SECTION 23 11 00

FACILITY FUEL PIPING

BASED ON DFD MASTER SPECIFICATION DATED 10/25/2016

This section has been written to cover most (but not all) situations that you will encounter. Depending on the requirements of your specific project, you may have to add material, delete items, or modify what is currently written. The Division of Facilities Development expects changes and comments from you.

# P A R T 1 - G E N E R A L

## SCOPE

This section contains specifications for fuel pipe and fuel pipe fittings for this project. Included are the following topics:

PART 1 - GENERAL

Scope

Related Work

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PART 2 - PRODUCTS

Fuel Oil (Supply, return, fill, vent, and gauge)

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Natural Gas

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Unions and Flanges

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## RELATED WORK

Section 01 91 01 or 01 91 02 – Commissioning Process

Section 23 05 23 - General-Duty Valves for HVAC Piping

Section 23 05 15 - Piping Specialties

Section 23 05 29 - Hangers and Supports for HVAC Piping and Equipment

Section 23 08 00 – Commissioning of HVAC

Section 23 25 00 - HVAC Water Treatment.

## REFERENCE

Applicable provisions of Division 1 govern work under this section.

## REFERENCE STANDARDS

Edit the following list so only the standards that are needed in your spec are included in it.

ANSI B16.3 Malleable Iron Threaded Fittings

ASTM A53 Pipe, Steel, Black and Hot-Dipped, Zinc Coated Welded and Seamless

ASTM A234 Pipe Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and Elevated Temperatures

## SHOP DRAWINGS

Refer to division 1, General Conditions, Submittals.

Contractor shall submit schedule indicating the ASTM specification number of the pipe being proposed along with its type and grade and sufficient information to indicate the type and rating of fittings for each service.

TYPE E OR S STEEL PIPE:

Mill certification papers, also known as material test reports, for the pipe furnished for this project, in English. Heat numbers on these papers to match the heat numbers stenciled on the pipe. Chemical analysis indicated on the mill certification papers to meet or exceed the requirements of the referenced ASTM specification.

## QUALITY ASSURANCE

Order all Type E and Type S steel pipe with heat numbers rolled, stamped, or stenciled to each length or each bundle, depending on the size of the pipe, and in accordance with the appropriate ASTM specification.

Any installed material not meeting the specification requirements must be replaced with material that meets these specifications without additional cost to the Owner.

## DELIVERY, STORAGE, AND HANDLING

Promptly inspect shipments to insure that the material is undamaged and complies with specifications.

Cover pipe to eliminate rust and corrosion while allowing sufficient ventilation to avoid condensation. Do not store materials directly on grade. Protect pipe, tube, and fitting ends so they are not damaged. Where end caps are provided or specified, take precautions so the caps remain in place.

Offsite storage agreements will not relieve the contractor from using proper storage techniques.

Storage and protection methods must allow inspection to verify products.

## DESIGN CRITERIA

Use only new material, free of defects, rust and scale, and meeting the latest revision of ASTM specifications as listed in this specification.

Construct all piping for the highest pressures and temperatures in the respective system in accordance with ANSI B31, but not less than 125 psig unless specifically indicated otherwise.

Non-metallic piping will be acceptable only for the services indicated. It will not be acceptable in occupied spaces and ventilation plenum spaces, including plenum ceilings.

Where weld fittings or mechanical grooved fittings are used, use only long radius elbows having a centerline radius of 1.5 pipe diameters.

Where ASTM A53 grade A pipe is specified, ASTM A53 grade B pipe may be substituted at Contractor's option. Where the grade or type is not specified, Contractor may choose from those commercially available.

## WELDER QUALIFICATIONS

Before any metallic welding is performed, Contractor to submit his Standard Welding Procedure Specification together with the Procedure Qualification Record as required by Section IX of the ASME Boiler and Pressure Vessel Code and/or the National Certified Pipe Welding Bureau.

Welder certifications are required to be renewed every three years. If qualification papers are needed on a project, verify that they are current.

Before any polyethylene fusion welding is performed, Contractor to submit certification that the welders to be used on this project have successfully demonstrated proper welding procedures in accordance with the Code of Federal Regulations, Title 49, Part 192, Section 192.285.

The A/E or DFD reserves the right to test the work of any welder employed on the project, at the Contractor's expense. If the work of the welder is found to be unsatisfactory, the welder shall be prevented from doing further welding on the project.

