

University of Houston Master Specification

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SECTION 22 5000 - FUEL OIL PIPING SYSTEM

Maintain Section format, including the UH master spec designation and version date in bold in the center columns of the header and footer. Complete the header and footer with Project information.

Edit and finalize this Section, where prompted by Editor's notes, to suit Project specific requirements. Make selections for the Project at text identified in **bold**.

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

Delete hidden text after this Section has been edited for the Project.

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. The Contractor's attention is specifically directed, but not limited, to the following documents for additional requirements:
 - 1. The current version of the *Uniform General Conditions for Construction Contracts*, State of Texas, available on the web site of the Texas Facilities Commission.
 - 2. The University of Houston's *Supplemental General Conditions and special Conditions for Construction*

1.2 DESCRIPTION OF WORK

- A. Work Included: Provide a complete fuel oil supply system including pumps, piping, fittings, valves, controls and accessories as specified and required for a complete and operating system.
- B. Fuel tanks are specified under Section 22 5010, "Fuel Oil Storage Tanks."
- C. Make all final supply and return connections to equipment furnished under other Sections of the Specifications, as required.

1.3 REFERENCE STANDARDS

- A. The latest published edition of a reference shall be applicable to this Project unless identified by a specific edition date.
- B. All reference amendments adopted prior to the effective date of this Contract shall be applicable to this Project.
- C. All materials, installation and workmanship shall comply with the applicable requirements and standards addressed within the following references:
 - 1. ANSI B31.1 - Power Piping.

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2. ANSI B31.4 - Liquid Petroleum Transportation Piping Systems.
3. ANSI B31.9 - Building Service Piping.
4. API 2000 - Venting Atmospheric and Low Pressure Storage Tanks.
5. ASME Section 9 - Welding and Brazing Qualifications.
6. ASME B16.3 - Malleable Iron Threaded Fittings.
7. ASME B36.10 - Welded and Seamless Wrought Steel Pipe.
8. ASTM A53 - Pipe, Steel, Black and Hot-Dipped Zinc Coated, Welded and Seamless.
9. ASTM A234 - Pipe Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and Elevated Temperatures.
10. ASTM D2310 - Machine-Made Reinforced Thermosetting Resin Pipe.
11. ASTM D2996 - Filament-Wound Reinforced Thermosetting Resin Pipe.
12. ASTM D4021 - Glass-Fiber-Reinforced Polyester Underground Petroleum Storage Tanks.
13. NFPA 30 - Flammable and Combustible Liquids Code.
14. NFPA 31 - Installation of Oil Burning Equipment.
15. UL 1316 - Glass-Fiber-Reinforced Plastic Underground Tanks for Petroleum Products.
16. TNRCC, Chapter 334 - Underground and Aboveground Storage Tanks.
17. Conform to applicable EPA, State of Texas and Local Regulations for installation of fuel oil systems.

1.4 QUALITY ASSURANCE

- A. Acceptable Manufacturers: Provide products complying with these specifications and produced by one of the following:
 1. Glass Fiber Pipe:
 - a. Smith Fiberglass.
 - b. Perm Alert.
 2. Valves:
 - a. Apollo.
 - b. Crane Company.
 - c. Jenkins Bros. Valves.
 - d. Nibco.

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- e. OPW.
 - f. Red and White.
 - g. Stockham Valve and Fittings.
3. Pumps:
- a. Red Jacket.
4. Fuel Gauge/Water Detector:
- a. Gilbarco.
 - b. Hersey.

1.5 SUBMITTALS

A. Shop Drawing submittals shall include, but not be limited to, the following:

- 1. Cut sheets of pipe and fittings, valves, pumps, pump controllers, monitoring equipment and other required accessories clearly indicating all features, options, materials and dimensions.
- 2. Complete wiring diagrams for pump controllers and monitoring equipment.
- 3. Additional information as required in Section 23 0100 "Mechanical General Provisions."

1.6 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Deliver fuel oil system components in factory-fabricated water-resistant wrapping.
- B. Handle fuel oil system components carefully to avoid damage to material component, enclosure and finish.
- C. Store fuel oil system components in a clean, dry space and protect from the weather.

