

SECTION 231113
FACILITY FUEL-OIL PIPING

PART 1 - GENERAL

1.1 STIPULATIONS

- A. The specifications sections "General Conditions of Contract", "Special Conditions", and "Division 1 – General Requirements" form a part of this section by this reference thereto, and shall have the same force and effect as if printed herewith in full.

1.2 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.3 SUMMARY

- A. This Section includes fuel-oil distribution systems and the following:
 - 1. Pipes, tubes, and fittings.
 - 2. Piping and tubing joining materials.
 - 3. Piping specialties.
 - 4. Valves.
 - 5. Mechanical sleeve seals.

1.4 DEFINITIONS

- A. AST: Aboveground storage tank.
- B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.
- C. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.
- D. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct shafts, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspace, and tunnels.
- E. FPM: Vinylidene fluoride-hexafluoropropylene copolymer rubber.
- F. FRP: Glass-fiber-reinforced plastic.

- G. UST: Underground storage tank.

1.5 PERFORMANCE REQUIREMENTS

- A. Maximum Operating-Pressure Ratings: 3-psig fuel-oil supply pressure at oil-fired appliances.
- B. Delegated Design: Design restraint and anchors for fuel-oil piping, ASTs, and equipment, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

1.6 SUBMITTALS

- A. Product Data: For each type of product indicated. Include construction details, material descriptions, and dimensions of individual components and profiles. Also include, where applicable, rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.
 - 1. Piping specialties.
 - 2. Valves: Include pressure rating, capacity, settings, and electrical connection data of selected models.
 - 3. Fuel-oil transfer pumps.
- B. Qualification Data: For qualified professional engineer.
- C. Welding certificates.
- D. Field quality-control reports.
- E. Operation and Maintenance Data: For fuel-oil equipment and accessories to include in emergency, operation, and maintenance manuals.
- F. Warranty: Sample of special warranty.

1.7 QUALITY ASSURANCE

- A. Steel Support Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
- B. Pipe Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.
- C. 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.
- D. Comply with ASME B31.9, "Building Services Piping," for fuel-oil piping materials, installation, testing, and inspecting.

- E. Comply with requirements of the EPA and of state and local authorities having jurisdiction. Include recording of fuel-oil storage tanks and monitoring of tanks and piping.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Lift and support fuel-oil storage tanks only at designated lifting or supporting points, as shown on Shop Drawings. Do not move or lift tanks unless empty.
- B. 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.
- C. Store pipes and tubes with protective PE coating to avoid damaging the coating and to protect from direct sunlight.
- D. Store PE pipes and valves protected from direct sunlight.

1.9 PROJECT CONDITIONS

- A. Interruption of Existing Fuel-Oil Service: Do not interrupt fuel-oil service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary fuel-oil supply according to requirements indicated:
 - 1. Notify Owner no fewer than two weeks days in advance of proposed interruption of fuel-oil service.
 - 2. Do not proceed with interruption of fuel-oil service without Owner's written permission.

PART 2 - PRODUCTS

2.1 PIPES, TUBES, AND FITTINGS

- A. See Part 3 piping schedule articles 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.
5. Protective Coating for Underground Piping: Factory-applied, three-layer coating of epoxy, adhesive, and PE.
- a. Joint Cover Kits: Epoxy paint, adhesive, and heat-shrink PE sleeves.

2.2 PIPING SPECIALTIES

A. Flexible Connectors: Comply with UL 567.

1. Metallic Connectors:

- a. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1) American Flexible Hose Co., Inc.
 - 2) Flexicraft Industries.
 - 3) FLEX-ING, Inc.
 - 4) Hose Master, Inc.
 - 5) Metraflex Company (The).
 - 6) Proco Products, Inc.
 - 7) Tru-Flex Metal Hose Corp.
 - 8) Unaflex.
 - 9) Or equal approved by the Professional.
- b. Listed and labeled for aboveground and underground applications by an NRTL acceptable to authorities having jurisdiction.
- c. Stainless-steel bellows with woven, flexible, bronze or stainless-steel, wire-reinforcing protective jacket.
- d. Minimum Operating Pressure: 150 psig.
- e. End Connections: Socket, flanged, or threaded end to match connected piping.
- f. Maximum Length: 30 inches.
- g. Swivel end, 50-psig maximum operating pressure.
- h. Factory-furnished anode.

B. Basket Strainers:

- 1. Body: ASTM A 126, Class B, high-tensile 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.
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.

2.3 JOINING MATERIALS

- A. Joint Compound and Tape: 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 Fiberglass Piping: As recommended by fiberglass piping manufacturer.