## NATURAL GAS SERVICE

All charges for the gas service as shown on the plans, including the connection from the main in the street or other location to the gas meter, shall be paid by this Contractor, including setting of gas meter(s) and all work performed by the gas company.

List the contact person at the gas utility along with their telephone number and address so the contractor can properly schedule this work.

Verify whether or not a gas meter needs a concrete pad. If it does, coordinate this with the architect so that the general contractor installs it.

# P A R T 2 - P R O D U C T S

## FUEL OIL (Supply, return, fill, vent and gauge)

This specification does not include the material requirements for an underground containment type system. Type E or S pipe material is required per ANSI B31.9.

2" and Smaller: ASTM A53, type E or S, standard weight (schedule 40) black steel pipe with ASTM A197/ANSI B16.3 class 150, black malleable iron threaded fittings or ASTM A234 grade WPB/ANSI B16.9 standard weight, seamless, carbon steel weld fittings.

2-1/2" and Larger: ASTM A53, type E or S, standard weight black steel pipe with ASTM A234 grade WPB/ANSI B16.9 standard weight, seamless, carbon steel weld fittings.

## LUBE OIL SYSTEMS

ASTM A53, type E or S, standard weight black steel pipe with ASTM A234 grade WPB/ANSI B16.9 standard weight, seamless, steel welded fittings. All piping and fittings shall be pickled clean, then dried and capped prior to shipping to the job site.

## NATURAL GAS

Type E or S pipe material is required per ANSI B31.9.

2" and Smaller: ASTM A53, type E or S, standard weight (schedule 40) black steel pipe with ASTM A197/ANSI B16.3 class 150 black malleable iron threaded fittings or ASTM A234 grade WPB/ANSI B16.9 standard weight, seamless, carbon steel weld fittings.

2-1/2" and Larger: ASTM A53, type E or S, standard weight black steel pipe with ASTM A234 grade WPB/ANSI B16.9 standard weight, seamless, carbon steel weld fittings.

## VENTS AND RELIEF VALVES

Use pipe and pipe fittings as specified for the system to which the relief valve or vent is connected.

## UNIONS AND FLANGES

2" and Smaller: ASTM A197/ANSI B16.3 malleable iron unions with brass seats. Use black malleable iron on black steel piping and galvanized malleable iron on galvanized steel piping. Use unions of a pressure class equal to or higher than that specified for the fittings of the respective piping service but not less than 250 psi.

2-1/2" and Larger: ASTM A181 or A105, grade 1 hot forged steel flanges of threaded, welding and of a pressure class compatible with that specified for valves, piping specialties and fittings of the respective piping service. Flanges smaller than 2-1/2" may be used as needed for connecting to equipment and piping specialties. Use raised face flanges ANSI B16.5 for mating with other raised face flanges on equipment with flat ring or full face gaskets. Use ANSI B16.1 flat face flanges with full face gaskets for mating with other flat face flanges on equipment.

Provide ASTM A 193 B7 grade bolts and A 194 2H grade nuts & hardened washers for connections (Star washers for grounding.)

GASKETS

Fuel Oil and Natural Gas Systems: Branded, compressed, non-asbestos sheet gaskets. Klingersil C4401, Garlock 3000, JM Clipper 978-C or approved equal.

# P A R T 3 - E X E C U T I O N

## PREPARATION

Remove all foreign material from interior and exterior of pipe and fittings.

## ERECTION

Install all piping parallel to building walls and ceilings and at heights which do not obstruct any portion of a window, doorway, stairway, or passageway. Where interferences develop in the field, offset or reroute piping as required to clear such interferences. In all cases, consult drawings for exact location of pipe spaces, ceiling heights, door and window openings, or other architectural details before installing piping.

Provide anchors, expansion joints, swing joints and/or expansion loops so that piping may expand and contract without damage to itself, equipment, or building.

See comment on expansion provisions in Section 23 05 15.

Mitered ells, notched tees, and orange peel reducers are not acceptable. On threaded piping, bushings are not acceptable.

"Weldolets" and "Threadolets" may be used for branch takeoffs up to one-half (1/2) the diameter of the main.

Do not route piping through transformer vaults or above transformers, panelboards, or switchboards, including the required service space for this equipment, unless the piping is serving this equipment.

This requirement is based on NFPA 70-1987, 384-4 and 450-47.

Install all valves, and piping specialties, including items furnished by others, as specified and/or detailed. Make connections to all equipment installed by others where that equipment requires the piping services indicated in this section.

## WELDED PIPE JOINTS

Make all welded joints by fusion welding in accordance with ASME Codes, ANSI B31, and State Codes where applicable.

