

# NFPA 31 Fuel Oil Piping, Installation and Testing

## Chapter 8 Fuel Piping Systems and Components

### 8.1 Scope.

This chapter shall apply to piping systems and their components used to transfer fuel oil from storage and supply tanks to oil-burning appliances and equipment.

### 8.2 Acceptable Piping Materials and Piping System Design.

#### **8.2.1**

Tank fill and vent piping shall be wrought-iron, steel, or Schedule 40 brass pipe. Oil supply lines shall be steel pipe or brass or copper tubing. Wall thickness of wrought-iron and steel pipe shall comply with the specifications in ANSI/ASME B36.10, *Standard on Welded and Seamless Wrought Steel Pipe*.

*Exception: As provided for in 8.2.2.*

#### **8.2.2**

Piping shall be permitted to be of materials other than those specified in [8.2.1](#) if used underground and back-filled or if used as part of an engineered fuel storage system. Such piping shall be designed in accordance with good engineering practice for the material used and shall be approved by the authority having jurisdiction. Such piping shall be installed in accordance with manufacturers' instructions.

#### **8.2.3**

Listed flexible metal hose shall be permitted to be used where rigid connections are impractical. It shall be installed in full compliance with its listing.

#### **8.2.4**

Piping used to connect oil burners and oil-burning appliances to their fuel supply shall not be smaller than  $\frac{3}{8}$ -in. (9.5-mm) iron pipe size or  $\frac{3}{8}$ -in. (9.5-mm) O.D. tubing. Copper tubing shall have 0.035-in. (0.89-mm) nominal and 0.032-in. (0.81-mm) minimum wall thickness.

*Exception No. 1:  $\frac{1}{4}$ -in. (6.4-mm) pipe or  $\frac{5}{16}$ -in. (7.9-mm) O.D. tubing shall be permitted to be used in the suction line of systems where the top of the tank is below the level of the oil pump.*

*Exception No. 2: Conversion range oil burners need not meet these requirements.*

#### **8.2.5**

Pipe shall be connected with standard fittings and tubing with fittings of listed types.

##### **8.2.5.1**

Pipe connectors made of combustible materials or dependent on the frictional characteristics of combustible materials shall not be used inside of buildings or aboveground outside of buildings. Such connectors shall be permitted to be used underground if of listed type and installed in accordance with their listing.

##### **8.2.5.2**

All threaded joints and connections shall be made tight with suitable lubricant or pipe compound.

### 8.2.5.3

Unions requiring gaskets or packings, right or left couplings, and sweat fittings employing solder having a melting point of less than 1000°F (538°C) shall not be used in oil lines.

### 8.2.5.4

Cast-iron fittings shall not be used.

### 8.2.6

Piping shall be substantially supported and protected against physical damage and, where necessary, protected against corrosion. All buried piping shall be protected against corrosion.

### 8.2.7

Proper allowance shall be made for expansion, contraction, jarring, and vibration.

### 8.2.8

Pipe lines connected to underground tanks shall be provided with double swing joints or flexible connectors, or shall be otherwise arranged to permit the tanks to settle without impairing the tightness of the pipe connections.

*Exception No. 1: Tubing need not meet these requirements.*

*Exception No. 2: Straight fill lines and test wells that have no changes in direction need not meet these requirements.*

### 8.2.9

Piping systems shall be maintained liquid tight. A piping system that leaks shall be emptied of liquid or repaired in an approved manner.

### 8.2.10

Fuel oil shall not be transferred to an oil-burning appliance by pressurizing the tank with air or other gas.

## 8.3 Tank Fill Piping.

### 8.3.1

The fill pipe shall be large enough and so located as to permit ready filling in a manner that minimizes spills. The fill pipe shall terminate outside the building at a point at least 2 ft (0.6 m) from any building opening at the same or lower level. The fill pipe shall terminate in a manner that minimizes spills when the filling hose is disconnected. The end of the fill pipe shall be equipped with a tight metal cover designed to discourage tampering and shall be identified as a fuel oil fill.

