



7.1 Scope.

This chapter shall apply to tanks used to store or to supply liquid fuel for use in liquid fuel-burning appliances.

7.2 Basic Design and Construction of Tanks.

7.2.1

Tanks shall be designed and constructed to any shape or type consistent with sound engineering practice for the materials of construction used and shall be listed in accordance with one of the design standards specified in 7.2.7 or their approved equivalents.

7.2.2

Tanks shall be installed and used in accordance with this standard and shall be approved for the specific liquid fuel-burning application.

7.2.3

Tanks meeting the requirements of Chapters 21, 22, and 23 of NFPA 30 shall be deemed as meeting the requirements of this section.

7.2.4

Tanks shall be permitted to have combustible or noncombustible internal linings that are compatible with the intended liquid fuel(s).

7.2.5 Tank Openings for Fill and Venting.

7.2.5.1

All tanks shall be provided with top openings large enough to prevent abnormal pressures in the tank during normal operations (fill and withdrawal) and emergency venting (fire exposure for aboveground tanks), but not smaller than the nominal pipe sizes specified in Table 7.2.5.1.

Table 7.2.5.1 Minimum Diameter of Tank Vent Opening

Capacity of Tank (U.S. gal)	Diameter of Vent, Nominal Opening Size (in.)
660 or less	1 ¼
661 to 3,000	1 ½
3,001 to 10,000	2
10,001 to 20,000	2 ½
20,001 to 35,000	3

For SI units, 1 gal = 3.785 L, 1 in. = 25 mm.

7.2.5.2

Normal and emergency vent opening(s) shall be permitted to be either separate or combined, provided openings are sized in accordance with Table 7.2.5.1.

7.2.5.3

Interstitial spaces of secondary containment tanks shall be provided with venting sized in accordance with Table 7.2.5.1.

7.2.5.4

Each compartment of a compartmented tank shall be provided with venting sized in accordance with Table 7.2.5.1.

7.2.6 Operating Pressures.

7.2.6.1

Tanks shall be permitted to be operated under normal operating conditions at pressures that do not exceed a gauge pressure of 1 psi (gauge pressure of 7 kPa), measured at the top of the tank, but shall be limited to a gauge pressure of 2.5 psi (gauge pressure of 17 kPa) under emergency venting conditions, also measured at the top of the tank.

7.2.6.2

Where the vertical length of the fill and vent pipes is such that the static head imposed on the bottom of the tank exceeds a gauge pressure of 10 psi (70 kPa) if the pipes are filled with liquid, the tank and its related piping shall be tested hydrostatically to a pressure equal to the static head thus imposed.

7.2.7 Design Standards.

7.2.7.1

Atmospheric tanks shall be constructed in accordance with one of the following or its approved equivalent:

- (1) API Standard 650, *Welded Steel Tanks for Oil Storage*
- (2) UL 58, *Standard for Steel Underground Tanks for Flammable and Combustible Liquids*
- (3) ANSI/UL 80, *Standard for Steel Tanks for Oil-Burner Fuels and Other Combustible Liquids*
- (4) ANSI/UL 142, *Standard for Steel Aboveground Tanks for Flammable and Combustible Liquids*
- (5) ANSI/UL 443, *Standard for Steel Auxiliary Tanks for Oil Burner Fuel*
- (6) UL 1316, *Standard for Glass-Fiber-Reinforced Plastic Underground Storage Tanks for Petroleum Products, Alcohols, and Alcohol-Gasoline Mixtures*
- (7) ANSI/UL 1746, *Standard for External Corrosion Protection Systems for Steel Underground Storage Tanks*
- (8) UL 2080, *Standard for Fire Resistant Tanks for Flammable and Combustible Liquids*
- (9) UL 2085, *Standard for Protected Aboveground Tanks for Flammable and Combustible Liquids*
- (10) UL 2245, *Standard for Below-Grade Vaults for Flammable Liquid Storage Tanks*
- (11) SU 2258, *Outline of Investigation for Nonmetallic Tanks for Oil Burner Fuels and Other Combustible Liquids*
- (12) UL 142A, *Outline of Investigation for Special Purpose Aboveground Tanks for Specific Flammable and Combustible Liquids*

7.2.7.2

Tanks intended for use inside buildings and with a capacity between 10 gal (38 L) and 1320 gal (5000 L) shall be constructed in accordance with 7.2.7.1(3), 7.2.7.1(4), 7.2.7.1(5), 7.2.7.1(8), 7.2.7.1(9), or 7.2.7.1(11).

7.2.7.3

Tanks intended for use inside buildings and with a capacity greater than 1320 gal (5000 L) shall be constructed in accordance with 7.2.7.1(4), 7.2.7.1(8), or 7.2.7.1(9).

7.2.7.4

Tanks intended for use outside aboveground with a capacity no greater than 1320 gal (5000 L) shall be constructed in accordance with 7.2.7.1(3), 7.2.7.1(4), 7.2.7.1(8), 7.2.7.1(9), or 7.2.7.1(11).

7.2.7.5

Tanks intended for use outside aboveground with a capacity greater than 1320 gal (5000 L) shall be constructed in accordance with 7.2.7.1(1), 7.2.7.1(4), 7.2.7.1(8), or 7.2.7.1(9).