All pipe welding shall be completed by Qualified Welders in accordance with the Contractor’s Procedure Specifications.

Contractor will ensure that these steps are followed where pipe sections will be joined by welding:

1. Cleaning – Welding surfaces will be clean and free of defects.
2. Alignment – Inside diameter of piping components will be aligned as accurately as possible. Internal misalignment shall not exceed 1/16”.
3. Spacing – Pipe sections will be spaced to allow deposition of weld filler material through the entire weld joint thickness.
4. Girth Butt Welds:
   1. Girth butt welds shall be complete penetration welds.
   2. Concavity will not exceed 1/32”
   3. Under cuts will not exceed 1/32”
   4. As welded surfaces are permitted however surfaces will be free from coarse ripples, grooves, abrupt ridges and valleys.

Electrodes shall be Lincoln, or approved equal, with coating and diameter as recommended by the manufacturer for the type and thickness of work being done.

## THREADED PIPE JOINTS

Use a Teflon based thread lubricant or Teflon tape when making joints; no hard setting pipe thread cement or caulking will be allowed.

## FUEL OIL (Supply, return, fill, vent, and gauge)

This specification does not include the installation requirements for a containment type underground system.

Contractors installing fuel oil piping in the City of Madison must be an approved installer by the Madison Fire Department and must submit plans to the Madison Fire Department for approval. Contact Sheryl Peterson, (608) 261-9657, at the Madison Fire Department.

Install fuel oil supply, return, fill, vent and gauge lines where indicated on the drawings, including flexible connections and other piping specialties included with equipment furnished by others. Solder joints, unions with gaskets, packing, or Teflon tape will not be acceptable. Pipe joining materials must be compatible with the fuel oil system.

Teflon tape is not acceptable on fuel oil piping.

Provide double or triple swing joints in the pipe lines connected to underground tanks, except straight fill lines and test wells, to permit the tanks to settle without impairing the tightness of the pipe connections.

Install flexible piping connections in supply and return lines at each engine. Return line from each engine to the main oil tank or the day tank shall contain no manual or automatic valves to restrict the flow; pressure relief valves are acceptable. Upon written application, copper tubing may be approved in exposed locations if it is encased in a steel conduit.

Refer to NFPA 30-1990, 3-3.4 for additional commentary on use of copper, aluminum or brass in fuel oil piping systems.

For supply or suction piping serving multiple fuel consuming devices, install shut-off valves to isolate each device.

Clean all welding piping before all regulators and control valves. Test by placing target cloth over piping and blow with compressed air. Clean piping until target cloth is clean and free of debris.

Terminate oil tank fill piping at least two feet from any building wall. Install vent pipe to drain toward tank without sags or traps in which liquid may collect. Where two or more tanks are indicated to be vented through a common line, the point of connection between the individual vent lines shall not be lower than the top of any fill pipe opening. Terminate all vent pipes outside of the building, not less than two feet measured vertically or horizontally from any building opening, not less than twenty five feet from any outside air intake louver, and with a weatherproof and flameproof vent cap or hood.

## LUBE OIL SYSTEMS:

All piping, fittings and tanks shall be acid pickled after fabrication. Clean all piping and strainers before starting systems. Tighten all flanges and joints before startup. Retighten joints after startup until all leaks are stopped.

## NATURAL GAS

Pitch horizontal piping down 1" in 60 feet in the direction of flow. Install a 4" minimum depth dirt leg at the bottom of each vertical run and at each appliance. When installing mains and branches, cap gas tight each tee or pipe end which will not be immediately extended. All branch connections to the main shall be from the top or side of the main.

Teflon tape is acceptable on natural gas lines.

Do not install gas pipe in a ventilation air plenum.

If an above ground vent terminates in an area subject to snow accumulation, terminate the line at least five feet above grade.

Install a shut off valve at each appliance. Provide a valved connection at the main for equipment and appliances furnished by others.

Piping through a roof shall be run through an approved roof penetration with flashing and counter flashing.

Each gas pressure reducing valve vent and relief valve vent shall be run separately to a point outside of the building, terminated with a screened vent cap, and located according to gas utility regulations.

Clean all welded piping before all regulators and control valves. Test by placing target cloth over piping and blow with compressed air. Clean piping until target cloth is clean and free of debris.

## VENTS AND RELIEF VALVES

Install vent and relief valve discharge lines as indicated on the drawings, as detailed, and as specified for each specific valve or piping specialty item. In no event is a termination to occur less than six feet above a roof line.

