SECTION 231113 - FACILITY FUEL-OIL PIPING

Revise this Section by deleting and inserting text to meet Project-specific requirements.

This Section uses the term "Architect." Change this term to match that used to identify the design professional as defined in the General and Supplementary Conditions.

Verify that Section titles referenced in this Section are correct for this Project's Specifications; Section titles may have changed.

1. GENERAL
   * + 1. RELATED DOCUMENTS

Retain or delete this article in all Sections of Project Manual.

* + - * 1. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
      1. SUMMARY
         1. Section Includes:

Fuel-oil pipes, tubes, and fittings.

Double-containment pipe and fittings.

Piping specialties.

Joining materials.

Specialty valves.

Mechanical leak-detection valves.

Leak-detection and monitoring system.

Labels and identification.

* + - 1. DEFINITIONS

Retain terms that remain after this Section has been edited for a project.

* + - * 1. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.
        2. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.
        3. 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, crawlspaces, and tunnels.
      1. SUBMITTALS
         1. Submittals for this section are subject to the re-evaluation fee identified in Article 4 of the General Conditions.
         2. Manufacturer’s installation instructions shall be provided along with product data.
         3. Submittals shall be provided in the order in which they are specified and tabbed (for combined submittals).
         4. Product Data: For each type of product.

Include construction details, material descriptions, and dimensions of individual components and profiles.

Include, where applicable, rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

For valves, include pressure rating, capacity, settings, and electrical connection data of selected models.

USE PARAGRAPH BELOW WITH EPD REQUIREMENT WHEN PROJECT ESTIMATE IS $1M OR MORE.

* + - * 1. Submit an Environmental Product Declaration (EPD) from the manufacturer for steel pipe within this specification section, if available. A statement of the contractor’s good faith effort to obtain the EPD shall be provided if not available.

Manufacturer-provided EPDs must be Product Specific Type III (Third-Party Reviewed), in adherence with ISO 14025 *Environmental labels and declarations*, ISO 14044 *Environmental management – Life cycle assessment*, and ISO 21930 *Core rules for environmental product declarations of construction products and services.*

* + - * 1. Shop Drawings: For fuel-oil piping.

Include plans, elevations sections, hangers, and supports for multiple pipes.

Include details of location of anchors, alignment guides, and expansion joints and loops.

Scale: [**1/4 inch per foot] <Insert scale**>.

Retain "Delegated-Design Submittal" Paragraph below if design services have been delegated to Contractor. If design was finished during design phase, by design professionals, and incorporated in the contract documents, remove "calculation", "analysis data" and "signed and sealed by the professional engineer" requirements.

For acceptable reason, if full design isn’t being provided during design phase, delegated design submittal, including calculations, shall be provided by the contractor per this paragraph.

* + - * 1. Delegated-Design Submittal: For fuel-oil piping indicated to comply with performance requirements and design criteria.

Include analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

Detail fabrication and assembly of anchors and seismic restraints.

Design Calculations: Calculate requirements for selecting seismic restraints.

Detail fabrication and assembly of pipe anchors, hangers, supports for multiple pipes, and attachments of the same to building structure.

Retain "Coordination Drawings" paragraph below for situations where limited space necessitates maximum utilization for efficient installation of different components or if coordination is required for installation of products and materials by separate installers. Coordinate paragraph with other Sections specifying products listed below. Preparation of coordination drawings requires the participation of each trade involved in installations within the limited space.

* + - * 1. 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.

Site Survey: Plans, drawn to scale, on which fuel-oil piping and tanks are shown and coordinated with other services and utilities.

Retain "Brazing certificates" paragraph below if retaining procedures for brazing certification in "Quality Assurance" Article.

* + - * 1. Brazing certificates.

Retain "Welding certificates" paragraph below if retaining procedures for welder certification in "Quality Assurance" Article.

* + - * 1. Welding certificates.

Retain "Field quality-control reports" paragraph below if Contractor is responsible for field quality-control testing and inspecting.

* + - * 1. Field quality-control reports.
        2. Sample Warranty: For special warranty.
      1. CLOSEOUT SUBMITTALS
         1. Operation and Maintenance Data: For fuel-oil equipment and accessories to include in emergency, operation, and maintenance manuals.
      2. MAINTENANCE MATERIAL SUBMITTALS
         1. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
      3. QUALITY ASSURANCE

Retain "Brazing certificates" paragraph in "Informational Submittals" Article if retaining "Brazing" paragraph below.

* + - * 1. Brazing: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX.