PART 2 - PRODUCTS

2.1 PIPE AND FITTINGS

A. Fuel Oil Piping Buried Below Ground

- 1. Pipe: Provide ASTM A53, Grade B, Seamless or ERW, Schedule 40 carbon steel or glass fiber reinforced epoxy piping ASTM D2992, filament wound, reinforced, thermosetting epoxy resin piping with threaded and bonded fittings and connections. Pipe shall bear UL label for petroleum products' piping.
- 2. Adapters: Provide adapters as required for connections to threaded piping.
- 3. Fittings: Compression molded using epoxy molding compound and bearing the same UL label as pipe for fiberglass and as specified for piping above grade for steel.
- 4. Secondary Containment: Provide a double wall, secondary containment system over all primary fuel oil piping, consisting of an outer 0.15-inch thick, filament wound FRP

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containment system with epoxy joints and factory fabricated end fittings as applicable for the proposed installation. At the Contractor's option, all underground piping may be installed in a single secondary containment.

5. Acceptable Product: Smith Fiberglass "Red Thread II", Perm Alert or an approved substitution.
6. Adhesives: Provide manufacturer's recommended adhesives and curing agents.

B. Fuel Oil Piping Above Ground

1. Piping: Black steel ASTM A53, Grade B, seamless, Schedule 40 with threaded ends.
2. Socket Weld Fittings: ANSI B16.11 forged steel socket-weld fittings matching pipe schedule for all non-threaded joints.
3. Threaded Fittings: Malleable iron, **[150] [300]** psi class, ANSI B16.3 at valves and unions.
4. Refer to Section 23 2000 "HVAC Piping Systems," for additional requirements.

2.2 VALVES AND ACCESSORIES

A. Valves for Fuel Oil Isolation/Balancing Service at or Less Than 200 PSIG:

1. Ball Valves:
 - a. Ball valves shall be two-piece, full line size (full port) 316 stainless steel balls and stems and reinforced seats and stuffing box rings. All ball valves shall be designed to permit repacking while valve is in line. Valves shall be furnished with blowout proof stems. Valves used for balancing shall be provided with balancing stops.
 - b. Ball valves 2 inches and smaller shall be threaded body bronze or brass valves of a full port design. Valves shall be rated for 300 psi WOG and shall conform to Federal Specification WW V 35B. Valves shall be:
 - 1) Apollo No. 70Ä100 Series.
 - 2) Crane No. 9032 Series.
 - 3) Jenkins No. 900ÄT Series.
 - 4) Nibco No. TÄ585 Series.
 - 5) Red and White No. 5044 Series.
 - 6) Stockham No. SÄ204ÄBRÄRÄ2.
2. Check Valves:
 - a. Check valves 2 inches and smaller shall be Class 125 threaded bronze swing check valves with horizontal swing and replaceable discs. Valves shall be rated for 200 psi WOG and shall conform to MSS SPÄ80 and shall be:
 - 1) Crane No. 37.
 - 2) Jenkins No. 92ÄÄ.
 - 3) Lunkenheimer No. 2144.
 - 4) Nibco No. TÄ433.
 - 5) Red and White No. 238.

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6) Stockham No. BÄ321.

- B. Foot Valve: Double poppet with metal-to-metal seat and 8Ä mesh screen. Body and poppet shall be bronze; screen shall be brass. Valve rated at 125 psi cold non-shock pressure at 350³F.
- C. Strainers: Refer to Section 23 2000 "HVAC Piping Systems" for requirements.
- D. **[Solenoid Valves: Provide ASCO or approved equal bronze body, two-way solenoid valves rated for 400 psi WOG minimum. Valves shall be 120 volt rated coils with Class F insulation and shall be of a normally closed (fail closed) design.]**
- E. **[Pressure Regulating Valves: Provide A.W. Cash "B" Series or approved equal pressure regulating valves. Valve shall be iron body, Buna-N diaphragms, and brass piston and cylinder. Valves shall be designed to reduce 120 psi to 20 psi in the fuel oil return line and shall be rated for 150 psi WOG.]**

2.3 FUEL OIL PUMPS

- A. Capacities: Pumps shall deliver the capacities scheduled or shown on the Drawings.
- B. Type: Pumps shall be **[submersible]** single-stage type, bronze fitted, bronze impeller, stainless steel shaft.
- C. Pressure Rating: Pumps, casings, connections and mechanical seals shall be rated for operation at the system working pressure.
- D. Design: Pumps shall be UL-listed and labeled for installation and operation in a Class 1, Division 1, Group D hazardous location.