## UNIONS AND FLANGES

Install a union or flange, as required, at each automatic control valve and at each piping specialty or piece of equipment which may require removal for maintenance, repair, or replacement. Where a valve is located at a piece of equipment, locate the flange or union connection on the equipment side of the valve. Concealed unions or flanges are not acceptable.

GASKETS

Store horizontally in cool, dry location and protect from sunlight, water and chemicals. Inspect flange surfaces for warping, radial scoring or heavy tool marks. Inspect fasteners, nuts and washers for burrs or cracks. Replace defective materials.

Align flanges parallel and perpendicular with bolt holes centered without using excessive force. Center gasket in opening. Lubricate fastener threads, nuts and washers with lubricant formulated for application.

Draw flanges together evenly to avoid pinching gasket. Tighten fasteners in cross pattern sequence (12 – 6 o’clock, 3 – 9 o’clock, etc.), one pass by hand and four passes by torque wrench at 30% full torque, 60% full torque and two passes at full torque per ASME B16.5.

## PIPING SYSTEM LEAK TESTS

Verify that the piping system being tested is fully connected to all components and that all equipment is properly installed, wired, and ready for operation. If required for the additional pressure load under test, provide temporary restraints at expansion joints or isolate them during the test. Verify that hangers can withstand any additional weight load that may be imposed by the test.

Provide all piping, fittings, blind flanges, and equipment to perform the testing.

Conduct pressure test with test medium of air or water unless specifically indicated. Minimum test time is indicated in the table below; additional time may be necessary to conduct an examination for leakage. Each test must be witnessed by the Division's representative. If leaks are found, repair the area with new materials and repeat the test; caulking will not be acceptable.

For hydrostatic tests, use clean water and remove all air from the piping being tested by means of air vents or loosening of flanges/unions. Measure and record test pressure at the high point in the system.

For air tests, gradually increase the pressure to not more than one half of the test pressure; then increase the pressure in steps of approximately one-tenth of the test pressure until the required test pressure is reached. Examine all joints and connections with a soap bubble solution or equivalent method. The piping system exclusive of possible localized instances at pump or valve packing shall show no evidence of leaking. After testing is complete, slowly release the pressure in a safe manner.

Measure natural gas system test pressure with a water manometer or an equivalent device calibrated in increments not greater than 0.1 inch water column. System will not be approved until it can be demonstrated that there is no measurable loss of test pressure during the test period.

Conduct fuel oil system test so as not to impose a pressure of more than 10 psig on the tank. Instead of a pressure test, suction lines may be tested under a vacuum of not less than 20 inches of mercury maintained for at least one hour.

Consultant must verify that all system components have been designed for these test pressures; contact DFD engineering personnel if there are questions.

|  |  |  |  |
| --- | --- | --- | --- |
| **System** | **Pressure** | **Medium** | **Duration** |
| Fuel oil | See text | - | 8 hr |
| Lub oil | See text | - | 8 hr |
| Natural gas | 100 psig | Air | 24 hr |

All pressure tests are to be documented on a Division of Facilities Development form included in this specification.

On piping that cannot be tested because of connection to an active line, provide temporary blind flanges and hydrostatically test new section of piping. After completion of test, remove temporary flanges and make final connections to piping. Die penetrate test pass weld or x-ray the piping that was not hydrostatically tested up to the active system.

## CONSTRUCTION VERIFICATION ITEMS

Contractor is responsible for utilizing the construction verification checklists supplied under specification Section 23 08 00 in accordance with the procedures defined for construction verification in Section 01 91 01 or 01 91 02.

END OF SECTION

# PIPING SYSTEM LEAKAGE TEST REPORT

**State of Wisconsin**

**Department of Administration Date**

**Division of Facilities Development Submitted:**

**Project Name:**

**Location: DFD Project No:**

**Contractor:**

**□ HVAC □ Refrigeration □ Controls**

□ **Power Plant** □ **Plumbing** □ **Sprinkler**

**Test Medium:** □ **Air** □ **Water** □ **Other**

**Test performed per specification section No.**

**Specified Test Duration \_\_\_\_\_ Hours Specified Test Pressure PSIG**

**System Identification:**

**Describe Location:**

**Test Date:**

**Start Test Time: Initial Pressure: PSIG**

**Stop Test Time: Final Pressure: PSIG**

**Tested By: Witnessed By:**

**Title: Title:**

**Signed: Signed:**

**Date: Date:**

**Comments:**