2.4 MANUAL FUEL-OIL SHUTOFF VALVES

- A. See valve schedule in Part 3 for where each valve type is applied in various services.
- B. General Requirements for Metallic Valves, NPS 2 and Smaller for Liquid Service: Comply with UL 842.
 1. CWP Rating: 125 psig.
 2. Threaded Ends: Comply with ASME B1.20.1.
 3. Dryseal Threads on Flare Ends: Comply with ASME B1.20.3.
 4. Tamperproof Feature: Locking feature for valves indicated in the valve schedule.
 5. Service Mark: Initials "WOG" shall be permanently marked on valve body.
- C. General Requirements for Metallic Valves, NPS 2-1/2 and Larger: Comply with UL 842.
 1. CWP Rating: 125 psig.
 2. Flanged Ends: Comply with ASME B16.5 for steel flanges.
 3. Tamperproof Feature: Locking feature for valves indicated in the valve schedule.
 4. Service Mark: Initials "WOG" shall be permanently marked on valve body.

D. One-Piece, Bronze Ball Valve with Bronze Trim: MSS SP-110.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. BrassCraft Manufacturing Company; a Masco company.
 - b. Conbraco Industries, Inc.; Apollo Div.
 - c. Lyall, R. W. & Company, Inc.
 - d. McDonald, A. Y. Mfg. Co.
 - e. Perfection Corporation; A Subsidiary of American Meter Company.
 - f. Or equal approved by the Professional.
2. Body: Bronze, complying with ASTM B 584.
3. Ball: Chrome-plated brass.
4. Stem: Bronze; blowout proof.
5. Seats: Reinforced TFE; blowout proof.
6. Packing: Separate packnut with adjustable-stem packing threaded ends.
7. Ends: Threaded, flared, or socket as indicated in the valve schedule.
8. CWP Rating: 600 psig.
9. Service Mark: Initials "WOG" shall be permanently marked on valve body.

E. Two-Piece, Full-Port, Bronze Ball Valves with Bronze Trim: MSS SP-110.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. BrassCraft Manufacturing Company; a Masco company.
 - b. Conbraco Industries, Inc.; Apollo Div.
 - c. Lyall, R. W. & Company, Inc.
 - d. McDonald, A. Y. Mfg. Co.
 - e. Perfection Corporation; A Subsidiary of American Meter Company.
 - f. Or equal approved by the Professional.
2. Body: Bronze, complying with ASTM B 584.
3. Ball: Chrome-plated bronze.
4. Stem: Bronze; blowout proof.
5. Seats: Reinforced TFE; blowout proof.
6. Packing: Threaded-body packnut design with adjustable-stem packing.
7. Ends: Threaded, flared, or socket as indicated in the valve schedule.
8. CWP Rating: 600 psig.
9. Service Mark: Initials "WOG" shall be permanently marked on valve body.

2.5 SPECIALTY VALVES

A. Pressure Relief Valves: Comply with UL 842.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

- a. Anderson Greenwood; Division of Tyco Flow Control.
 - b. Fulflo Specialties, Inc.
 - c. Webster Fuel Pumps & Valves; a division of Capital City Tool, Inc.
 - d. Or equal approved by the Professional.
 - 2. Listed and labeled for fuel-oil service by an NRTL acceptable to authorities having jurisdiction.
 - 3. Body: Brass, bronze, or cast steel.
 - 4. Springs: Stainless steel, interchangeable.
 - 5. Seat and Seal: Nitrile rubber.
 - 6. Orifice: Stainless steel, interchangeable.
 - 7. Factory-Applied Finish: Baked enamel.
 - 8. Maximum Inlet Pressure: 150 psig.
 - 9. Relief Pressure Setting: 60 psig.
- B. Oil Safety Valves: Comply with UL 842.
- 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Anderson Greenwood; Division of Tyco Flow Control.
 - b. Suntec Industries Incorporated.
 - c. Webster Fuel Pumps & Valves; a division of Capital City Tool, Inc.
 - d. Or equal approved by the Professional.
 - 2. Listed and labeled for fuel-oil service by an NRTL acceptable to authorities having jurisdiction.
 - 3. Body: Brass, bronze, or cast steel.
 - 4. Springs: Stainless steel.
 - 5. Seat and Diaphragm: Nitrile rubber.
 - 6. Orifice: Stainless steel, interchangeable.
 - 7. Factory-Applied Finish: Baked enamel.
 - 8. Manual override port.
 - 9. Maximum Inlet Pressure: 60 psig.
 - 10. Maximum Outlet Pressure: 3 psig.
- C. Emergency Shutoff Valves: Comply with UL 842.
- 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Ameron International; Fiberglass Pipe Group.
 - b. Conley Corporation.
 - c. EMCO Wheaton; a Gardner Denver Company.
 - d. Environ Products, Inc.
 - e. OPW.
 - f. Or equal approved by the Professional.