2.4 PUMP CONTROL PANEL

- A. General: Provide a fuel oil pump control panel in a NEMA I wall-mounted enclosure. The control panel shall include an alternator two lockable disconnect switches, two full voltage non-reversing motor starters, a control power transformer, pump running lights and manual switches to allow selective operation of each pump. The control panel shall be designed for two individual incoming power circuits. Automatic operation of the pump shall be initiated by closure of the float switch contact on the generator set day tanks. **[Control panel shall provide 120-volt control via an auxiliary contact in each pump starter to open the respective pump discharge solenoid valve.]** The alternator shall change the lead (running) pump at each operation. All control panel switches and indicators, plus the overall control panel, shall have engraved nameplates.
- B. Shutdown: Pumps shall be interlocked to automatically shutdown when a low level is sensed in the main storage tank via a dry contact closure in the fuel level monitoring system.

2.5 TANK LEVEL/WATER MONITOR

- A. General: Provide an electronic monitoring system to monitor the fuel oil level in the fuel oil storage tank, monitor the tank for leakage and detect the presence and amount of water in the tank with the fuel.
- B. Components: The system shall consist of a printer/control unit, tank probe and interconnecting wiring. The entire system shall be UL-listed for fuel oil system use.

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- C. Printer/Control Unit: Provide a wall mounted printer/control unit that provides continuous tank leak monitoring when the supplied equipment is not operating, documents pump start and stop times when the supplied equipment is operating and provides a low fuel level output to shut down the fuel oil pumps when a low fuel level is detected. Include an integral printer to print tank level reports indicating tank level in gallons, fuel depth, water depth, and fuel temperature, leak monitor reports, and alarm reports. The control unit shall have dry alarm output contacts for high level, low level and leak detected [**and an RS 232C communications port**] for monitoring by [_____].
- D. Tank Probes: Provide probes suitable for installation in tank(s) via a 4-inch riser pipe. Probes shall be temperature compensated to correct for fuel oil temperature variations.
- E. Leak Detection Mode: The monitoring system shall be capable of detecting leakage rates as small as 0.2 gallons per hour.
- F. System: Monitoring system shall be a Gilbarco Tank Monitor 2 Generator Series or an approved substitution.

2.6 ACCESSORIES

- A. Flexible Pipe Connections: Provide full line size flexible connectors at each pump discharge connection [**, at connections to the fuel oil tank vault**] and fuel oil return. All connectors shall be suitable for use at the pressure and temperature encountered at point of operation. End fitting of connectors shall conform to pipe fitting types specified elsewhere. Threaded connections 2 inches and smaller shall be Amber/Booth Type SS PM metal hose connections constructed of stainless steel hose and braid with carbon steel NPT threaded end fittings. Minimum lengths shall conform to the following:
 - 1. 1 ½ inch diameter (and smaller) x 10 inches long.
 - 2. 2 inches x 12 inches long.
 - 3. 2 ½ inches x 13 inches long.
- B. Fuel Fill Fittings: Provide OPW #633 T/644-TT or equal UL listed fuel fill fittings with a gasketed lockable cap.
- C. Extractor Vent Fitting: Provide OPW #53VM0160 or equal UL listed extractor/vent fittings.
- D. Vent Caps: Provide OPW #63 or approved substitute UL-listed vent cap fittings with an iron body and 40 mesh brass screen at the fuel oil tank vent line.
- E. Monitor Manholes: Provide H 20 rated steel traffic cover manholes, minimum 14-inch diameter, with sump for installation of monitoring probes. Sump bottom shall have openings for entry of piping riser with secondary containment and conduit.
- F. Manway Manholes: Provide Neenah or approved substitution H 20 rated [**gasketed,**] steel traffic cover manholes, minimum 24-inch diameter.