Retain one or both of "Steel Support Welding Qualifications" and "Pipe Welding Qualifications" paragraphs below for welding supports. Retain first paragraph for welded piping supports; retain second for welded steel pipe joints. Also retain "Welding certificates" paragraph in "Informational Submittals" Article.

* + - * 1. Steel Support Welding Qualifications: Qualify procedures and personnel according to AWS D1.1, "Structural Welding Code - Steel."
        2. Pipe Welding Qualifications: Qualify procedures and personnel according to ASME Boiler and Pressure Vessel Code.
      1. DELIVERY, STORAGE, AND HANDLING
         1. 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.
         2. 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.
         3. Store pipes and tubes with protective PE coating to avoid damaging the coating and to protect from direct sunlight.
         4. Store PE pipes and valves protected from direct sunlight.
      2. FIELD CONDITIONS

Retain this article if interruption of existing fuel-oil service is required.

* + - * 1. Interruption of Existing Fuel-Oil Service: Do not interrupt fuel-oil service to facilities occupied by Director’s Representative or others unless permitted under the following conditions and then only after arranging to provide temporary fuel-oil supply according to requirements indicated:

Notify [**Director’s Representative**] no fewer than [**two] <Insert number**> days in advance of proposed interruption of fuel-oil service.

Do not proceed with interruption of fuel-oil service [**Director’s Representative's**] written permission.

* + - 1. WARRANTY

When warranties are required, verify with Director’s Representative that warranties stated in this article are not less than remedies available to Owner under prevailing local laws.

* + - * 1. Special Warranty: Manufacturer agrees to repair or replace components of flexible, double-containment piping and related equipment that fail in materials or workmanship within specified warranty period.

Failures due to defective materials or workmanship for materials including piping, dispenser sumps, water-tight sump entry boots, terminations, and other end fittings.

Verify available warranties and warranty periods for double-containment piping.

Warranty Period: [**10] [30] <Insert number**> years from date of Substantial Completion.

1. PRODUCTS

Manufacturers and products listed in SpecAgent and MasterWorks Paragraph Builder are neither recommended nor endorsed by the AIA or Deltek. Before inserting names, verify that manufacturers and products listed there comply with requirements retained or revised in descriptions and are both available and suitable for the intended applications.

* + - 1. SYSTEM DESCRIPTION
         1. 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.
         2. Comply with ASME B31.9, "Building Services Piping," for fuel-oil piping materials, installation, testing, and inspecting.
         3. Fuel-Oil Valves: Comply with UL 842 and have service mark initials "WOG" permanently marked on valve body.
         4. Comply with requirements of the EPA and of state and local authorities having jurisdiction. Include recording of fuel-oil piping.
      2. PERFORMANCE REQUIREMENTS
         1. Maximum Operating-Pressure Ratings: 3-psig fuel-oil supply pressure at oil-fired appliances.

Retain "Delegated Design" paragraph below if Contractor is required to assume responsibility for design.

* + - 1. FUEL-OIL PIPES, TUBES, AND FITTINGS

This article includes examples of materials listed in NFPA 30, "Flammable and Combustible Liquids Code." Coordinate piping materials in this article with piping schedules in Part 3. See "Writing Guide" Article in the Evaluations for a discussion of how this Section is organized and the most efficient way to edit this Section.

* + - * 1. See "Outdoor Piping Installation" and "Indoor Piping Installation" articles for where pipes, tubes, fittings, and joining materials are applied in various services.
        2. Steel Pipe: ASTM A53, black steel, Schedule 40, Type E or S, Grade B.

Malleable-Iron Threaded Fittings: ASME B16.3, Class 150, standard pattern.

Wrought-Steel Welding Fittings: ASTM A234, for butt and socket welding.

Unions: ASME B16.39, Class 150, malleable iron with brass-to-iron seat, ground joint, and threaded ends.

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:

Material Group: 1.1.

End Connections: Threaded or butt welding to match pipe.

Lapped Face: Not permitted underground.

Gasket Materials: Asbestos free, ASME B16.20 metallic, or ASME B16.21 nonmetallic, gaskets compatible with fuel oil.

Bolts and Nuts: ASME B18.2.1, cadmium-plated steel.

Retain "Protective Coating for Underground Piping" subparagraph below for underground steel pipe. Cathodic protection may be required in addition to protective coating. Coordinate with requirements in Section 134713 "Cathodic Protection."

Protective Coating for Underground Piping: Factory-applied, three-layer coating of epoxy, adhesive, and PE.

Joint Cover Kits: Epoxy paint, adhesive, and heat-shrink PE sleeves.