2. Listed and labeled for fuel-oil service by an NRTL acceptable to authorities having jurisdiction.
3. Double poppet valve.
4. Body: ASTM A 126, cast iron.
5. Disk: FPM.
6. Poppet Spring: Stainless steel.
7. Stem: Plated brass.
8. O-Ring: FPM.
9. Packing Nut: PTFE-coated brass.
10. Fusible link to close valve at 165 deg F (74 deg C).
11. Thermal relief to vent line pressure buildup due to fire.
12. Air test port.
13. Maximum Operating Pressure: 0.5 psig (3.45 kPa).

D. Mechanical Leak Detector: Comply with UL 842.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
2. Basis-of-Design Product: Subject to compliance with requirements, provide product comparable to product by one of the following:
 - a. FE Petro, Inc.
 - b. Red Jacket Pumps; a division of Veeder-Root.
 - c. Or equal approved by the Professional.
3. Listed and labeled for fuel-oil service by an NRTL acceptable to authorities having jurisdiction.
4. Body: ASTM A 126, cast iron.
5. O-Rings: Elastomeric compatible with fuel oil.
6. Piston and Stem Seals: PTFE.
7. Stem and Spring: Stainless steel.
8. Piston Cylinder: Burnished brass.
9. Indicated Leak Rate: Maximum 3 gph (3 mL/s) at 10 psig (69 kPa).
10. Leak Indication: Reduced flow.

2.6 If Project has more than one duplex or triplex fuel-oil transfer pump set, delete paragraph below and schedule pump sets on Drawings.

2.7 SLEEVES

- A. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized steel, plain ends.
- B. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop unless otherwise indicated.

2.8 MECHANICAL SLEEVE SEALS

- A. Description: Modular sealing element unit, designed for field assembly, to fill annular space between pipe and sleeve.
 - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Advance Products & Systems, Inc.
 - b. Calpico Inc.
 - c. Metraflex Company (The).
 - d. Pipeline Seal and Insulator, Inc.
 - e. Or equal approved by the Professional.
 - 2. Sealing Elements: EPDM interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe and sleeve.
 - 3. Pressure Plates: Carbon steel.
 - 4. Connecting Bolts and Nuts: Carbon steel with corrosion-resistant coating of length required to secure pressure plates to sealing elements. Include one nut and bolt for each sealing element.

2.9 ESCUTCHEONS

- A. General Requirements for Escutcheons: Manufactured wall and ceiling escutcheons and floor plates, with ID to fit around pipe or tube and with OD that completely covers opening.
- B. One-Piece, Deep-Pattern Escutcheons: Deep-drawn brass with polished chrome-plated finish.
- C. One-Piece, Cast-Brass Escutcheons: With set screw.
 - 1. Finish: Polished chrome-plated or rough brass.
- D. One-Piece, Floor-Plate Escutcheons: Cast-iron floor plate.
- E. Split-Casting, Floor-Plate Escutcheons: Cast brass with concealed hinge and set screw.

2.10 SOURCE QUALITY CONTROL

- A. Pressure test and inspect

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine roughing-in for fuel-oil piping system to verify actual locations of piping connections before equipment installation.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 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.

3.3 OUTDOOR PIPING INSTALLATION

- A. Steel Piping with Protective Coating:
 - 1. Apply joint cover kits to pipe after joining, to cover, seal, and protect joints.
 - 2. Repair damage to PE coating on pipe as recommended in writing by protective coating manufacturer. Review protective coating damage with Architect prior to repair.
 - 3. Replace pipe having damaged PE coating with new pipe.
- B. Install fittings for changes in direction in rigid pipe.
- C. Install system components with pressure rating equal to or greater than system operating pressure.
- D. Aboveground, Exterior-Wall Pipe Penetrations: Seal penetrations using steel pipe sleeves and mechanical sleeve seals. Install sleeve size to allow for 1-inch (25-mm) annular clear space between pipe and sleeve for installing mechanical sleeve seals.
- E. Mechanical Sleeve Seal Installation: Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.
- F. Install pressure gage on suction and discharge from each pump. Pressure gages are specified in Division 23 Section "Meters and Gages for HVAC Piping."