7.2.7.6 *

Tanks intended for use underground shall be constructed in accordance with 7.2.7.1(2), 7.2.7.1(6), or 7.2.7.1(7). Tanks constructed in accordance with 7.2.7.1(2) shall be protected in accordance with either of the following:

- (1) An approved cathodic protection system that is engineered, installed, and maintained in accordance with recognized standards
- (2) Approved or listed external corrosion-resistant systems or materials integral with the tank

7.2.7.7 *

If a tank is installed in a vault outside the building, either above or below grade, the vault shall be constructed in accordance with 7.2.7.1(10).

7.2.8 Areas Subject to Flood or Earthquake.

Where a tank is located in an area that is designated as subject to flood or earthquake, the following additional requirements shall apply to the tank, its connections, and its foundation and supports, as appropriate.

7.2.8.1

Where in a designated flood zone, the requirements of NFPA 30, *NORA Recommended Practice for Anchoring of Heating Oil Tanks*, or local requirements shall be met.

7.2.8.2

When in a designated seismic zone, the local requirements for earthquake resistance shall be met.

7.3 Supports and Foundations.**7.3.1 ***

Tanks and their supports shall rest on foundations made of solid concrete.

7.3.2

The tank foundation shall be designed to minimize uneven settling and to minimize corrosion in any part of the tank resting on the foundation.

7.3.3

The tank supports shall be integral to the tank or shall be of concrete, solid masonry, or steel. For outside aboveground tanks, the supports shall be firmly anchored to the foundation.

7.3.4

Steel supports for any outside aboveground tank whose capacity exceeds 660 gal (2500 L) shall be considered protected if they meet one of the following methods and are approved by the authority having jurisdiction:

- (1) They are protected by materials having a fire resistance rating of not less than 2 hours.
- (2) They are not otherwise protected, but are less than 12 in. (0.3 m) high at their lowest point.
- (3) They are protected by a water spray system that meets the requirements of NFPA 15 or NFPA 13.

7.3.5

Every tank shall be supported in such manner that excessive concentrations of loads on the supporting portion of the shell are prevented.

7.3.6

In areas subject to earthquake, tank supports and connections shall be designed to resist damage as a result of such shocks.

7.4 Installation of Underground Tanks.**7.4.1**

This section shall apply to tanks installed underground with backfill and to tanks buried beneath buildings.

7.4.2

Excavations for underground tanks shall be made in accordance with applicable building codes to avoid undermining the foundations of existing structures.

7.4.3

Underground tanks and tanks buried beneath buildings shall be located with respect to existing building foundations and supports so that the loads carried by the latter cannot be transmitted to the tank.

7.4.4

The distance from any part of an underground tank to the nearest wall of any basement or pit or to any property line shall not be less than 1 ft (0.3 m).

7.4.5 *

Underground tanks shall be installed in accordance with manufacturers' instructions and in accordance with applicable requirements of Chapter 23 of NFPA 30.

7.4.6

Underground tanks shall be equipped with vent opening(s) or automatically operated vent(s) for each tank compartment and interstitial space, which shall be arranged to discharge to the open air outside of buildings.

7.4.7 *

Underground tanks that are taken out of service shall be removed or permanently closed in accordance with the applicable requirements of NFPA 30.

7.5 Installation of Tanks Inside Buildings.

7.5.1

This section shall apply to tanks installed inside buildings, either enclosed or unenclosed, as herein described.

7.5.2

A safety can of less than 6.5 gal (26 L) capacity shall be permitted to be used for temporary fuel storage. It shall comply with ANSI/UL 30, *Metal Safety Cans*, or ANSI/UL 1313, *Nonmetallic Safety Cans for Petroleum Products*, and shall be specifically approved only for temporary use.

7.5.3

A supply tank of 60 gal (227 L) or less capacity shall be constructed in accordance with ANSI/UL 142, *Standard for Steel Aboveground Tanks for Flammable and Combustible Liquids*, and shall be specifically approved for permanent or temporary purposes.

7.5.4

A supply tank that exceeds 60 gal (227 L) capacity shall be installed on the lowest floor (story, cellar, or basement) of a building, except as provided for in 7.5.5.

7.5.5

A maximum of 660 gal (2500 L) of storage tank capacity shall be permitted to be installed on a higher floor, provided the following conditions are met:

- (1) The higher floor does not have any floor or open space directly below it.
- (2) The higher floor is provided with a liquidtight sill, containment device, or equivalent means having the ability to hold a minimum of 15 percent of the aggregate tank capacity to prevent spilled heating fuel from entering an adjacent, lower area.

7.5.6

A tank of less than 10 gal (38 L) capacity shall not be placed within 2 ft (0.6 m) from any ignition source, either in or external to the appliance being served, nor shall it be placed in a manner such that the temperature of the fuel in the tank exceeds the temperature of its surroundings by 25°F (14°C) or more.

7.5.7

A tank of capacity between 10 gal and 1320 gal (38 L and 5000 L) shall not be placed within 5 ft (1.5 m) horizontally from any open flame or fuel burning appliance unless separated from the source of heat by a barrier having a 1-hour fire resistance rating extending horizontally at least 1 ft (0.3 m) past the liquid fuel-burning appliance or the tank, whichever is greater, and extending vertically from floor to ceiling.