*Exception: A crankcase oil or used oil fill pipe for a tank directly serving a used oil fired burner and appliance shall be permitted to terminate indoors in accordance with [NFPA 30A](#), Code for Motor Fuel Dispensing Facilities and Repair Garages. If the fill pipe has a funnel-type opening, then it shall be provided with a readily accessible manual shutoff valve of the 1/4-turn-to-close type, between the funnel-type opening and the tank.*

### 8.3.2

Cross-connections that allow gravity flow from one tank to another shall be prohibited.

*Exception: Two supply tanks whose aggregate capacity does not exceed 660 gal (2500 L) shall be permitted to be cross-connected as specified in 7.5.15.*

### **8.3.3 Piping for Auxiliary Tanks.**

An overflow pipe from an auxiliary tank shall have no valves or obstructions.

### **8.4 Fuel Return Piping.**

A return line from a burner or pump to a supply tank shall have no valves or obstructions and shall enter the top of the same tank.

### **8.5 Supply Piping to Oil-Burning Appliances.**

#### **8.5.1**

All piping shall be connected into the top of the supply tank. Where two tanks are cross-connected, the tops of the tanks shall be on the same horizontal plane

*Exception No. 1: The burner supply line from a tank that does not exceed 660 gal (2500 L) need not meet this requirement.*

*Exception No. 2: The cross-connection between two tanks having an aggregate capacity that does not exceed 660 gal (2500 L) need not meet this requirement.*

#### **8.5.2**

The pressure at the oil supply inlet to an oil-burning appliance shall not exceed 3 psig (gage pressure of 21 kPa).

*Exception: An appliance that is approved for a higher inlet pressure.*

#### **8.5.3**

Where supply tanks are set below the level of the burner, the oil piping shall pitch toward the supply tank. The piping shall not have traps.

#### **8.5.4**

For commercial and industrial installations, the oil supply from tanks of any capacity permitted by this standard shall meet the following requirements:

- (1) The burner supply line shall be permitted to be connected to an outside aboveground supply tank at a point below the liquid level, but each such connection shall be provided with an internal or external shutoff valve located as close as practicable to the shell of the tank. External valves and their connections to the tank shall be of steel.
- (2) A transfer pump shall be permitted to be used.

### **8.6 Vent Piping.**

#### **8.6.1**

Vent pipes shall drain toward the tank or toward one tank where two tanks are cross-connected. The vent pipes shall have no sags or traps where liquid can collect. Vent pipes shall be located so that they are not subjected to physical damage.

#### **8.6.2**

The lower end of the vent pipe shall enter the tank through the top and shall extend into the tank not more than 1 in. (25 mm).

#### **8.6.3**

Vent pipes shall terminate outside of buildings at a point not less than 2 ft (0.6 m) measured vertically or horizontally from any building opening. They shall terminate high enough above the ground to avoid being obstructed with snow and ice.

#### **8.6.4**

The outer end of the vent pipe shall terminate in a weatherproof vent cap or fitting or shall be provided with a weatherproof hood. Vent caps shall have a minimum free open

area equal to the cross-sectional area of the vent pipe and shall not employ screens finer than No. 4 mesh.

#### **8.6.5**

Vent pipes from tanks containing heaters shall extend to a location where oil vapors discharging from the vent will be readily diffused.

#### **8.6.6**

If the static head with a vent pipe filled with oil exceeds 10 psig (gage pressure of 70 kPa), the tank shall be designed to withstand the maximum static head that will be imposed.

#### **8.6.7**

Vent pipes from more than one tank shall be permitted to be manifolded and connected into one outlet pipe. The outlet pipe shall be at least one pipe size larger than the largest individual vent pipe connected thereto. In no case shall the point of connection between two or more vent pipes be lower than the top of any fill pipe opening.