* + - * 1. Drawn-Temper Copper Tube: Comply with [**ASTM B88, Type K] [ASTM B88, Type L].**

Copper Fittings: ASME B16.22, wrought copper, streamlined pattern.

Bronze Flanges and Flanged Fittings: ASME B16.24, Class 150.

Gasket Material: Asbestos free, ASME B16.20 metallic or ASME B16.21 nonmetallic, gaskets compatible with fuel oil.

Bolts and Nuts: ASME B18.2.1, cadmium-plated steel.

* + - * 1. Annealed-Temper Copper Tube: Comply with [ASTM B88, Type K] [ASTM B88, Type L].

Copper Fittings: ASME B16.22, wrought copper, streamlined pattern.

Verify acceptability of fittings in subparagraph below with authorities having jurisdiction before retaining.

Flare Fittings: Comply with ASME B16.26 and SAE J513.

Copper fittings with long nuts.

Metal-to-metal compression seal without gasket.

Dryseal threads complying with ASME B1.20.3.

* + - 1. DOUBLE-CONTAINMENT PIPE AND FITTINGS
         1. Flexible, Nonmetallic, Double-Containment Piping: Comply with UL 971.

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:

OPW Fueling Components; Dover Company.

Altaflo LLC

OmegaFlex, Inc.

Approved equivalent.

Pipe Materials: PVDF complying with ASTM D3222 for carrier pipe with mechanical couplings to seal carrier, and PE pipe complying with ASTM D4976 for containment piping.

[**Fiberglass] [PE**] sumps.

Watertight sump entry boots, pipe adapters with test ports and tubes, coaxial fittings, and couplings.

Minimum Operating Pressure Rating: 10 psig.

Plastic to Steel Pipe Transition Fittings: Factory-fabricated fittings with plastic end matching or compatible with carrier piping, and steel pipe end complying with ASTM A53, black steel, Schedule 40, Type E or S, Grade B.

Retain subparagraph below if double-containment piping will have cable leak-detection system installed in annular space.

Include design and fabrication of double-containment pipe and fitting assemblies with provision for field installation of cable leak-detection system in annular space between carrier and containment piping.

* + - * 1. Flexible, Metallic, Double-Containment Piping: Comply with UL 971A.

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:

Omega Flex, Inc.

OPW Fueling Components; Dover Company.

Rovanco Piping Systems

Approved equivalent.

Pipe Materials:

Metallic Lining: ASTM A240 [**Type 304] [Type 316**] corrugated stainless steel tubing.

Carrier Pipe: Fluoropolymer tube.

Jacket: UV stabilized.

Watertight sump entry boots, pipe adapters with test ports and tubes, coaxial fittings, and couplings.

Minimum Operating Pressure Rating: 10 psig.

Plastic to Steel Pipe Transition Fittings: Factory-fabricated fittings with plastic end matching or compatible with carrier piping, and steel pipe end complying with ASTM A53, black steel, Schedule 40, Type E or S, Grade B.

Retain subparagraph below if double-containment piping will have cable leak-detection system installed in annular space.

Include design and fabrication of double-containment pipe and fitting assemblies with provision for field installation of cable leak-detection system in annular space between carrier and containment piping.

* + - * 1. Rigid, Double-Containment Piping: Comply with UL 971.

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:

Ameron; a National Oilwell Varco brand.

Conley Corporation.

PermAlert.

Smith Fiberglass; a National Oilwell Varco brand.

Tricon Piping Systems, Inc.

Approved equivalent.

RTRP: ASTM D2996 or ASTM D2997 carrier and containment piping and mechanical couplings to seal carrier and containment piping or individually bonded joints.

Minimum Operating-Pressure Rating for RTRP NPS 2 and NPS 3: 150 psig.

Minimum Operating-Pressure Rating for RTRP NPS 4 and NPS 6: 125 psig. Compliance with UL 971 is not required for NPS 6 and larger piping.

Fittings: RTRF complying with ASTM D2996 or ASTM D2997 and made by RTRP manufacturer; watertight sump entry boots, termination, or other end fittings.

Retain "Leak-Detection System" subparagraph below if double-containment piping will have cable leak-detection system installed in annular space.

Leak-Detection System: Include design and fabrication of double-containment pipe and fitting assemblies with provision for field installation of cable leak-detection system in annular space between carrier and containment piping.

* + - 1. PIPING SPECIALTIES
         1. Metallic Flexible Connectors:

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:

American Flexible Hose Co., Inc.

