SECTION 33 50 00

**FUEL DISTRIBUTION UTILITIES**

**BASED ON DFD MASTER SPECIFICATION DATED 10/01/2012**

***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 all fuel utility distribution systems for this project. Included are the following topics:

PART 1 - GENERAL

 Scope

 Related Work

 Reference

 Reference Standards

 Shop Drawings

 Quality Assurance

 Delivery, Storage, and Handling

 Design Criteria

 Welder Qualifications

 Natural Gas Service

PART 2 - PRODUCTS

 Fuel Oil – supply, return,fill, vent, and gauge systems - Aboveground

 Fuel Oil Piping Systems – Underground Containment Type

 Natural Gas – Aboveground

 Natural Gas - Underground

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 Unions and Flanges

PART 3 - EXECUTION

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 Erection

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**RELATED WORK**

Section 01 91 01 or 01 91 02 – Commissioning Process

Division 13 – Special Construction (Above and Below Ground Fuel Oil Storgage Tanks)

Division 23 – Heating, Ventilating and Air Conditioning

Division 31 – Earthwork

Section 33 08 00 – Commissioning of Utilities

**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

ANSI B16.4 Cast Iron Threaded Fittings

ANSI B16.5 Pipe Flanges and Flanged Fittings

ANSI B16.22 Wrought Copper and Wrought Copper Alloy Solder Joint Pressure Fittings

ANSI B16.29 Wrought Copper and Wrought Copper Alloy Solder Joint Drainage Fittings - DWV

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

ASTM A105 Forgings, Carbon Steel, for Piping Components

ASTM A126 Gray Cast Iron Castings for Valves, Flanges, and Pipe Fittings

ASTM A181 Forgings, Carbon Steel for General Purpose Piping

ASTM A197 Cupola Malleable Iron

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

ASTM B75 Seamless Copper Tube

ASTM D2513 Thermoplastic Gas Pressure Pipe, Tubing, and Fittings

**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.

***Use the following paragraphs when the project involves central power plant work. Check with DFD engineering personnel to verify whether these paragraphs are needed on other projects.***

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 stencilled on the pipe. Chemical analysis indicated on the mill certification papers to meet or exceed the requirements of the referenced ASTM specification.

COPPER TUBE:

Statement from manufacturer on his letterhead that the pipe furnished meets the ASTM specification contained in this section.

**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.

Order all copper tube with each length marked with the name or trademark of the manufacturer and type of tube; with each shipping unit marked with the purchase order number, metal or alloy designation, temper, size, and name of supplier; all in accordance with ASTM B88.

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. Protect fittings, flanges, and unions by storage inside or by durable, waterproof, above ground packaging.

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 are used, use only long radius elbows having a centerline radius of 1.5 pipe diameters.

Where ASTM B88, type L hard temper copper tubing is specified, ASTM B88, type K hard temper copper tubing may be substituted at Contractor's option.

**WELDER QUALIFICATIONS**

***Use the following paragraph for all building service piping and steam piping less than or equal to 15 psig.***

Welding procedures, welders, and welding operators for all building service piping and steam piping less than or equal to 15 psig to be in accordance with certified welding procedures of the National Certified Pipe Welding Bureau.

***Use the following paragraph when the project has any high pressure steam piping (greater than 15 psig).***

Welding procedures, welders, and welding operators for all steam system piping at service pressures above 15 psig to be qualified complying with the provisions of the latest revision of ANSI/ASME B 31.1-Power Piping or Section IX of the ASME Boiler and Pressure Vessel Code for boiler external piping.

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** - forsupply, return, fill, vent and gauge systems - **ABOVEGROUND**

See Division 23 for specifications.

FUEL OIL PIPING SYSTEMS - UNDERGROUND CONTAINMENT TYPE

Primary Product Pipe (Inner Pipe):

2 Inches 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 WPN/ANSI B16.9 standard weight, seamless carbon steel weld fitting.

ASTM B75 copper, type K or L, annealed with ASME B16.22 fittings and flared or soldered joints.

Dual angle filament wound fiberglass reinforced epoxy pipe with an integral epoxy liner and resin rich exterior coating. Fitting to be compression molded and filament wound fiberglass reinforced epoxy. Fitting joints joined by means of a deep socket, matching tapered bell and spigot adhesive joints. Adhesive shall be a two‑part amine cured epoxy. Fiberglass pipe and fittings shall bear the U.L. label, and have Wisconsin approved number for intended use.