#### **8.6.8**

The vent outlet of a supply tank shall terminate at least 5 ft (1.5 m) from any air inlet or any flue gas outlet of any appliance.

#### **8.6.9**

Vent pipes shall not be cross-connected with pipes other than vent pipes.

### **8.7 Pumps, Valves, Gages, and Appurtenances.**

#### **8.7.1**

Tanks in which a constant oil level is not maintained by an automatic pump shall be equipped with a method of determining the oil level.

#### **8.7.2**

Gauging devices, such as liquid level indicators or signals, shall be designed and installed so that oil or vapor will not be discharged into a building.

#### **8.7.3**

Inside tanks provided with fill and vent pipes used for No. 1 or No. 2 fuel oil shall be provided with a device to indicate at the fill point, either visually or audibly, when the oil in the tank has reached a predetermined safe level.

#### **8.7.4**

Supply tanks shall not be equipped with a glass gage or any type of gage that, when broken, will permit the escape of oil from the tank.

#### **8.7.5**

An oil pump that is not a part of a listed burner shall be a positive displacement type that automatically shuts off the oil supply when stopped.

#### **8.7.6**

An automatic pump that is not an integral part of a burner shall be a listed type installed in full compliance with its listing.

#### **8.7.7**

A readily accessible manual shutoff valve shall be installed at each point where required to control the flow of fuel in normal operation and at each point where required to avoid spills during servicing. The valve shall be installed so that it closes against the supply pressure.

### **8.7.8**

Where a shutoff is installed in the discharge line of an oil pump that is not an integral part of a burner, a pressure relief valve shall be connected into the discharge line between the pump and the shutoff valve. The pressure relief valve shall be arranged to return surplus oil to the supply tank or to bypass it around the pump.

*Exception: Pumps that have an internal bypass valve need not meet this requirement.*

### **8.7.9**

A fuel oil line incorporating a heater shall be provided with a pressure relief valve arranged to discharge to the return line when any valve, pump, or other device could prevent the release of excessive pressure because of the expansion of the heated oil.

### **8.7.10**

Where oil is supplied by gravity feed to a burner requiring uniform flow and a constant level valve is not incorporated in the burner assembly or the oil is not supplied by an automatic pump, a constant level valve shall be installed in the supply line at the gravity tank or as close thereto as practicable, to ensure uniform delivery of oil to the burner.

If the constant level valve is not provided with an antiflooding device, the vent opening of the constant level valve shall be connected by piping or tubing to the outside of the building. Vent piping or tubing from a constant level valve shall not be connected to a tank or to a tank vent.

### **8.7.11**

Provision shall be made for adequate ventilation of enclosures, such as vaults or pits, where pumps and accessories are installed prior to entering for inspection or repair.

### **8.7.12**

Test wells shall not be installed inside buildings. For outside service, test wells shall be equipped with a tight metal cover designed to discourage tampering.

## **8.8 Testing and Maintenance.**

### **8.8.1**

After installation and before being covered, piping shall be tested for leaks. Piping shall be tested hydrostatically or pneumatically with air at not less than 1½ times its maximum working pressure, but not less than 5 psig (gage pressure of 35 kPa) measured at the highest point of the system.

#### **8.8.1.1**

The test shall be made so as not to impose a pressure of more than 10 psig (gage pressure of 70 kPa) on any tank connected to the piping.

#### **8.8.1.2**

Pressure shall be maintained for at least 30 minutes or for sufficient time to complete visual inspection of all joints and connections.

#### **8.8.1.3**

Suction lines shall be permitted to be tested under a vacuum of not less than 20 in. Hg (68 kPa) maintained for at least 30 minutes.

### **8.8.2**

Where the vertical length of the fill and vent pipes is such that, when filled with liquid, the static head imposed exceeds 10 psig (gage pressure of 70 kPa), the piping shall be tested hydrostatically to a pressure equal to the static head thus imposed. (See 7.2.7.2)