PART 3 - EXECUTION

3.1 INSTALLATION

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A. Pipe, Valves and Fittings:

1. Install piping, valves and fittings to make fuel systems complete.
2. Install valves with screwed, flanged or welded ends to match pipe jointing at point of connections.
3. Make change of direction in piping with 90-degree elbows and nipple connections.
4. Pipe shall be clean and free of sand and grease at connection ends.
5. Fiberglass Piping: Install fiberglass piping systems in accordance with the manufacturer's written installation instructions. Pipe shall be tapered, threaded and bonded as required at joint and fittings. Heat shall be applied to ensure proper curing when recommended by the manufacturer. Sleeve piping penetrations through concrete construction.
 - a. Refer to Section 23 0300 "Basic Materials and Methods" for additional requirements.
6. Steel Pipe: Ream steel pipe after cutting and before threading or socket welding. All piping system fittings, except at valves and equipment with threaded connections, shall be made using socket-welded fittings. Thread with clean-cut taper threads of length to engage all threads in fittings and leave no full-cut threads exposed after make-up. Use John Crane, or approved substitution, or Teflon thread tape applied only to male threads to make-up joints.
 - a. Refer to Sections 23 0300 "Basic Materials and Methods," 23 2000 "HVAC Piping Systems" and 23 2010 "HVAC Piping Valves and Accessories" for additional requirements.
7. Secondary Containment: Install secondary containment system after piping has been successfully tested.

B. Fuel Oil Pumps

1. General: Install pumps where shown, in accordance with manufacturer's written instructions and recognized industry practices, to ensure that pumps comply with requirements and serve intended purposes. Comply with NEMA standards and requirements of NEC.
2. Pressure Test: Field pressure-test all pumps to 1 1/2 times rated working pressure.
3. Grounding: Provide positive electrical pump and motor grounding in accordance with requirements of the NEC.

C. Pump Controllers: Install the pump control panel in accordance with the manufacturer's written installation instructions for wiring by Division 26.

D. Monitoring Systems: Install monitoring systems in accordance with the manufacturer's written instructions. Locate monitor panel as shown on the Drawings and provide wiring in empty conduit provided by Division 26. Provide the services of a factory service engineer to check, start up, calibrate and certify monitoring systems. Coordinate monitoring panel remote monitoring connections with Owner's Project Manager.

3.2 FIELD QUALITY CONTROL

A. Furnish all instruments, equipment, and labor necessary to conduct all tests.

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- B. Methods of sampling, inspecting and testing shall conform to specified standards and codes.
- C. Performance Testing:
 - 1. Prove operation of each pumping control and monitoring system.
 - 2. Should any item or system fail to perform in acceptable manner, adjust, remodel or replace system or items as required.
 - 3. Repeat performance test, adjust or repair systems or item as often as necessary to prove that system and items of equipment are in proper and satisfactory operating condition.
 - 4. Refer to Section 23 0593 "Testing, Adjusting and Balancing" for additional testing requirements.
- D. Pressure Testing:
 - 1. Before secondary containment fittings are installed and pipe trenches are back filled and with tank vent open, pneumatically test all supply, return, vent and monitor piping at 150 psi.
 - 2. Maintain pressure for 24 hours without pressure drop.
 - 3. Isolate tanks from lines during testing. Maximum tank test pressure 5 psi.
 - 4. Locate leaks by covering all connections with mild soap solution and watching for leaks during pressure tests.
 - 5. To prevent water hammer or over pressurization, do not use quick closing valves and booster pumps without suitable controls.
 - 6. Apply pressure slowly to achieve test pressure and slowly close system.
 - 7. Avoid sudden or excessive pressure surge that could produce failure or whipping action due to sudden release of stored energy.
 - 8. Pneumatically test secondary containment piping at 25 psi.
- E. Furnish equipment manufacturer's qualified representative to monitor and furnish supervisory instructions to ensure proper equipment installation and operation, comply with warranty requirements and prepare for system acceptance.
- F. Defective Work:
 - 1. If inspection or tests reveal defects, replace or repair defective work or material as necessary.
 - 2. Repeat inspection and tests.
 - 3. Make repairs to piping with new materials.
 - 4. No caulking of screwed joints or holes will be accepted.
- G. Certification: Certify to Owner in writing that the complete fuel oil and monitoring systems are installed in accordance with all applicable local, state and federal codes, standards and regulations.

3.3 IDENTIFICATION

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- A. Refer to Section 23 0300 "Basic Materials and Methods" for applicable painting, nameplates and labeling requirements.

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