Secondary Containment Piping (Outer Pipe. Minimum piping size allowed is 2‑inch diameter.):

2 Inches and Larger: Shall consist of totally encapsulating the primary pipe with minimum of one pipe size larger than primary pipe. Secondary containment pipe shall be dual angle filament wound fiberglass reinforced epoxy pipe with an integral epoxy liner and resin rich exterior coating. Fittings shall be factory fabricated of 2‑piece construction complete with nut, bolts, and washers for field assembly or rubber boot type with clamp down fastening system, and have Wisconsin approval number for intended use.

**NATURAL GAS – ABOVEGROUND**

See Division 23 for specifications.

**NATURAL GAS – UNDERGROUND**

ASTM D2513 thermoplastic polyethylene gas pressure pipe with butt-weld or socket-type polyethylene fusion joints and fittings.

**UNDERGROUND PIPE WRAP**

Use a flexible polymer film with a coal tar and synthetic elastomeric coating of 36 mil thickness and dielectric strength exceeding 12 KV. Use a compatible primer below the polymer film.

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**

See Division 23 for aboveground system specifications.

Note:

Do not use flanges for underground gas or oil systems. Use fittings that are solvent-welded or fusion-bonded joints only.

**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**

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 routings or related architectural details before installing piping.

Provide anchors, offset fittings and/or expansion loops so that piping may expand and contract without damage to itself or connected equipment.

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

Install drains and dirt legs at system elevation changes to permit complete drainage if required and to protect downstream systems and equipment from pipe scale and debris. Do not locate drains or dirt legs in inaccessible locations.

Do not route piping through sub-grade utility vaults.

***This requirement is based on NFPA Standards..***

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.

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.

**COPPER PIPE JOINTS**

Remove all slivers and burrs remaining from the cutting operation by reaming and filing both pipe surfaces. Clean fitting and tube with emery cloth or sandpaper. Remove residue from the cleaning operation, apply flux, and assemble joint. Use 95-5 solder or brazing to secure joint as specified for the specific piping service.

**FUEL OIL**

***This specification to be used for aboveground installations. See next paragraph for underground systems.***

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 and unions with gaskets or packing will not be acceptable. Pipe joining materials must be compatible with the fuel oil system.

***Teflon tape is not acceptable.***

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 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.

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.

Underground Fuel Oil Piping Systems: (FRP Type)

Inspection: Before starting installation, all pipe shall be visually inspected for damage. All damaged areas shall be located, cut out, repaired, or removed.

Handling: Pipe shall be handled carefully to avoid impact damage. Care shall be taken to keep tapered surfaces dry and free of dirt, grease, or oil. Do not drop or throw pipe, or allow objects to be thrown on top of pipe.

Trenches: Piping trenches shall be deep enough to provide a minimum of 4 inches of bedding between containment pipe and trench bottom and 4 inches of backfill cover when under concrete or 8 inches of backfill cover when under asphalt pavement. Trenches shall be wide enough to allow a minimum of one pipe diameter between containment pipe and trench side wall or adjacent containment pipes.

Bed and Backfill Materials: Bed and backfill shall be clean sand or pea gravel (a rounded aggregate, clean and free flowing, with a particle size not less than 1/8 inch and not more than 3/4 inch in diameter). Bed and backfill shall be free of all debris, sharp rocks, broken concrete, trash, ice, etc. The bed for piping shall be uniformly graded to provide firm, even support for pipe.

All product piping shall be sloped uniformly and be free of sags, dips, low spots, or vapor traps.

Joint Preparation Primary Pipe: Bell and spigot tapered surfaces shall be thoroughly dry and clean before applying any adhesive. Dirt shall be removed by lightly sanding tapered surfaces with emery cloth, wiping off dust with a clean, dry cloth. Grease or oil spots shall be removed by sparingly cleaning with joint cleaner, lightly sanding with emery cloth, and wiping off dust with a clean, dry cloth. When water or moisture is present on tapered surfaces, they shall be dried with a blow dryer or heat gun. Before joining fiberglass threads to steel fittings, inspect threads are free of burrs. Thread sealing compound shall be non‑hardening, solvent free, and compatible with the fuels proposed for the system.

Secondary containment piping shall be assembled and dry‑fitted after all primary piping is dry‑fitted in place.

Joint Preparation - Secondary Pipe: Pipe ends of all secondary containment piping shall have factory tapers removed. All pipe ends shall be square cut and shall have one ‑inch insertion into each containment fitting. Layout of containment piping shall accommodate at least containment coupling between fittings where practical to allow joint preparation and inspection during testing of primary piping.

