

SECTION 231113 - FACILITY FUEL-OIL PIPING

PART 1 - GENERAL

1.01 BUY AMERICAN REQUIREMENTS

- A. Provide certificates to show that all products meet the following requirements.
 - 1. American Iron and Steel (AIS)
 - 2. Build America, Buy America Act
- B. See Supplementary Conditions for details.

1.02 SUMMARY

- A. Section Includes:
 - 1. Fuel-oil pipes, tubes, and fittings.
 - 2. Piping specialties.

1.03 SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, material descriptions, and dimensions of individual components and profiles.
 - 2. Include, where applicable, rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.
- B. Shop Drawings: For fuel-oil piping.
 - 1. Include plans, elevations sections, hangers, and supports for multiple pipes.
 - 2. Include details of location of anchors, alignment guides, and expansion joints and loops.
 - 3. Scale: 1/4 inch per foot.
- C. Coordination Drawings: Plans and details, drawn to scale, on which fuel-oil piping is shown and coordinated with other installations, using input from installers of the items involved.
- D. Brazing certificates.
- E. Welding certificates.
- F. Field quality-control reports.
 - 1. Startup reports for leak-detection and monitoring system
- G. Warranty: For special warranty.
- H. Operation and Maintenance Data: For fuel-oil equipment and accessories to include in emergency, operation, and maintenance manuals.

1.04 QUALITY ASSURANCE

- A. Brazing: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX.

- B. Steel Support Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
- C. Pipe Welding Qualifications:
 - 1. Qualify procedures and personnel according to ASME Boiler and Pressure Vessel Code.
 - 2. Pipe welder to have a minimum of 3 years of documented experience.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture.
- B. Store pipes and tubes with protective PE coating to avoid damaging the coating and to protect from direct sunlight.

1.06 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of flexible piping and related equipment that fail in materials or workmanship within specified warranty period.
 - 1. Failures due to defective materials or workmanship for materials including piping, dispenser sumps, water-tight sump entry boots, terminations, and other end fittings.
 - 2. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 SYSTEM DESCRIPTION

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Comply with ASME B31.9, "Building Services Piping," for fuel-oil piping materials, installation, testing, and inspecting.
- C. Comply with requirements of the EPA and of state and local authorities having jurisdiction. Include recording of fuel-oil piping location.
- D. Fuel-Oil Valves: Comply with UL 842 and have service mark initials "WOG" permanently marked on valve body.
- E. Comply with requirements of the EPA and of state and local authorities having jurisdiction.

2.02 PIPES, TUBES, AND FITTINGS

- A. See "Piping Schedules" for where pipes, tubes, fittings, and joining materials are applied in various services.
- B. Steel Pipe: ASTM A 53/A 53M, black steel, Schedule 40, Type E or S, Grade B.
 - 1. Malleable-Iron Threaded Fittings: ASME B16.3, Class 150, standard pattern.
 - 2. Wrought-Steel Welding Fittings: ASTM A 234/A 234M, for butt and socket welding.

3. Unions: ASME B16.39, Class 150, malleable iron with brass-to-iron seat, ground joint, and threaded ends.
 4. Forged-Steel Flanges and Flanged Fittings: ASME B16.5, minimum Class 150, including bolts, nuts, and gaskets of the following material group, end connections, and facings:
 - a. Material Group: 1.1.
 - b. End Connections: Threaded or butt welding to match pipe.
 - c. Lapped Face: Not permitted underground.
 - d. Gasket Materials: Asbestos free, ASME B16.20 metallic, or ASME B16.21 nonmetallic, gaskets compatible with fuel oil.
 - e. Bolts and Nuts: ASME B18.2.1, cadmium-plated steel.
 - f. Protective Coating for Underground Piping: Factory-applied, three-layer coating of epoxy, adhesive, and Poly-Ethylene (PE).
 - g. Joint Cover Kits: Epoxy paint, adhesive, and heat-shrink PE sleeves.
- C. Drawn-Temper Copper Tube: Comply with ASTM B 88, Type K.
1. Copper Fittings: ASME B16.22, wrought copper, streamlined pattern.
 2. Bronze Flanges and Flanged Fittings: ASME B16.24, Class 150.
 - a. Gasket Material: Asbestos free, ASME B16.20 metallic or ASME B16.21 nonmetallic, gaskets compatible with fuel oil.
 - b. Bolts and Nuts: ASME B18.2.1, cadmium-plated steel.
- D. Annealed-Temper Copper Tube: Comply with ASTM B 88, Type K.
1. Copper Fittings: ASME B16.22, wrought copper, streamlined pattern.
 2. Flare Fittings: Comply with ASME B16.26 and SAE J513.
 - a. Copper fittings with long nuts.
 - b. Metal-to-metal compression seal without gasket.
 - c. Dryseal threads complying with ASME B1.20.3.