Flexicraft Industries.

FLEX-ING, Inc.

Hose Master, Inc.

Metraflex Company (The).

Proco Products, Inc.

Tru-Flex Metal Hose Corp.

Unaflex.

Approved equivalent.

Flexible connectors in first subparagraph below are listed and labeled for fuel-oil service by an NRTL acceptable to authorities having jurisdiction, but there is no UL-applicable standard.

Listed and labeled for aboveground and underground applications by an NRTL acceptable to authorities having jurisdiction.

Stainless-steel bellows with woven, flexible, bronze or stainless-steel, wire-reinforcing protective jacket.

Minimum Operating Pressure: 150 psig.

End Connections: Socket, flanged, or threaded end to match connected piping.

Maximum Length: 30 inches

Items in first two subparagraphs below are optional features.

Swivel end, 50-psig maximum operating pressure.

Factory-furnished anode for connection to cathodic protection.

* + - * 1. Nonmetallic Flexible Connectors:

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:

American Flexible Hose Co., Inc.

Flexicraft Industries.

FLEX-ING, Inc.

Tru-Flex Metal Hose Corp.

Approved equivalent.

Flexible connectors in first subparagraph below are listed and labeled for fuel-oil service by an NRTL acceptable to authorities having jurisdiction, but there is no UL-applicable standard.

Listed and labeled for underground applications by an NRTL acceptable to authorities having jurisdiction.

PFTE bellows with woven, flexible, bronze or stainless-steel, wire-reinforcing protective jacket.

Minimum Operating Pressure: 150 psig.

End Connections: Socket, flanged, or threaded end to match connected piping.

Maximum Length: 30 inches

Items in subparagraphs below are optional features.

Swivel end, 50-psig maximum operating pressure.

Factory-furnished anode.

Retain one or more of first three paragraphs below. If retaining more than one type of strainer, indicate location of each type on Drawings.

* + - * 1. Y-Pattern Strainers:

Body: ASTM A126, Class B, cast iron with bolted cover and bottom drain connection.

End Connections: Threaded ends for NPS 2 and smaller; flanged ends for NPS 2-1/2 and larger.

Strainer Screen: [60] [80]-mesh startup strainer and perforated stainless-steel basket with 50 percent free area.

CWP Rating: 125 psig.

* + - * 1. Basket Strainers:

Body: ASTM A126, Class B, high-tensile cast iron with bolted cover and bottom drain connection.

End Connections: Threaded ends for NPS 2 and smaller; flanged ends for NPS 2-1/2 and larger.

Strainer Screen: [60] [80]-mesh startup strainer and perforated stainless-steel basket with 50 percent free area.

CWP Rating: 125 psig.

* + - * 1. T-Pattern Strainers:

Body: Ductile or malleable iron with removable access coupling and end cap for strainer maintenance.

End Connections: Grooved ends.

Strainer Screen: [60] [80]-mesh startup strainer and perforated stainless-steel basket with 57 percent free area.

CWP Rating: 750 psig.

* + - * 1. Manual Air Vents:

Body: Bronze.

Internal Parts: Nonferrous.

Operator: Screwdriver or thumbscrew.

Inlet Connection: NPS 1/2.

Discharge Connection: NPS 1/8.

CWP Rating: 150 psig.

Maximum Operating Temperature: 225 deg F.

* + - 1. JOINING MATERIALS
         1. Joint Compound and Tape for Threaded Joints: Suitable for fuel oil.
         2. Welding Filler Metals: Comply with AWS D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.
         3. Brazing Filler Metals: Alloy with melting point greater than 1000 deg F complying with AWS A5.8. Brazing alloys containing more than 0.05 percent phosphorus are prohibited.
         4. Bonding Adhesive for RTRP and RTRF: As recommended by piping and fitting manufacturer.
      2. SPECIALTY VALVES
         1. Pressure Relief Valves:

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:

Anderson Greenwood; Pentair, Ltd.

Fulflo Specialties, Inc.

OPW Engineered Systems; OPW Fluid Transfer Group; a Dover company.

Webster Fuel Pumps & Valves; a division of Capital City Tool, Inc.

Approved equivalent.

Retain first subparagraph below to require listed and labeled for fuel-oil service by an NRTL acceptable to authorities having jurisdiction, but there is no UL-applicable standard.

Listed and labeled for fuel-oil service by an NRTL acceptable to authorities having jurisdiction.

Body: Brass, bronze, or cast steel.

Springs: Stainless steel, interchangeable.

Seat and Seal: Nitrile rubber.