7.5.8

A tank of a capacity between 10 gal and 330 gal (38 L and 1250 L) that is provided with an opening in the bottom for use as a fuel supply connection to an appliance or as a drain shall be arranged as follows:

- (1) The tank shall be pitched toward the opening with a slope of not less than $\frac{1}{4}$ in./ft (20 mm/m).
- (2) Each supply line shall be provided with a readily accessible, thermally actuated automatic shutoff valve installed as close as practical to the tank. (See also 8.7.3).
- (3) If the oil filter or strainer is installed at the tank, it shall be within 6 in. (150 mm) of the thermally actuated automatic shutoff valve required by 7.5.8(2).
- (4) A properly sized and rated fuel filter or strainer shall be installed in the fuel supply line to the appliance downstream and within 6 in. (150 mm) of the thermally actuated automatic shutoff valve required by 7.5.8(2).
- (5) Where three or more tanks are installed as part of a fuel storage system, each appliance supply line shall be provided with its own readily accessible safety shutoff valve.

7.5.9

Each tank or tank system shall be equipped with separate fill and vent openings.

7.5.10

Each tank shall be equipped with a gauging device. (See 8.10.2.)

7.5.10.1

Where tanks are cross-connected, as shown in Figure 8.9.1, Figure 8.9.2, and Figure 8.9.3, gauges shall only be installed in the vented tank(s).

7.5.11

Any unused opening in a tank shall be closed by a vaportight threaded plug or cap.

7.5.12

A tank or tank system shall be permitted to supply more than one liquid fuel-burning appliance.

7.5.13

Where a tank or tank system is not located in a dedicated room or enclosure, the maximum capacity in the building shall not exceed 1320 gal (5000 L) for a nonengineered system or 1375 gal (5200 L) for an engineered system, unless the installation meets the criteria in 7.5.13.1 or 7.5.13.2.

7.5.13.1

Fuel tanks of any size shall be permitted within a mechanical room, provided the room is designed using recognized engineering practices with suitable fire detection, fire suppression, and containment means to prevent the spread of fire beyond the room of origin.

7.5.13.2

Where a tank or tank system is not located in a dedicated room or enclosure, but is separated from other tank(s) by construction having a fire resistance rating of at least 2 hours, the maximum capacity in each separate area shall not exceed the quantities specified in 7.5.13. The maximum total capacity in the building shall not be limited.

7.5.13.3

Where a tank or tank system is located in a dedicated room or enclosure that is separated from the rest of the building by construction having a fire resistance rating of at least 1 hour, the maximum total capacity in the room shall not exceed 1320 gal (5000 L) for a nonengineered system or 1375 gal (5200 L) for an engineered system.

7.5.13.4

Where a tank or tank system is located in a dedicated room or enclosure that is separated from the rest of the building by construction having a fire resistance rating of at least 3 hours, the maximum total capacity in the room shall be permitted to exceed 1320 gal (5000 L) for a nonengineered system or 1375 gal (5200 L) for an engineered system.

7.5.13.5

Dedicated rooms or enclosures shall meet all applicable requirements of Section 7.6.

7.5.13.6

Tanks shall not obstruct quick and safe access to any utility service meters, electrical panelboards, or shutoff valves.

7.6 Requirements for Dedicated Tank Rooms and Tank Enclosures.

7.6.1

Each tank room or tank enclosure shall have a doorway with a noncombustible liquidtight sill or ramp at least 6 in. (150 mm) high and a self-closing, listed fire door that meets the requirements of NFPA 80.

7.6.1.1

If the sill or ramp is more than 6 in. (150 mm) high, the walls of the room or enclosure shall be built to withstand the static head that would be expected in event of a fuel spill, up to the height corresponding to the expected spill depth.

7.6.2

Fire doors for rooms or enclosures of 2-hour fire-resistant construction shall have a fire protection rating of 1½ hours.

7.6.3

Fire doors for rooms or enclosures of 3-hour fire-resistant construction shall have a fire protection rating of at least 3 hours.

7.6.4

Each tank room or tank enclosure shall be provided with means to ventilate the room or enclosure prior to its being entered for inspection or repair.

7.6.5

A tank installed in a room or area having a fire resistance rating of 2 hours or less shall be of such size and shape that it can be installed in and removed from the room or area and from the building as a unit (i.e., in one piece).

7.7 Auxiliary Tanks.

7.7.1

Auxiliary tanks shall not exceed 60 gal (227 L) capacity and shall be used only for connection in the supply line between the main tank and the appliance.

7.7.2

Auxiliary tanks shall comply with 7.2.7.1(5).

7.7.3

Auxiliary tanks shall be filled by pump transfer through continuous piping from the supply tank.

7.7.4

Auxiliary tanks shall be located at a level above the top of the supply tank from which they are filled.

7.8 Installation of Outside Aboveground Tanks.

7.8.1

This section shall apply to tanks that are installed aboveground outside of buildings. This section shall not apply to a centralized oil distribution system.