2.03 PIPING SPECIALTIES

A. Metallic Flexible Connectors:

1. Listed and labeled for aboveground and underground applications by an NRTL acceptable to authorities having jurisdiction.
2. Stainless-steel bellows with woven, flexible, bronze or stainless-steel, wire-reinforcing protective jacket.
3. Minimum Operating Pressure: 150 psig.
4. End Connections: Socket, flanged, or threaded end to match connected piping.
5. Maximum Length: 30 inches.
6. Swivel end, 50-psig maximum operating pressure.
7. Factory-furnished anode for connection to cathodic protection.

B. Y-Pattern Strainers:

1. Body: ASTM A 126, Class B, cast iron with bolted cover and bottom drain connection.
2. End Connections: Threaded ends for NPS 2 and smaller; flanged ends for NPS 2-1/2 and larger.

3. Strainer Screen: 60-mesh startup strainer and perforated stainless-steel basket with 50 percent free area.
 4. CWP Rating: 125 psig.
- C. Manual Air Vents:
1. Body: Bronze or Stainless Steel.
 2. Internal Parts: Nonferrous.
 3. Operator: Screwdriver or thumbscrew.
 4. Inlet Connection: NPS 1/2.
 5. Discharge Connection: NPS 1/8.
 6. CWP Rating: 150 psig.
 7. Maximum Operating Temperature: 225 deg F.

2.04 JOINING MATERIALS

- A. Joint Compound for Threaded Joints: Suitable for fuel oil.
- B. Welding Filler Metals: Comply with AWS D10.12/D10.12M for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.
- C. Brazing Filler Metals: Alloy with melting point greater than 1000 deg F complying with AWS A5.8/A5.8M. Brazing alloys containing more than 0.05 percent phosphorus are prohibited.
- D. Bonding Adhesive for RTRP and RTRF: As recommended by piping and fitting manufacturer.

2.05 SPECIALTY VALVES

- A. Pressure Relief Valves:
1. Listed and labeled for fuel-oil service by an NRTL acceptable to authorities having jurisdiction.
 2. Body: Brass, bronze, or cast steel.
 3. Springs: Stainless steel, interchangeable.
 4. Seat and Seal: Nitrile rubber.
 5. Orifice: Stainless steel, interchangeable.
 6. Factory-Applied Finish: Baked enamel.
 7. Maximum Inlet Pressure: 150 psig.
 8. Relief Pressure Setting: 60 psig.
- B. Oil Safety Valves:
1. Listed and labeled for fuel-oil service by an NRTL acceptable to authorities having jurisdiction.
 2. Body: Brass, bronze, or cast steel.
 3. Springs: Stainless steel.
 4. Seat and Diaphragm: Nitrile rubber.
 5. Orifice: Stainless steel, interchangeable.
 6. Factory-Applied Finish: Baked enamel.
 7. Manual override port.
 8. Maximum Inlet Pressure: 60 psig.
 9. Maximum Outlet Pressure: 3 psig.

C. Emergency Shutoff (Fusible) Valves:

1. Listed and labeled for fuel-oil service by an NRTL acceptable to authorities having jurisdiction.
2. Single poppet valve.
3. Body: ASTM A 126, cast iron.
4. Disk: FPM.
5. Poppet Spring: Stainless steel.
6. Stem: Plated brass.
7. O-Ring: FPM.
8. Packing Nut: PTFE-coated brass.
9. Fusible link to close valve at 165 deg F.
10. Thermal relief to vent line pressure buildup due to fire.
11. Air test port.
12. Maximum Operating Pressure: 0.5 psig.

D. Anti-Siphon Valve:

1. Ductile iron, stainless steel, or aluminum body.
2. Ductile iron, stainless steel, or aluminum cap.
3. Stainless steel spring.
4. Stainless steel or aluminum plunger.
5. Viton or Nitrile seals.

2.06 LABELING AND IDENTIFYING

- A. Detectable Warning Tape: Acid- and alkali-resistant PE film warning tape manufactured for marking and identifying underground utilities, a minimum of 6 inches wide and 4 mils thick, continuously inscribed with a description of utility, with metallic core encased in a protective jacket for corrosion protection, detectable by metal detector when tape is buried up to 30 inches deep; colored yellow.

1.01 GATE VALVES

- A. Manufacturers: Nibco or equal.
- B. Up To and Including 2 inches : MSS SP-80, Class 125, bronze body, bronze trim, rising stem, hand wheel, inside screw, solid wedge disc, solder or threaded ends.
- C. Larger than 2 inches : MSS SP-70, Class 125, iron body, bronze trim, outside screw and yoke, hand wheel, solid wedge disc, flanged ends. Furnish chain-wheel operators for valves 6 inches and larger, mounted over 8 feet above floor.