Orifice: Stainless steel, interchangeable.

Factory-Applied Finish: Baked enamel.

Maximum Inlet Pressure**: [150 psig] <Insert pressure**>.

Relief Pressure Setting: [**60 psig] <Insert pressure**>.

* + - * 1. Oil Safety Valves:

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:

Anderson Greenwood; Pentair, Ltd.

Fulflo Specialties, Inc.

OPW Engineered Systems; OPW Fluid Transfer Group; a Dover company.

Webster Fuel Pumps & Valves; a division of Capital City Tool, Inc.

Approved equivalent.

Retain first subparagraph below to require listed and labeled for fuel-oil service by an NRTL acceptable to authorities having jurisdiction, but there is no UL-applicable standard.

Listed and labeled for fuel-oil service by an NRTL acceptable to authorities having jurisdiction.

Body: Brass, bronze, or cast steel.

Springs: Stainless steel.

Seat and Diaphragm: Nitrile rubber.

Orifice: Stainless steel, interchangeable.

Factory-Applied Finish: Baked enamel.

Manual override port.

Maximum Inlet Pressure: [**60 psig] <Insert pressure**>.

Maximum Outlet Pressure: [**3 psig] <Insert pressure**>.

Retain "Emergency Shutoff Valves" paragraph below for piping terminations under fuel dispenser that will close in case of mechanical damage or fire.

* + - * 1. Emergency Shutoff Valves:

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:

EMCO Wheaton.

Franklin Fueling Systems.

OPW Engineered Systems; OPW Fluid Transfer Group; a Dover company.

Approved equivalent.

Retain first subparagraph below to require listed and labeled for fuel-oil service by an NRTL acceptable to authorities having jurisdiction, but there is no UL-applicable standard.

Listed and labeled for fuel-oil service by an NRTL acceptable to authorities having jurisdiction.

[**Single] [Double**] poppet valve.

Body: ASTM A126, cast iron.

Disk: FPM.

Poppet Spring: Stainless steel.

Stem: Plated brass.

O-Ring: FPM.

Packing Nut: PTFE-coated brass.

Fusible link to close valve at 165 deg F.

Thermal relief to vent line pressure buildup due to fire.

Air test port.

Maximum Operating Pressure: 0.5 psig.

* + - 1. MECHANICAL LEAK-DETECTION VALVES

Retain this article for diesel-fuel-oil dispenser piping.

* + - * 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:

Franklin Fueling Systems.

Grainger Industrial Supply

Red Jacket Pumps.

Approved equivalent.

Retain first paragraph below to require listed and labeled for fuel-oil service by an NRTL acceptable to authorities having jurisdiction, but there is no UL-applicable standard.

* + - * 1. Listed and labeled for fuel-oil service by an NRTL acceptable to authorities having jurisdiction.
        2. Body: ASTM A126, cast iron.
        3. O-Rings: Elastomeric compatible with fuel oil.
        4. Piston and Stem Seals: PTFE.
        5. Stem and Spring: Stainless steel.
        6. Piston Cylinder: Burnished brass.
        7. Indicated Leak Rate: Maximum 3 gph at 10 psig.
        8. Leak Indication: Reduced flow.
      1. LEAK-DETECTION AND MONITORING SYSTEM
         1. Cable and Sensor System: Comply with UL 1238.

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:

Caldwell Systems Corporation.

Containment Solutions, Inc.

Franklin Fueling Systems.

Gems Sensors & Controls, Inc.

Highland Tank & Manufacturing Company, Inc.

INCON, Inc.

Approved equivalent.

Calibrated leak-detection and monitoring system with probes and other sensors and remote alarm panel for fuel-oil piping.

Include fittings and devices required for testing.

* + - 1. LABELS AND IDENTIFICATION
         1. 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. EXECUTION
   * + 1. EXAMINATION
          1. Examine areas for compliance with requirements for installation tolerances and other conditions affecting performance of fuel-oil piping.
          2. Examine installation of fuel-burning equipment and fuel-handling and storage equipment to verify actual locations of piping connections before installing fuel-oil piping.
          3. Proceed with installation only after unsatisfactory conditions have been corrected.
       2. EARTHWORK
          1. Comply with requirements in Section 312000 "Earth Moving" for excavating, trenching, and backfilling.
       3. PREPARATION

Retain first paragraph below for renovations and additions.