7.8.2

A tank or tanks whose capacity does not exceed 660 gal (2500 L) shall be permitted to be installed outside of and adjacent to a building, provided they are separated from the nearest line of adjoining property by the following minimum distance:

- (1) 5 ft (1.5 m) for tanks not exceeding 275 gal (1040 L) capacity
- (2) 10 ft (3 m) for tanks greater than 275 gal (1040 L) capacity, but not exceeding 660 gal (2500 L) capacity

7.8.3

A tank or tanks whose capacity exceeds 660 gal (2500 L) shall be installed in accordance with all applicable requirements of Chapter 22 of NFPA 30.

7.8.4 *

Outside aboveground tanks and their appurtenances and supports shall be protected from external corrosion by a coating suitable for exterior use.

7.8.5

Tanks that are intended for temporary supply to an appliance shall comply with 7.2.7.1(5).

7.8.6

Outside aboveground tanks shall also comply with 7.5.8 through 7.5.12 and with 7.5.13.6.

7.9 Tank Heating Systems.

7.9.1

Where tanks are provided with heating systems to maintain fuel at the required temperature for proper atomization, the heating systems shall meet the requirements of 7.9.2 through 7.9.4, as applicable.

7.9.2 *

Where tanks are heated by steam coils, the maximum operating pressure of the steam coils shall not exceed a gauge pressure of 15 psi (gauge pressure of 105 kPa).

7.9.2.1

Where a pressure-reducing valve is used to limit the steam pressure to a gauge pressure of 15 psi (gauge pressure of 105 kPa) or less, the following shall apply:

- (1) A relief valve set at not more than a gauge pressure of 5 psi (gauge pressure of 35 kPa) above the normal pressure in the coil shall be provided.
- (2) Provision shall be made to limit the steam temperature to 250°F (121°C).

7.9.3

Where tanks are heated by hot water coils, the hot water shall be provided by indirect heaters and the maximum temperature of the water shall be limited to 250°F (121°C).

7.9.4

Where tanks are heated by electric heaters, the heaters shall be equipped with listed and approved thermostats designed to prevent the fuel from exceeding its minimum flash point.

7.10 Special Storage Arrangements.

In particular installations, the provisions of Chapter 7 shall be permitted to be altered by the authority having jurisdiction after consideration of special features such as the following:

- (1) Topographical conditions, barricades, walls, and proximity to buildings or adjoining property
- (2) Height and character of construction and nature of occupancies of such buildings
- (3) Capacity and construction of proposed fuel tanks
- (4) Characteristics and properties of the combustible liquid fuels to be stored
- (5) Degree of private fire protection to be provided
- (6) Capability of the fire department to cope with combustible liquid fires

7.11 Tank Leakage Testing and Periodic Inspection.**7.11.1**

Except as provided for in 7.11.1.1, all shop-built and field-erected tanks shall be leak tested before they are placed in service in accordance with one of the following, as applicable:

- (1) For shop-built tanks, the manufacturers' instructions
- (2) For field-erected tanks, Section 21.5 of NFPA 30

7.11.1.1

An ASME code stamp or a listing mark acceptable to the authority having jurisdiction shall be evidence of compliance with this test.

7.11.2

Following completion of a new installation, the tank and its piping shall be inspected for leakage during the initial fill by a qualified technician and, if a leak is found, the tank or piping shall be repaired and retested.

7.11.3

Each tank shall be periodically inspected by a qualified technician for evidence of leakage and shall be maintained liquidtight. Tanks found to be leaking shall be repaired or replaced.

7.12 Abandonment and Removal from Service of Tanks and Related Equipment.

Except as provided for in 7.12.1, if a tank and its related piping are abandoned for whatever reason, the tank and all piping connected to it, including the outside fill and vent piping and any piping connected to the appliance, shall be emptied of all contents, cleaned, removed from the premises or property, and disposed of in accordance with applicable local, state, and federal rules and regulations.

7.12.1

If a liquid fuel-burning appliance is converted to an alternate fuel, but the tank is kept in place so that it can be returned to service at some future date, the following requirements shall be met before the alternate fuel is used:

- (1) The entire contents of the tank shall be completely removed and the tank purged of all vapors.
- (2) The fuel tank vent line shall remain intact and open.
- (3) The outside fill pipe shall be removed and the tank opening shall be capped or plugged or the outside fill pipe shall be capped and filled with concrete, and all remaining piping, other than the vent line, shall be capped or sealed.

7.13 Fuel Storage Systems That Are Permanently Taken Out of Service.**7.13.1**

If a fuel storage tank is permanently removed from service for whatever reason, the tank and all piping connected to it, including the outside fill and vent piping and any supply piping connected to the appliance, shall be:

- (1) Emptied of all liquid contents and sludge
- (2) Cleaned and rendered free of combustible vapors
- (3) Removed from the premises or property
- (4) Properly disposed of in accordance with all applicable local, state, and federal rules and regulations

7.13.2

The remover/installer of a tank taken out of service shall submit an affidavit of compliance to the authority having jurisdiction or to the tank owner stating that such fuel storage system was removed, in compliance with this section.

7.14 Permanent Abandonment of Underground Tanks.

If an underground fuel storage tank is permanently removed from service, the requirements of 21.7.4.3.3 of NFPA 30 shall apply. (See also Annex C of NFPA 30.)