1.02 GLOBE VALVES

- A. Manufacturers: Nibco or equal.
- B. Up To and Including 2 inches : MSS SP-80, Class 125, bronze body, bronze trim, hand wheel, bronze disc, solder or threaded ends.

- C. Larger than 2 inches : MSS SP-85, Class 125, iron body, bronze trim, hand wheel, outside screw and yoke, renewable bronze plug-type disc, renewable seat, flanged ends. Furnish chain-wheel operators for valves 6 inches and larger, mounted over 8 feet above floor.

1.03 BALL VALVES

- A. Manufacturers: Nibco or equal.
- B. Ball Valves: MSS SP-110, 2000 WOG, steel, one piece body, chrome-plated carbon steel ball, full port, teflon seats and seals, blow-out proof stem, lever handle threaded ends.

1.04 SWING CHECK VALVES

- A. Manufacturers: Nibco or equal.
- B. Up to 2 inches: MSS SP-80, Class 125, bronze body and cap, bronze swing disc, solder or threaded ends.
- C. 2 inches and Larger: MSS SP-71, Class 125, iron body, bronze swing disc, renewable disc seal, and seat, flanged or grooved ends.

1.05 ANTI-SIPHON VALVES

- A. Manufacturers: Preferred Utilities Type A or approved equal.
- B. Valve shall be of bronze construction.

1.06 FUSIBLE VALVES:

- A. Fusible valves shall be brass body with fusible element in the handwheel, and shall automatically close when acted upon by heat of 165 deg F. The fusible valve shall be capable of being operated manually and shall have self-adjusting stuffing box and back seat features to prevent leaks at the valve stem. Fusible valves shall be Firomatic Model No. 300-F or equal.

1.07 FUEL FILTERS:

- A. Provide and install in-line fuel filters as shown on the Drawings with replaceable cartridges capable of removing down to 10 micron particles. The filter units shall include a water sump and drainage fitting and shall be sized to match the burner or equipment fuel consumption.

1.08 PIPE HANGERS AND SUPPORTS

- A. See Section 230529 "Hangers and Supports for Plumbing Piping and Equipment".
- B. Conform to NFPA 31, and ASME B31.1.
- C. Hangers for Pipe Sizes 1/2 to 1-1/2 inch Carbon steel, adjustable swivel, split ring.

- D. Wall Support for Pipe 3 inches and Smaller: Cast iron hook.
- E. Vertical Support: Steel riser clamp.
- F. Floor Support: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
- G. Copper Pipe Support: Carbon steel ring, adjustable, copper plated.

1.09 STRAINERS

- A. Manufacturers: Watts or equal.
- B. Threaded brass body for Class 150, threaded bronze body 300 psi CWP, Y pattern with 1/32-inch stainless steel perforated screen.

1.10 FLEXIBLE CONNECTORS

- A. Flexible Metal Hose
 - 1. Manufacturers: Anament, Inc. #16308 or equal.
 - 2. Type 321 stainless steel corrugated metal hose with 304 stainless steel wire braid sheath covering, close-pitch annular corrugations.
 - 3. Rated for 125 psig working pressure 12-inch minimum live length, threaded end connections.
 - 4. Connector shall conform to UL 567 for above and below ground fuel use.
- B. Elastomeric Hose
 - 1. Manufacturer: Aeroquip 1525 fire-resistant fuel hose or equal.
 - 2. Elastomeric tube with brass plated steel wire reinforcement and braided refractory insulation for fire resistance.
- C. Rated for 125 psig working pressure and 16 inches Hg vacuum.

2.07

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine areas for compliance with requirements for installation tolerances and other conditions affecting performance of fuel-oil piping.
- B. Examine installation of fuel-burning equipment and fuel-handling and storage equipment to verify actual locations of piping connections before installing fuel-oil piping.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

- A. Close equipment shutoff valves before turning off fuel oil to premises or piping section.

- B. Comply with NFPA 30 and NFPA 31 requirements for prevention of accidental ignition.

3.03 OUTDOOR PIPING INSTALLATION

- A. Install vent pipe at a minimum slope of 2 percent downward toward fuel-oil storage tank sump.
- B. Assemble and install entry boots for pipe penetrations through sump sidewalls for liquid-tight joints.
- C. Install metal pipes and tubes, fittings, valves, and flexible connectors at piping connections to AST and UST.
- D. Install fittings for changes in direction in rigid pipe.
- E. Install system components with pressure rating equal to or greater than system operating pressure.