* + - * 1. Close equipment shutoff valves before turning off fuel oil to premises or piping section.
        2. Comply with NFPA 30 and NFPA 31 requirements for prevention of accidental ignition.
      1. INSTALLATION OF OUTDOOR PIPING

NFPA 30 requires a minimum of 18 inches of compacted backfill, 8 inches under asphalt 2 inches thick, or 4 inches under 4 inches of reinforced concrete in areas subject to vehicle traffic; 6 inches of compacted backfill in areas without traffic. Deeper installations may be required or recommended by pipe and equipment manufacturers where frost conditions may occur.

* + - * 1. Install Underground Fuel-Oil Piping Buried:

Under Compacted Backfill: [**18 inches] <Insert dimension**> below finished grade.

Under Asphalt 2 Inches Thick: 8 inches below bottom of asphalt.

Under 4 Inches of Reinforced Concrete in Areas Subject to Vehicle Traffic: 4 inches below bottom of concrete.

If fuel-oil piping is installed with less than [12 inches] <Insert dimension> of cover to finished grade, install in containment piping.

* + - * 1. Steel Piping with Protective Coating:

Apply joint cover kits to pipe after joining, to cover, seal, and protect joints.

Retain one of two subparagraphs below. Verify acceptability of repaired coating systems with authorities having jurisdiction.

Repair damage to PE coating on pipe as recommended in writing by protective coating manufacturer. Review protective coating damage with Director’s Representative prior to repair.

Replace pipe having damaged PE coating with new pipe.

* + - * 1. Install double-containment, fuel-oil pipe at a minimum slope of 1 percent downward toward fuel-oil storage tank sump.
        2. Install vent pipe at a minimum slope of 2 percent downward toward fuel-oil storage tank sump.
        3. Assemble and install entry boots for pipe penetrations through sump sidewalls for liquid-tight joints.
        4. Install metal pipes and tubes, fittings, valves, and flexible connectors at piping connections to AST and UST.
        5. Install fittings for changes in direction in rigid pipe.
        6. Install system components with pressure rating equal to or greater than system operating pressure.
      1. INSTALLATION OF INDOOR PIPING
         1. 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 on Coordination Drawings.
         2. Arrange for pipe spaces, chases, slots, sleeves, and openings in building structure during progress of construction to allow for mechanical installations.
         3. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.
         4. 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.
         5. Install piping above accessible ceilings at a height that allows sufficient space for ceiling panel removal.
         6. Install piping free of sags and bends.
         7. Install fittings for changes in direction and branch connections.
         8. Comply with requirements for equipment specifications for roughing-in requirements.
         9. 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.
         10. Prohibited Locations:

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.

Do not install fuel-oil piping in solid walls or partitions.

* + - * 1. Use eccentric reducer fittings to make reductions in pipe sizes. Install fittings with level side down.
        2. Connect branch piping from top or side of horizontal piping.
        3. 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.
        4. Do not use fuel-oil piping as grounding electrode.
        5. Install sleeves and sleeve seals for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 230517 "Sleeves and Sleeve Seals for HVAC Piping."
        6. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 230518 "Escutcheons for HVAC Piping."
      1. INSTALLATION OF VALVES
         1. Install manual fuel-oil shutoff valves on branch connections to fuel-oil appliance.
         2. Install valves in accessible locations.

Coordinate Oil safety valve selection and design requirements with system design and paragraph below as oil safety valves are not available for large boilers (oil flow over 70 gph).

* + - * 1. Install oil safety valves at inlet of each oil-fired appliance.
        2. Install pressure relief valves in distribution piping between the supply and return lines.
        3. Install one-piece, bronze ball valve with hose end connection at low points in fuel-oil piping. Comply with requirements in Section 230523.12 "Ball Valves for HVAC Piping."
        4. Install manual air vents at high points in fuel-oil piping.

Retain paragraph below for systems with fuel-oil or diesel-fuel-oil dispensers.

* + - * 1. Install emergency shutoff valves at dispensers.
      1. PIPING JOINT CONSTRUCTION
         1. Ream ends of pipes and tubes and remove burrs.
         2. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
         3. 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:

Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.

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.

* + - * 1. Welded Joints: Construct joints according to AWS D10.12, using qualified processes and welding operators according to "Quality Assurance" Article.

Bevel plain ends of steel pipe.

Patch factory-applied protective coating as recommended by manufacturer at field welds and where damage to coating occurs during construction.

* + - * 1. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tubing" Chapter.
        2. Flanged Joints: Install gasket material, size, type, and thickness for service application. Install gasket concentrically positioned.
        3. Flared Joints: Comply with SAE J513. Tighten finger tight then use wrench according to fitting manufacturer's written instructions. Do not overtighten.
        4. Fiberglass-Bonded Joints: Prepare pipe ends and fittings, apply adhesive, and join according to pipe manufacturer's written instructions.
      1. INSTALLATION OF HANGERS AND SUPPORTS

Retain first paragraph below for projects in areas that require seismic restraints.