8.1 Scope.

This chapter shall apply to piping systems and components used to provide filling and venting of tanks and transfer of heating fuel from tanks to heating fuel-burning appliances and equipment.

8.2 Acceptable Piping — Types and Materials.

8.2.1

Tank fill and vent piping shall be one of the types listed in 8.2.1.1 and 8.2.1.2, with male or female threaded ends that comply with a recognized thread specification.

8.2.1.1

For aboveground fill and vent piping, only the following types and materials shall be permitted:

- (1) Minimum Schedule 40 steel pipe that complies with either ANSI/ASME B36.10M, *Standard on Welded and Seamless Wrought Steel Pipe*; ASTM A53/53M, *Welded and Seamless Steel Pipe (Black & Galvanized)*; or ASTM A106, *Seamless Carbon Steel Pipe (High Temp Service)*
- (2) Minimum Schedule 40 brass pipe that complies with ASTM B43, *Seamless Red Brass Pipe*
- (3) Other piping that is part of an engineered fuel storage system that is listed, installed in accordance with manufacturer's instructions, and approved by the authority having jurisdiction

8.2.1.2

For underground fill and vent piping, only the following types and materials shall be permitted:

- (1) Listed nonmetallic piping that complies with UL 971, *Underground Nonmetallic Piping for Flammable Liquids*
- (2) Listed metallic piping that complies with SU 971A, *Underground Metallic Piping for Flammable Liquids*
- (3) Steel pipe that meets 8.2.1.1(1)
- (4) Brass pipe that meets 8.2.1.1(2)

8.2.2

Fuel supply lines shall be one of the piping types listed in 8.2.2.1 or 8.2.2.2, with threaded ends that comply with a recognized thread specification or tubing types intended for flared or engineered connections.

8.2.2.1

For aboveground fuel supply lines, only the following types and materials shall be permitted:

- (1) Minimum Schedule 40 steel pipe that complies with ANSI/ASME B36.10M, *Welded and Seamless Wrought Steel Pipe*; ASTM A53/53M, *Welded and Seamless Steel Pipe (Black & Galvanized)*; or ASTM A106, *Seamless Carbon Steel Pipe (High Temp Service)*
- (2) Minimum Schedule 40 brass pipe that complies with ASTM B43, *Seamless Red Brass Pipe*
- (3) Listed flexible metal pipe rated for aboveground use, where rigid connections are impractical
- (4) Minimum 0.032 in. thick copper tubing that complies with ASTM B75, *Seamless Copper Tube*; ASTM B88, *Seamless Copper Water Tube*; or ASTM B280, *Seamless Copper Tube for Air Conditioning & Refrigeration Service*
- (5) Minimum 0.032 in. thick brass tubing that complies with ASTM B135, *Seamless Brass Tube*
- (6) Minimum 0.035 in. thick stainless steel tubing that complies with ASTM A254, *Copper-Brazed Steel Tubing*; or ASTM A269, *Seamless & Welded Stainless Steel Tubing*

8.2.2.2

For underground fuel supply lines and for copper fuel supply lines that are in direct contact with concrete or soil, only the following types and materials shall be permitted:

- (1) Listed nonmetallic piping that complies with UL 971, *Underground Nonmetallic Piping for Flammable Liquids*
- (2) Listed corrosion-resistant metallic piping that complies with SU 971A, *Underground Metallic Piping for Flammable Liquids*
- (3) Listed corrosion-resistant flexible metal piping rated for underground use, where rigid connections are impractical
- (4) Corrosion-resistant copper tubing in accordance with 8.2.2.1(4), corrosion-resistant brass tubing in accordance with 8.2.2.1(5), or stainless steel tubing in accordance with 8.2.2.1(6)

8.2.2.2.1

Except where within 12 in. (300 mm) of a tank or appliance, tubing of copper, brass, or stainless steel, as identified in 8.2.2.2, shall be either provided with a listed corrosion-resistant coating or shall be installed through a corrosion-resistant conduit.

8.3 Acceptable Fittings — Types and Materials.

8.3.1

Pipe fittings shall be malleable iron, steel, stainless steel, or brass with male or female thread types that comply with a recognized thread specification. Threads shall be of the type, size, and direction that match with the pipe end threads with which they connect and shall be made liquidtight with suitable pipe joint or sealing compounds.

8.3.2

Tubing fittings shall be of listed types suitable for metal-to-metal flare or engineered connections for the metals and thicknesses of the tubing with which they connect. They shall be of the type and size that match with the tube end flare or engineered fitting with which they connect. They shall be flared or connected by use of the tools and methods recommended by the fitting manufacturer.

8.3.3

Other fittings and connection types shall be permitted if they are part of an engineered system that is listed for use with heating fuel and installed in accordance with the manufacturer's instructions.

8.3.4

Cast iron fittings shall not be used.

8.4 Piping System Design.

8.4.1

Piping systems shall be:

- (1) Liquidtight
- (2) Substantially supported
- (3) Protected against physical damage

8.4.2

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

8.4.3

Piping systems made of combustible materials shall not be used inside of buildings or aboveground outside of buildings unless listed with at least a 30-minute fire rating.

8.4.4

Piping systems for 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 piping system.

