

**CHAPTER XII
CONTROLS**

1200.0—SCOPE

For heating, air-conditioning and refrigeration equipment, including blower and exhaust fans

1201.0—HOT TANKS OR HEATERS AND SAFETY DEVICES
(Based on North Carolina Plumbing Code)

General.

- (a) All automatically fired water tanks shall be equipped with the following minimum controls and devices as applicable:
 - (1) Operating temperature controls.
 - (2) High limit temperature control with maximum thermostetting of 210 deg. F. (energy cut-off).
 - (3) A positive flame failure cut-off.
 - (4) Approved and listed burner and controls;
Gas-fired-American Gas Association.
Oil-fired-Underwriters' Laboratories.
 - (5) An approved type pressure relief and temperature relief valve or an approved type combination thereof. New installations shall comply with General Statutes 66-27.1. Temperature relief ratings shall be in accordance with ANSI standard Z21.22 (1970).
- (b) No individual firm, corporation, or business shall install, sell or offer for sale any automatic hot water tank or heater of 120 gallon capacity or less which does not have installed thereon by the manufacturer of such tank or heater an American Society of Mechanical Engineers and National Board of Boiler and Pressure Vessel Inspectors approved type pressure-temperature relief valve, and so labeled by the manufacturer's identification stamped or cast upon the tank or heater or upon a plate secured to it.
- (c) Relief valves shall be connected to the top of the tank with the spindle vertical, if possible, either directly to a tapped or flanged opening in the tank, or to a fitting connected to the tank by a close nipple. The temperature sensing probe shall be actuated by the water within the top six inches of the tank and the relieving capacity of any one valve shall equal or exceed the heat (BTU's) input of the heater or to the storage tank. Relief Valve pressure setting shall not exceed the tank or heater manufacturer's rated working pressure and thermostetting shall not be connected to the drainage system as a direct waste, but shall be piped to a floor drain or other safe location; discharge piping to be the same size as relief valve outlet or larger.
- (d) For installation with a separate storage tank, relief valves shall be installed on the tank and there shall not be any type of valve installed between the water heater and the storage tank. When shut-off valves are provided between the heater and storage tank, additional approved type safety relief valve (s) shall be installed on the heater.
- (e) Dip tubes, supply and hot water nipples, supply water baffles or heat traps when used in hot water supply storage tanks or heaters shall be constructed and tested to withstand a temperature of 400 deg. F without deteriorating in any manner, and the tank so labeled by the manufacturer.

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- (f) Copper or steel coil tube type hot water supply heaters which are not covered by the ASME Boiler Code that have been designed and constructed as safe as otherwise provided in the ASME Code and are AGA or U.L. approved shall be equipped with approved safety devices as required by this section.
- (g) A hot water supply or storage tank, fired or unfired, shall not be used as a heating boiler.
- (h) All storage tanks shall have clearly and indelibly stamped in metal or so marked upon a plate welded thereto, or otherwise permanently attached, the maximum allowable working pressure. Such markings shall be in an accessible position outside of the tank so as to make inspection or reinspection readily possible. All storage tanks for domestic hot water shall meet the applicable ASME standards.
- (i) All electric, gas and oil water heaters must be approved and listed by nationally recognized testing laboratories such as A.G.A., U.L., etc.; and all hot water tanks (fired or unfired) shall bear the ASME label of approval when required. The maximum allowable working pressure of a tank or heater shall in no case exceed the pressure indicated by the manufacturer's identification stamped upon the tank or upon a plate secured to it.
- (j) Flue Connection—Each fired tank or fired coil heater shall be equipped with a minimum three inch diameter vent pipe or flue connected to an approved gas vent or chimney meeting the requirements of the State Building Code.

Tanks or heaters that exceed any of the following limitations shall meet the requirements of the ASME Boiler Code, Section VIII and conformity shall be certified by the inspection and stamping of the National Board of Boiler and Pressure Vessel Inspectors.