3.4 INDOOR PIPING INSTALLATION

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.

- 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 to allow 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. Install escutcheons for penetrations of walls, ceilings, and floors.
 - 1. New Piping:
 - a. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep-pattern type.
 - b. Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, stamped-steel type.
 - c. Piping in Unfinished Service Spaces: One-piece, cast-brass type with rough-brass finish.
 - d. Piping in Unfinished Service Spaces: One-piece, stamped-steel type with set screw.
 - e. Piping in Equipment Rooms: One-piece, cast-brass type.
 - f. Piping in Equipment Rooms: One-piece, stamped-steel type with set screw
 - g. Piping at Floor Penetrations in Equipment Rooms: One-piece, floor-plate type.
 - 2. Existing Piping:
 - a. Piping in Unfinished Service Spaces: Split-casting, cast-brass type with rough-brass finish.
 - b. Piping in Unfinished Service Spaces: Split-plate, stamped-steel type with concealed or exposed-rivet hinge and set screw or spring clips.
 - c. Piping in Equipment Rooms: Split-casting, cast-brass type.
 - d. Piping in Equipment Rooms: Split-plate, stamped-steel type with set screw or spring clips.
 - e. Piping at Floor Penetrations in Equipment Rooms: Split-casting, floor-plate type.
- I. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Comply with requirements in Division 07 Section "Penetration Firestopping."
- J. Verify final equipment locations for roughing-in.

- K. Comply with requirements for equipment specifications in Division 22 and Division 23 Sections for roughing-in requirements.
- L. 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.
- M. Prohibited Locations:
 - 1. Do not install fuel-oil piping in or through circulating air ducts, 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.
- N. Use eccentric reducer fittings to make reductions in pipe sizes. Install fittings with level side down.
- O. Connect branch piping from top or side of horizontal piping.
- P. 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.
- Q. Do not use fuel-oil piping as grounding electrode.
- R. Install basket strainer on inlet side of fuel-oil pump.

3.5 VALVE INSTALLATION

- A. Install manual fuel-oil shutoff valves on branch connections to fuel-oil appliance.
- B. Install valves in accessible locations.
- C. Protect valves from physical damage.
- D. Install metal tag attached with metal chain indicating fuel-oil piping systems.
- E. Identify valves as specified in Division 23 Section "Identification for HVAC Piping and Equipment."
- F. Install oil safety valves at inlet of each oil-fired appliance.
- G. Install pressure relief valves in distribution piping between the supply and return lines.
- H. Install one-piece, bronze ball valve with hose end connection at low points in fuel-oil piping.
- I. Install manual air vents at high points in fuel-oil piping.

3.6 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.
 - 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.

3.7 HANGER AND SUPPORT INSTALLATION

- A. Pipe hanger and support and equipment support materials and installation requirements are specified in Division 23 Section "Hangers and Supports for HVAC Piping and Equipment."
- B. Install hangers for horizontal steel piping with the following maximum spacing and minimum rod sizes:
 - 1. NPS 1-1/4 (DN 32) and Smaller: Maximum span, 84 inches; minimum rod size, 3/8 inch (10 mm).
 - 2. NPS 1-1/2 (DN 40): Maximum span, 108 inches; minimum rod size, 3/8 inch.
 - 3. NPS 2 (DN 50): Maximum span, 10 feet; minimum rod size, 3/8 inch.
 - 4. NPS 2-1/2: Maximum span, 11 feet; minimum rod size, 1/2 inch.
 - 5. NPS 3 (DN 80): Maximum span, 12 feet; minimum rod size, 1/2 inch.
 - 6. NPS 4 (DN 100): Maximum span, 13 feet (4 m); minimum rod size, 5/8 inch.
- C. Support vertical steel pipe at each floor and at spacing not greater than 15 feet.
- D. Install hangers for horizontal, drawn-temper copper tubing with the following maximum spacing and minimum rod sizes:
 - 1. NPS 3/4 and Smaller: Maximum span, 60 inches; minimum rod size, 3/8 inch.
 - 2. NPS 1: Maximum span, 72 inches; minimum rod size, 3/8 inch.
 - 3. NPS 1-1/4: Maximum span, 84 inches; minimum rod size, 3/8 inch.
 - 4. NPS 1-1/2 and NPS 2: Maximum span, 96 inches; minimum rod size, 3/8 inch. 2-1/2: Maximum span, 108 inches; minimum rod size, 1/2 inch.
 - 5. NPS 3: Maximum span, 10 feet; minimum rod size, 1/2 inch.
 - 6. NPS 4: Maximum span, 11 feet; minimum rod size, 5/8 inch.

