged steel, slip-on, flanges, or welded neck.
 - 2. Copper Piping: Bronze.
 - 3. Gaskets: 1/16 inch thick pre-formed neoprene.
- C. Grooved and Shouldered Pipe End Couplings:
 - 1. Housing Clamps: Malleable iron, outdoor galvanized, to engage and lock designed to permit some angular deflection, contraction, and expansion.
 - 2. Sealing Gasket: C-shape elastomer composition for operating temperature as applicable.
 - 3. Accessories: Steel bolts, nuts, and washers.
- D. Connections: Brass transitions.

PART 3 – EXECUTION

3.1 PREPARATION

- A. Ream pipe and tube ends. Remove burrs.
- B. Remove scale and dirt on inside and outside before assembly.
- C. Prepare piping connections to equipment with flanges or unions.
- D. Keep open ends of pipe free from scale and dirt. Protect open ends with temporary plugs or caps.

3.2 INSTALLATION

- A. Install heating water, glycol, chilled water, condenser water, and engine exhaust piping in conformance with ASME B31.9.
- B. Route piping parallel to building structure and maintain gradient.
- C. Install piping to conserve building space, and not interfere with use of space.
- D. Group piping whenever practical at common elevations.
- E. Sleeve pipe passing through partitions, walls and floors.

- F. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.
- G. Inserts:
 - 1. Provide inserts for placement in concrete forms.
 - 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.
- H. Provide clearance in hangers and from structure and other equipment for installation of insulation.
- I. Provide access where valves and fittings are not exposed.
- J. Slope piping and arrange systems to drain at low points.
 - 1. Slope steam piping one inch in 40 feet in direction of flow.
 - 2. Slope steam condensate piping one inch in 40 feet. Provide drip trap assembly at low points and before control valves. Run condensate lines from trap to nearest condensate receiver. Provide loop vents over trapped sections.
- K. Arrange refrigeration piping to return oil to compressor. Provide traps and loops in piping, and provide double risers as required. Slope horizontal piping 0.40 percent in direction of flow.
- L. Flood refrigerant piping system with nitrogen when brazing.
- M. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welds.
- N. Prepare unfinished pipe, fittings and supports ready for finish painting. Refer to Section 09050.
- O. Follow ASHRAE 15 procedures for charging and purging of systems and for disposal of refrigerant.

3.3 FIELD QUALITY CONTROL

- A. Section 01450 - Quality Requirements: Testing and Inspection Services and 01770 – Execution Requirements: Testing, adjusting, and balancing.
- B. Test refrigeration system in accordance with ASME B31.5.
- C. Pressure test system with dry nitrogen to 200 psig. Test to no leakage.

END OF SECTION