8.4.5

All connections to an underground tank shall be made through the top of the tank, except as provided for in 9.2.10.

8.4.6

Fuel shall not be transferred through piping to an appliance by pressurization of the tank.

8.4.7

Each tank or tank system shall be equipped with separate fill and vent pipes, both of which shall terminate aboveground outside the building.

8.4.8

Gauges for indicating the oil level in tank(s) shall be listed in accordance with UL 180, *Liquid Level Gauges for Oil Burner Fuel and Other Combustible Liquids*, and shall be installed in accordance with manufacturers' instructions.

8.5 Tank Fill Piping.**8.5.1**

The fill pipe connected to the tank shall be large enough and so located as to permit ready filling in a manner that minimizes spills. The fill pipe shall also be:

- (1) At least 1 $\frac{1}{4}$ in. (30 mm) nominal pipe size
- (2) Pitched toward the tank
- (3) Protected from physical damage
- (4) Without sags or traps where liquid can collect

8.5.2

For tanks that directly supply a fuel-burning appliance and are intended to be filled by hose from a delivery vehicle, the fill pipe shall terminate as follows:

- (1) Outside the building at a point at least 2 ft (0.6 m) from any building opening
- (2) In a manner that prevents spills when the filling hose is disconnected

8.5.3

For tanks that directly supply a used oil-burning appliance and are intended to be filled either by hose from a delivery vehicle or by hand at the point of use, the fill pipe shall be permitted to terminate as follows:

- (1) In accordance with NFPA 30A
- (2) With a funnel provided with a quarter-turn shutoff valve between the funnel and the tank

8.5.4

The end of the fill pipe shall be equipped with a tight metal cover designed to resist entry of water and shall be identified as a heating fuel fill opening.

8.6 Tank Vent Piping.**8.6.1**

Vent piping connected to a tank shall be large enough and so located as to permit adequate normal fill and emergency venting. The vent pipe shall also be:

- (1) Sized for the tank capacity in accordance with Table 7.2.5.1
- (2) Pitched toward the tank
- (3) Protected from physical damage
- (4) Without sags or traps where liquid can collect
- (5) Without obstructions other than an audible alarm at the tank opening

8.6.2

All vent pipes shall terminate outside of buildings at a point not less than 2 ft (0.6 m) from any building opening.

8.6.2.1

Vent pipes shall terminate high enough above the ground to avoid being obstructed by snow and ice.

8.6.2.2

Vent pipes shall terminate not more than 12 ft (3.6 m) from the fill pipe and at a point visible from the fill point.

8.6.3

The outer end of the vent pipe shall terminate in a corrosion-resistant weatherproof vent cap.

8.6.4

Vent caps shall have a minimum free open area equal to the cross-sectional area of the vent pipe and shall have screens No. 4 mesh or coarser.

8.7 Fuel Supply Piping and Return Piping.**8.7.1**

The fuel supply piping between the supply tank and the appliance shall be:

- (1) At least nominal $\frac{3}{8}$ in. (10 mm) pipe or tubing
- (2) Large enough to meet the fuel consumption rate of the appliance
- (3) Provided with a shutoff valve at the outlet, for an aboveground tank
- (4) Provided with a shutoff valve where an oil line enters a building, for an underground tank

8.7.2

The fuel supply piping from the supply tank shall be connected to the top of the tank, except for the following cases:

- (1) Tanks of 330 gal (1250 L) or less
- (2) Tanks with cross-connections

8.7.3

A readily accessible fusible link safety shutoff valve shall be installed:

- (1) As close as practical to the burner(s) supply connection
- (2) Immediately upstream of the filter and inside the building, if the piping passes through a foundation

8.7.4

The pressure at the fuel supply inlet to an appliance shall not exceed a gauge pressure of 3 psi (gauge pressure of 21 kPa), unless the appliance is approved for a higher inlet pressure.

8.7.5

Threaded pipe or valve ends installed in a tank bottom opening for gravity feed shall not penetrate above the bottom of the tank shell.

8.7.5.1

Use of stem pieces or other modifications to valves shall not circumvent the requirement of 8.7.5 to prevent water in the tank from draining out the bottom opening.

8.7.6

Unions or fittings that require gaskets or packings shall not be used in fuel lines.

8.7.7 Fuel Return Piping.

A return line from a burner or a pump back to a supply tank shall have no valves or obstructions except for a hard-seat or ball valve that shall be left in the open position, with the handle removed, and shall enter the top of the same tank.

8.8 Auxiliary Tank Piping.**8.8.1**

An auxiliary tank shall be provided with an overflow pipe draining to the supply tank and extending into the top of the supply tank, unless the auxiliary tank is specifically listed for use without an overflow pipe.