- E. Support vertical copper tube at each floor and at spacing not greater than 10 feet.

3.8 CONNECTIONS

- A. Install piping adjacent to equipment to allow service and maintenance.
- B. Install unions, in piping NPS 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 2-1/2 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 ball valve and union. Install union between valve and equipment.
- E. Install flexible piping connectors at final connection to burners or oil-fired appliances that must be moved for maintenance access.

3.9 LABELING AND IDENTIFYING

- A. Nameplates, pipe identification, and signs are specified in Division 23 Section "Identification for HVAC Piping and Equipment."
- B. Equipment Nameplates and Signs: Install engraved plastic-laminate equipment nameplates and signs on or near each service regulator, service meter.
 - 1. Text: In addition to identifying unit, distinguish between multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations.

3.10 FIELD PAINTING OF ABOVEGROUND PIPING

- A. Comply with requirements in Division 09 painting Sections for painting interior and exterior fuel-oil piping.
- B. Paint exposed, exterior metal piping, valves, and piping specialties, except components with factory-applied paint or protective coating.
 - 1. Alkyd System: MPI EXT 5.1D.
 - a. Prime Coat: Alkyd anticorrosive metal primer.
 - b. Intermediate Coat: Exterior alkyd enamel matching topcoat.
 - c. Topcoat: Exterior alkyd enamel (flat).
 - d. Color: Maroon.
- C. Paint exposed, interior metal piping, valves, and piping specialties, except components with factory-applied paint or protective coating.
 - 1. Latex Over Alkyd Primer System: MPI INT 5.1Q.

- a. Prime Coat: Alkyd anticorrosive metal primer.
 - b. Intermediate Coat: Interior latex matching topcoat.
 - c. Topcoat: Interior latex (flat).
 - d. Color: Maroon.
- D. Damage and Touchup: Repair marred and damaged factory-applied finishes with materials and by procedures to match original factory finish.

3.11 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.
- B. Perform tests and inspections.
 - 1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
- C. Tests and Inspections:
 - 1. Piping: Minimum hydrostatic or pneumatic test-pressures measured at highest point in system:
 - a. Fuel-Oil Distribution Piping: Minimum 5 psig for minimum 30 minutes.
 - b. Suction Piping: Minimum 20-in. Hg for minimum 30 minutes.
 - c. Isolate storage tanks if test pressure in piping will cause pressure in storage tanks to exceed 10 psig.
 - 2. Inspect and test fuel-oil piping according to NFPA 31, "Tests of Piping" Paragraph; and according to requirements of authorities having jurisdiction.
 - 3. Test liquid-level gage for accuracy by manually measuring fuel-oil levels at not less than three different depths while filling tank and checking against gage indication.
 - 4. Test leak-detection and monitoring system for accuracy by manually operating sensors and checking against alarm panel indication.
 - 5. Start fuel-oil transfer pumps to verify for proper operation of pump and check for leaks.
 - 6. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
 - 7. Bleed air from fuel-oil piping using manual air vents.
- D. Fuel-oil piping and equipment will be considered defective if it does not pass tests and inspections.
- E. Prepare test and inspection reports.

3.12 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.

3.13 INDOOR PIPING SCHEDULE

- A. Aboveground fuel-oil piping shall be[one of] the following:
 - 1. NPS 1/2 and Smaller: Steel pipe, steel or malleable-iron threaded fittings, and threaded joints.
 - 2. NPS 5/8 to NPS 2: Steel pipe, steel or malleable-iron threaded fittings, and threaded joints.
 - 3. NPS 2-1/2 and Larger: Steel pipe, steel fittings, and welded or flanged joints.
 - 4. Steel pipe with malleable-iron fittings and threaded joints.
 - 5. Steel pipe with wrought-steel fittings and welded joints.

3.14 ABOVEGROUND MANUAL FUEL-OIL SHUTOFF VALVE SCHEDULE

- A. Distribution piping valves for pipe NPS 2 and smaller shall be one of the following:
 - 1. One-piece, bronze ball valve with bronze trim.
 - 2. Two-piece, full-port, bronze ball valves with bronze trim.
- B. Distribution piping valves for pipe NPS 2-1/2 and larger shall be one of the following:
 - 1. Two-piece, full-port, bronze ball valves with bronze trim.
 - 2. Bronze, nonlubricated plug valve.
- C. Valves in branch piping for single appliance shall be the following:
 - 1. One-piece, bronze ball valve with bronze trim.

END OF SECTION 231113