Adhesive bonding of primary piping shall not commence until all containment piping has been dry‑fitted over the primary piping with all clearances maintained and interferences resolved.

Adhesive Primary Pipe: Adhesives shall be thoroughly mixed to a uniform color and consistency, in accordance with the manufacturer's instructions. Pot life, or working time of adhesive, varies with temperature. Adhesive that becomes warm or of a stiff consistency shall be discarded. Adhesive shall be applied in thin, even coats to clean, dry tapered surfaces of both spigot and bell ends.

Curing: Adhesive cure time is dependent upon temperature. Joint connections shall not be disturbed until fully cured. Consult manufacturer's instructions for approximate cure times at various temperatures.

Forced Accelerated Curing: Chem Cure Paks, or Electric Heat Blankets shall be used to accelerate curing when temperatures are at or below 60°F, or expected to fall below 60°F during the curing process. Consult manufacturer's instruction for use and application of Chem Cure Paks, or Electric Heat Blankets.

Adhesive Secondary Containment Piping: After completion of successfully testing primary piping and visually inspecting primary piping joints, assembly of secondary containment fittings shall commence. Adhesives shall be thoroughly mixed to a uniform color and consistency, in accordance with the manufacturer's instructions. Pot life, or working time of adhesive, varies with temperature. Adhesive that becomes warm or of a stiff consistency shall be discarded. Adhesive shall be applied in a uniform minimum thickness of 1/8 inch to all mating fitting and pipe surfaces. Bond surfaces shall be free of all gloss, dust, dirt, and shall be clean and dry. Fitting components shall be aligned properly to form a tight fit. Nuts and bolts shall be tightened to stages to bring mating surfaces together evenly.

Monitoring Primary Piping: A 10 psi pressure shall be maintained on the primary piping system during the duration of construction to monitor the integrity of the system while other trades ar working in the vicinity of the buried piping.

Monitoring Secondary Containment Piping: A 3 psi pressure shall be maintained on the piping system during the duration of construction to monitor the integrity of the system while other trades are working in the vicinity of the buried piping.

**NATURAL GAS**

Pitch horizontal piping down 1" in 60 feet in the direction of flow to dirt leg that is to be located in building for accessibility. 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 below a building or its foundation or 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.

All joints in underground polyethylene gas pipe must be made by qualified personnel proficient in the joining methods of ASTM D2513 thermoplastic gas pressure pipe and polyethylene fittings. Do not install polyethylene gas pipe inside buildings.

Install shut off valves as shown on drawings. Provide valve box and valve operator per NFPA and AGA standards.

Blow compressed air into gas piping system as a part of commissioning system, before placing into service, to clean piping until target cloth is clean and free of debris.

**UNDERGROUND PIPE WRAP**

Use for all underground metallic piping or underground metallic gas conduit.

Remove all dirt and other foreign material from exterior of pipe. Apply primer as recommended by the manufacturer. Use a spiral wrap process for applying tape to the pipe. Repair any breaks in the tape coating caused by the installation process.

**UNIONS AND FLANGES**

Concealed or underground unions or flanges are not acceptable.

**GASKETS**

Not required as no flanges are permitted underground.

**PIPING SYSTEM LEAK TESTS**

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 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.

Do not backfill pipe until it has been successfully tested.

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.

Fuel Oil Testing Primary Piping: Before assembling secondary containment fittings, all primary lines shall be hydrostatically tested at 1 1/2 times the anticipated working pressure (not less than 55 psi). Testing shall be maintained for a minimum of 1 hours. All fittings and joints shall be visually inspected for evidence of leakage. Any defective joints or fittings shall be cut out, replaced, or retested. DFD Construction Representative to be present to witness all testing of primary piping.

Conduct fuel oil system test so as not to impose a pressure on the storage tank. Isolate piping from tank for test. 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 primary piping 1.5 x Work. Press Water 1 hr

Fuel oil secondary conduit 5 psig Air 1 hr

Natural gas 100 psig Air 24 hr

***\*\*Verify operating system pressure with DFD and specify test pressure accordingly. Several state agencies have systems that operate at higher pressures and require test pressures in excess of that scheduled above.***

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

On piping that can not 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**

Contractor is responsible for utilizing the construction verification checklists supplied under specification Section 33 08 00 in accordance with the procedures defined for construction verification in Section 01 91 01 or 01 91 02.

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END OF SECTION

## 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:**