3.04 INDOOR PIPING INSTALLATION

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements are used to size pipe and calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved by Engineer and included on Coordination Drawings if required.
- B. Arrange for pipe spaces, chases, slots, sleeves, and openings in building structure during progress of construction to allow for mechanical installations.
- C. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.
- D. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- E. Install piping above accessible ceilings at a height that allows sufficient space for ceiling panel removal.
- F. Install piping free of sags and bends.
- G. Install fittings for changes in direction and branch connections.
- H. Comply with requirements for equipment specifications for roughing-in requirements.
- I. Conceal pipe installations in walls, pipe spaces, or utility spaces; above ceilings; below grade or floors; and in floor channels unless indicated to be exposed to view.
- J. Prohibited Locations:
 - 1. Do not install fuel-oil piping in or through HVAC ducts and plenums, clothes or trash chutes, chimneys or gas vents (flues), ventilating ducts, or dumbwaiter or elevator shafts.
 - 2. Do not install fuel-oil piping in solid walls or partitions.
- K. Use eccentric reducer fittings to make reductions in pipe sizes. Install fittings with level side down.

- L. Connect branch piping from top or side of horizontal piping.
- M. Install unions in pipes NPS 2 and smaller at final connection to each piece of equipment and elsewhere as indicated. Unions are not required on flanged devices.
- N. Do not use fuel-oil piping as grounding electrode.
- O. Install sleeves and sleeve seals for piping penetrations of walls, ceilings, and floors.
- P. Install escutcheons for piping penetrations of walls, ceilings, and floors of occupied spaces.

3.05 PIPING JOINT CONSTRUCTION

- A. Ream ends of pipes and tubes and remove burrs.
- B. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
- C. Threaded Joints: 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. Do not use Teflon tape.
 - 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.
- D. Welded Joints: Construct joints according to AWS D10.12/D10.12M, using qualified processes and welding operators according to "Quality Assurance" Article.
 - 1. Bevel plain ends of steel pipe.
 - 2. Patch factory-applied protective coating as recommended by manufacturer at field welds and where damage to coating occurs during construction.
- E. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tubing" Chapter.
- F. Flanged Joints: Install gasket material, size, type, and thickness for service application. Install gasket concentrically positioned.
- G. Flared Joints: Comply with SAE J513. Tighten finger tight then use wrench according to fitting manufacturer's written instructions. Do not overtighten.

3.06 CONNECTIONS

- A. Where installing piping adjacent to equipment, allow space for service and maintenance.
- B. Install unions, in piping NPS 2-1/2 and smaller, adjacent to each valve and at final connection to each piece of equipment having threaded pipe connection.
- C. Install flanges, in piping NPS 3 and larger, adjacent to flanged valves and at final connection to each piece of equipment having flanged pipe connection.
- D. Connect piping to equipment with shutoff valve and union. Install union between valve and equipment.

- E. Install flexible piping connectors at final connection to burners or oil-fired appliances.

3.07 LABELING AND IDENTIFYING

- A. Nameplates, pipe identification, valve tags, and signs are specified in "Identification for HVAC Piping and Equipment."

3.08 FIELD QUALITY CONTROL

- A. Pressure Test Piping: Minimum hydrostatic or pneumatic test-pressures measured at highest point in system:
 - 1. Fuel-Oil Distribution Piping: One and one-half times maximum working pressure with Minimum 5 psig for minimum 30 minutes.
 - 2. Suction Piping: Minimum 20 in. Hg for minimum 30 minutes.
 - 3. Isolate storage tanks if test pressure in piping will cause pressure in storage tanks to exceed 10 psig.
- B. Inspect and test fuel-oil piping according to NFPA 31, "Tests of Piping" Paragraph; and according to requirements of authorities having jurisdiction. Pressure test positive pressure piping. Vacuum test negative pressure piping.
- C. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- D. Bleed air from fuel-oil piping using manual air vents.
- E. Fuel-oil piping and equipment will be considered defective if it does not pass tests and inspections.
- F. Prepare test and inspection reports.

3.09 OUTDOOR PIPING SCHEDULE

- A. Aboveground fuel-oil piping shall be one of the following:
 - 1. NPS 2 and Smaller: Steel pipe, steel or malleable-iron threaded fittings, and threaded joints.
 - 2. NPS 2-1/2 and Larger: Steel pipe, steel welding fittings, and welded joints.

3.10 INDOOR PIPING SCHEDULE

- A. Aboveground fuel-oil piping shall be one of the following:
 - 1. NPS 1/2 to NPS 2: Steel pipe, steel or malleable-iron threaded fittings, and threaded joints.

2. NPS 2-1/2 and Larger: Steel pipe, steel fittings, and welded or flanged joints.

3.11 PIPE SUPPORT SPACING:

PIPE SIZE Inches	COPPER TUBING MAXIMUM HANGER SPACING Feet	STEEL PIPE MAXIMUM HANGER SPACING Feet	COPPER TUBING MINIMUM HANGER ROD DIAMETER Inches	STEEL PIPE MINIMUM HANGER ROD DIAMETER Inches
1/2	5	7	3/8	3/8
3/4	5	7	3/8	3/8
1	6	7	3/8	3/8
1-1/4	7	7	3/8	3/8

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