* + - * 1. Comply with requirements for seismic-restraint devices specified in Section 230548 "Vibration and Seismic Controls for HVAC."
        2. Comply with requirements for hangers, supports, and anchor devices specified in Section 230529 "Hangers and Supports for HVAC Piping and Equipment."
        3. Install hangers for [**steel piping] [and] [copper tubing**], with maximum horizontal spacing and minimum rod diameters, to comply with MSS-58, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.
        4. Support horizontal piping within [**12 inches] <Insert dimension**> of each fitting and coupling.
        5. Support vertical runs of [**copper tube] [and] [steel piping**] to comply with MSS-58, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.
        6. Interval of Support

Piping shall be supported at distances not exceeding the spacing specified in Table below, or in accordance with ANSI/MSS SP-58.

|  |  |  |
| --- | --- | --- |
| PIPING MATERIAL | MAXIMUM HORIZONTAL SPACING (feet) | MAXIMUM VERTICAL SPACING (feet) |
| Copper or copper-alloy pipe | 12 | 10 |
| Copper or copper-alloy tubing | 8 | 10 |
| Steel tubing | 8 | 10 |
| Steel pipe | 12 | 15 |

* + - 1. INSTALLATION OF LEAK-DETECTION AND MONITORING SYSTEM

Coordinate this article with fuel-oil storage tank and piping.

* + - * 1. Install leak-detection and monitoring system. Install alarm panel inside building where indicated.

Float-type probes at piping low points, if required, are used most often. Cable sensors are also available.

* + - * 1. Double-Containment, Fuel-Oil Piping: Install leak-detection sensor [**probes at low points in piping] [cable probes in interstitial space of double-containment piping**].
      1. CONNECTIONS

Coordinate piping installations and specialty arrangements with schematics on Drawings and with requirements specified. If Drawings are explicit enough, these requirements may be reduced or omitted.

* + - * 1. Where installing piping adjacent to equipment, allow space for service and maintenance.
        2. 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.
        3. 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.
        4. Connect piping to equipment with shutoff valve and union. Install union between valve and equipment.
        5. Install flexible piping connectors at final connection to burners or oil-fired appliances.
      1. LABELING AND IDENTIFYING

Retain one of first two paragraphs below.

* + - * 1. Nameplates, pipe identification, valve tags, and signs are specified in Section 230553 "Identification for HVAC Piping and Equipment."
        2. Equipment Nameplates and Signs: Install engraved plastic-laminate equipment nameplates and signs on or near each service regulator, service meter, and earthquake valve.

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.

Coordinate dimensions in paragraph below with depth of bury for fuel-oil piping.

* + - * 1. Install detectable warning tape directly above fuel-oil piping, [**12 inches] <Insert dimension**> below finished grade, except **[6 inches] <Insert dimension**> below subgrade under pavements and slabs. Terminate tracer wire in an accessible area, and identify as "tracer wire" for future use with plastic-laminate sign.

Piping: Over underground fuel-oil distribution piping.

* + - 1. FIELD QUALITY CONTROL

Pipe test pressures in this article are required by NFPA 31. Verify requirements with authorities having jurisdiction.

* + - * 1. Pressure Test Piping: Minimum hydrostatic or pneumatic test-pressures measured at highest point in system:

Fuel-Oil Distribution Piping: Minimum [**5 psig] <Insert dimension**> for minimum [**30] <Insert time**> minutes.

Fuel-Oil, Double-Containment Piping:

Carrier Pipe: Minimum [**5 psig] <Insert dimension**> for minimum [**30] <Insert time**> minutes.

Containment Conduit: Minimum [**5 psig] <Insert dimension**> for minimum [**60] <Insert time**> minutes.

Suction Piping: Minimum 20-in. Hg for minimum [30] <Insert time> minutes.

Isolate storage tanks if test pressure in piping will cause pressure in storage tanks to exceed 10 psig.

* + - * 1. Inspect and test fuel-oil piping according to NFPA 31, "Tests of Piping" Paragraph; and according to requirements of authorities having jurisdiction.
        2. Test leak-detection and monitoring system for accuracy by manually operating sensors and checking against alarm panel indication.
        3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
        4. Bleed air from fuel-oil piping using manual air vents.
        5. Fuel-oil piping and equipment will be considered defective if it does not pass tests and inspections.
        6. Prepare test and inspection reports.
      1. OUTDOOR PIPING SCHEDULE

Retain and revise applicable piping applications. Coordinate with materials specified in Part 2. Retain multiple materials for Contractor's option.