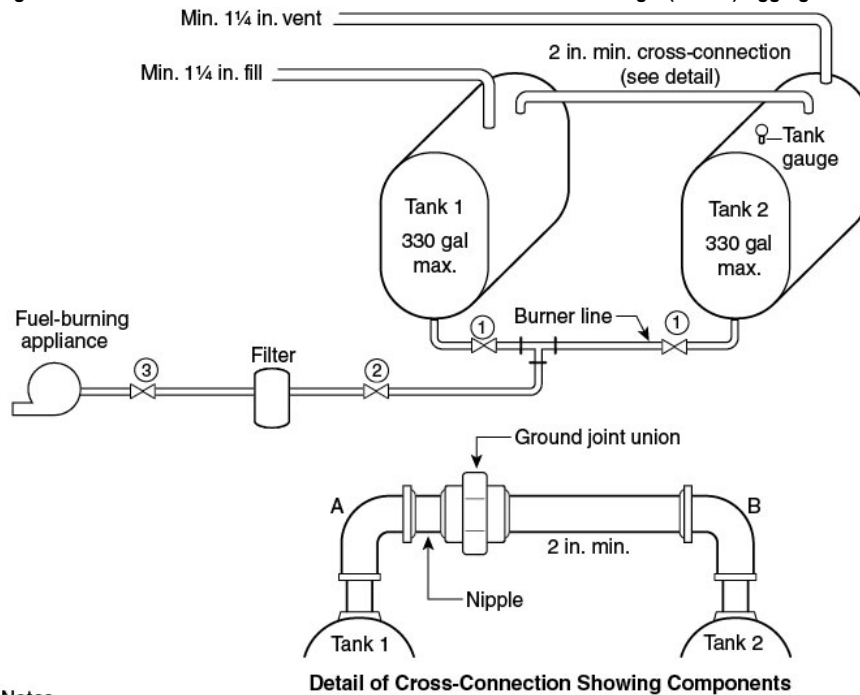
8.8.2

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

8.9 Piping for Cross-Connected Tanks.**8.9.1**

Cross-connection of two tanks of not more than 660 gal (2500 L) aggregate capacity to the same fuel-burning appliance(s) shall be permitted if piped in accordance with Figure 8.9.1.

Figure 8.9.1 Cross-Connection of Two Fuel Tanks of Not More Than 660 gal (2500 L) Aggregate Capacity.

**Notes:**

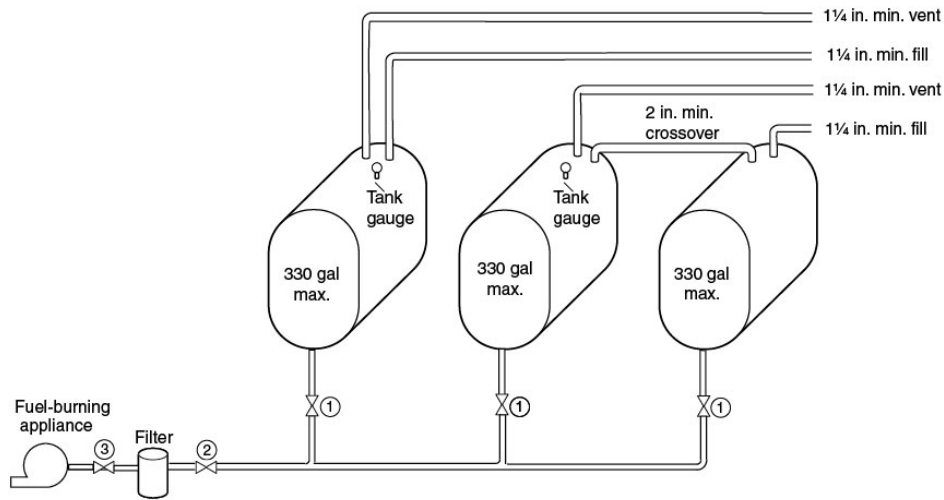
- ① Fusible link safety shutoff valve required by 8.7.1.3.
- ② Fusible link safety shutoff valve required by 8.10.6(1).
- ③ Fusible link safety shutoff valve required by 8.10.6(2).

For SI units, 1 gal = 3.785 L, 1 in. = 25 mm.

8.9.2

Cross-connection of three tanks of not more than 990 gal (3750 L) aggregate capacity to the same fuel-burning appliance(s) shall be permitted if piped in accordance with Figure 8.9.2.

Figure 8.9.2 Cross-Connection of Three Fuel Tanks of Not More Than 990 gal (3750 L) Aggregate Capacity.

**Notes:**

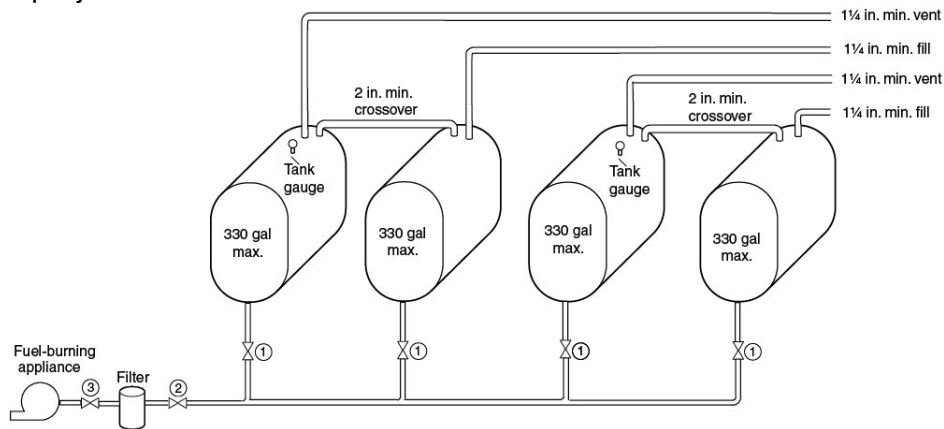
- ① Fusible link safety shutoff valve required by 8.7.1.3.
- ② Fusible link safety shutoff valve required by 8.10.6(1).
- ③ Fusible link safety shutoff valve required by 8.10.6(2).