Flexible, double-containment piping systems are available in NPS 3/4 to NPS 3 (DN 20 to DN 80). Rigid, double-containment piping is not limited in size.

* + - * 1. Underground Fuel-Oil Piping: [**Flexible] [Rigid**], double-containment piping. Size indicated is carrier-pipe size.

Retain "one of" option in paragraph below to allow Contractor to select piping materials from those retained. Fill and vent piping are not generally filled with fuel oil; therefore, they are not usually required to be double contained. Verify this installation practice with authorities having jurisdiction.

* + - * 1. Underground fuel-oil-tank fill and vent piping shall be[ one of] the following:

[**NPS 2] <Insert pipe size**> and Smaller: Steel pipe, steel or malleable-iron threaded fittings, and threaded joints. Coat pipe and fittings with protective coating for steel piping.

[**NPS 2-1/2] <Insert pipe size**> and Larger: Steel pipe, steel welding fittings, and welded joints. Coat pipe and fittings with protective coating for steel piping.

Indicate extent of containment conduit on Drawings. Containment conduit is required for piping with insufficient depth of bury.

* + - * 1. Containment Conduit: Steel pipe with wrought-steel fittings and welded joints. Coat pipe and fittings with protective coating for steel piping.

Retain "one of" option in paragraph below to allow Contractor to select piping materials from those retained.

* + - * 1. Aboveground fuel-oil piping shall be[ one of] the following:

Because fill and vent piping do not generally contain fuel oil, double-containment piping is usually not required. Verify requirements with authorities having jurisdiction.

[**NPS 2] <Insert pipe size**> and Smaller: Steel pipe, steel or malleable-iron threaded fittings, and threaded joints.

[**NPS 2-1/2] <Insert pipe size**> and Larger: Steel pipe, steel welding fittings, and welded joints.

Practical size limit for copper is NPS 4 (DN 100) because joints are difficult to heat evenly for brazing. ASME B31.9 requires that copper tubing not be used at ASTs that are placed behind a dike because piping may fail during a fire.

[**Annealed] [Drawn**]-temper copper tube with wrought-copper fittings and brazed joints.

* + - 1. INDOOR PIPING SCHEDULE

Retain and revise applicable piping applications. Coordinate with materials specified in Part 2.

Retain "one of" option in paragraph below to allow Contractor to select piping materials from those retained.

* + - * 1. Aboveground fuel-oil piping shall be[ one of] the following:

[**NPS 1/2] <Insert pipe size**> and Smaller: Annealed-temper copper pipe, wrought copper fittings, and brazed or flared joints.

[**NPS 5/8 to NPS 2] <Insert pipe size**>: [**Steel pipe, steel or malleable-iron threaded fittings, and threaded joints] [Drawn temper copper pipe, wrought copper fittings, and brazed joints**].

Practical size limit for copper is NPS 4 (DN 100) because joints are difficult to heat evenly for brazing.

[**NPS 2-1/2] <Insert pipe size**> and Larger: [**Steel pipe, steel fittings, and welded or flanged joints] [Drawn temper copper pipe, wrought copper fittings, and brazed or flanged joints**].

* + - 1. SHUTOFF VALVE SCHEDULE

Retain and revise applicable piping applications. Coordinate with materials specified in Part 2.

Retain "one of" option in first paragraph below to allow Contractor to select piping materials from those retained.

* + - * 1. Valves for aboveground distribution piping NPS 2 and smaller shall be[ one of] the following:

One-piece, bronze ball valve with bronze trim.

Two-piece, [**full] [regular**]-port, bronze ball valves with bronze trim.

Retain "one of" option in first paragraph below to allow Contractor to select piping materials from those retained.

* + - * 1. Distribution piping valves for pipe NPS 2-1/2 and larger shall be[ one of] the following:

Two-piece, [**full] [regular**]-port, bronze ball valves with bronze trim.

Bronze, [**nonlubricated] [lubricated**] plug valve.

Retain "one of" option in paragraph below to allow Contractor to select piping materials from those retained.

* + - * 1. Valves in branch piping for single appliance shall be[ one of] the following:

One-piece, bronze ball valve with bronze trim.

Two-piece, [**full] [regular**]-port, bronze ball valves with bronze trim.

END OF SECTION 231113