For SI units, 1 gal = 3.785 L, 1 in. = 25 mm.

8.9.3

Cross-connection of four tanks of not more than 1320 gal (5000 L) aggregate capacity to the same fuel-burning appliance(s) shall be permitted if piped in accordance with Figure 8.9.3.

Figure 8.9.3 Cross-Connection of Four Fuel Tanks of Not More Than 1320 gal (5000 L) Aggregate Capacity.

**Notes:**

- ① Fusible link safety shutoff valve required by 8.7.1.3.
- ② Fusible link safety shutoff valve required by 8.10.6(1).
- ③ Fusible link safety shutoff valve required by 8.10.6(2).

For SI units, 1 gal = 3.785 L, 1 in. = 25 mm.

8.9.4

Cross-connection of multiple tanks to the same burner or to the same group of burners using single fill and vent pipes shall be permitted in accordance with 8.9.1, 8.9.2, or 8.9.3, provided the tanks are rigidly secured to a common slab or foundation.

8.9.5

All fill and vent pipes shall drain toward the tank.

8.9.6

Vent pipes from more than one tank shall be permitted to be manifolded and connected into one outlet pipe.

8.9.6.1

The outlet pipe shall be at least one pipe size larger than the largest individual vent pipe connected thereto.

8.9.6.2

In no case shall the point of connection between two or more vent pipes be lower than the top of the fill pipe opening.

8.10 Pumps, Valves, Gauges, and Appurtenances.**8.10.1**

Tanks, including each compartment of multi-compartment tanks, in which a constant fuel level is not maintained by an automatic pump shall be equipped with a method of determining the fuel level.

8.10.2

Gauges for indicating the oil level in tank(s) shall be listed in accordance with ANSI/UL 180, *Liquid Level Gauges for Oil Burner Fuel and Other Combustible Liquids*. They shall be installed in accordance with manufacturers' instructions and so that fuel or vapor will not be discharged into the building.

8.10.3

Except as provided for in 8.10.3.1 and 8.10.3.2, supply tanks provided with fill and vent pipes shall be provided with a device to indicate either visually or audibly and within 12 ft (3.5 m) of the fill point, as specified by 8.6.2.2, when the fuel in the tank has reached a predetermined safe level.

8.10.3.1

Aboveground tanks that do not exceed 330 gal (1250 L) capacity shall rely on only an audible fill alarm to determine safe fill levels.

8.10.3.2

Underground tanks that can be filled using a portable fill pipe having an integral audible alarm that indicates a predetermined safe level shall not be required to meet the provisions of 8.10.3.

8.10.4

Supply tanks shall not be equipped with a glass gauge.

8.10.5

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

8.10.6

A readily accessible fusible link safety shutoff valve that closes against the supply pressure shall be installed at each of the following points:

- (1) Within 6 in. (150 mm) of the filter on the tank side of the filter
- (2) Within 12 in. (300 mm) of the inlet connection to the burner

8.10.7

Test wells shall be equipped with a tight-fitting metal cover.

8.11 Testing of Fuel Supply Piping.**8.11.1**

Unless fuel supply piping and all fittings are visible for inspection, they shall be tested for leaks by either a pressure test method in accordance with 8.11.3 or a vacuum test method in accordance with 8.11.4 before being covered, enclosed, or placed into service.

8.11.2

Before oil supply lines are tested for leaks, any supply tank and any fuel-burning appliance shall be isolated from pressure, unless rated for the applicable test pressure or vacuum.

8.11.3

Pressure testing for leakage shall be conducted with air or an inert gas and shall be held for a time sufficient to conduct a complete visual inspection of all piping and fittings, but in no case for less than 10 minutes after stabilization.

8.11.3.1

A gauge pressure of at least 5.0 psi (35 kPa), but not more than 10 psi (70 kPa), shall be applied to all portions of the supply piping to be evaluated.

8.11.3.2

Leakage shall be detected by the appearance of bubbles after a soap-and-water solution or an equivalent leak detection fluid has been sprayed onto all joints.

8.11.4

Vacuum testing for leakage shall be conducted with a vacuum pump and vacuum gauge with 0.5 in. Hg (12 mm Hg) increments and accuracy of at least 2 percent. Vacuum shall be held for at least 30 minutes after stabilization with no loss.

8.11.4.1

A vacuum of at least 20 in. Hg (500 mm Hg) shall be applied to all portions of the supply piping to be evaluated.

8.11.4.2

Leakage shall be determined by any loss of vacuum after the test time.

8.11.5

Gauges used for leak testing shall be suitable for the test type, shall be in working order, and shall be calibrated. Gauges shall have a test range of not more than twice the test pressure and shall indicate in increments of not more than 1.0 psi (7 kPa) or 1.0 in. Hg (25 mm Hg).