- (1) A heat input of 200,000 BTU's per hour.
 - (2) A water temperature of 200 deg. F.
 - (3) A nominal water containing capacity of 120 gallons.
- a Each hot water supply tank or heater of more than 120 gallons capacity shall have at least one officially-rated ASME and NB approved type pressure-temperature relief valve of the automatic reseating type set to relieve at or below the maximum allowable working pressure of the tank. When more than one relief valve is used on either hot water heating or hot water storage tanks, the additional valve or valves shall be officially-rated ASME and NB approved type and shall be set within the range not to exceed 20% of the lowest pressure at which any valve is set. Relief valve shall be spring loaded without disc guides on the pressure side of the valve. Relief valves shall be so arranged that they cannot be reset to relieve at a higher pressure than the maximum permitted by this paragraph.
 - b Pressure reducing valves shall be used in the water supply to the heater or tank where the static water pressure exceeds 75% of the water working pressure of the heater or tank. Where relief valves are weeping, due to residual heat expansion, or due to excessive pressure surges, it is recommended a pressure reducing valve and or a small expansion tank be installed.
 - c There shall be a stop and check valve in the water supply to the tank or heater.
 - d All storage tanks shall be equipped with adequate drain cocks.

1202.0—CONTROLS. (Residential type-Central Furnaces)

a. Temperature limit controls shall be of an approved type and shall be such that they cannot be set higher than the specified temperature setting.

1203.0—CONTROLS. (For residential type Boilers)

a. Temperature limit controls shall be of an approved type and shall be such that they cannot be set higher than the specified temperature setting.

b. Steam and hot water boilers respectively shall be provided with approved automatic limiting devices to prevent boiler steam pressure or boiler water temperature from exceeding the maximum allowable working pressure or temperature.

c. Steam boilers shall be provided with an automatic low water fuel cutoff to prevent firing the boiler in the event that the boiler water level drops to the lowest safe water line.

d. Steam and hot water boilers shall be equipped respectively with approved steam safety or pressure relief valves of appropriate discharge capacity. Steam safety valves and pressure relief valves shall be set to discharge at a pressure not to exceed the maximum allowable working pressure of the boiler.

**1204.0—CONTROLS - OIL BURNERS AND OIL FIRED EQUIPMENT
FURNACES, BOILERS, ETC.**

a. Oil burners other than oil stoves with integral tanks, shall be provided with some means for manually stopping the flow of oil to the burner. Such device or devices shall be placed in a convenient location at a safe distance from the burner. With electrically driven equipment this may be accomplished by an identified switch in the burner supply circuit, placed near the entrance to the room where the burner is located. A valve in the oil supply line operable from a location reached without passing near the burner may also be used.

b. Oil burners for which a competent attendant will not be constantly on duty in the room where the burner is located while the burner is in operation shall be equipped with a primary safety control of a type specifically listed for the burner with which it is used.

Note: Burners and oil-fired units so equipped are listed by Underwriters' Laboratories, Inc. and Underwriters' Laboratories of Canada as Oil Burners with primary safety controls and Oil-Fired Units with primary safety controls respectively.

c. Oil burners for which a competent attendant will be constantly on duty in the room where the burner is located, while the burner is in operation, are not required to be equipped with primary safety controls. When primary safety controls are installed in connection with oil burners of this type such automatic devices shall be of a type specifically listed for use with the burner to which they are attached.

Note: Oil burners of this type are listed by Underwriters' Laboratories, Inc. and Underwriters' Laboratories of Canada as Industrial Oil Burners without primary safety controls.

d. Primary safety controls for burners may consist of the combustion type electrical control or an anti-flooding device. The proper control to be furnished with each burner is indicated in the listing by the testing agency.

e. Each appliance fired by oil burners and each oil-fired unit shall be

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provided with automatic limit controls which will prevent unsafe pressure or low water in a steam boiler or overheating within a hot-water boiler, furnace or heater.

Note: All "closed" hot water boilers should, in addition to temperature limit switch protection, be provided with at least one ASME Code rated relief valve. If the boiler BTU output, determined in accordance with the ASME Code, paragraph H-44 is greater than relief valve BTU rating, additional relief valves or rupture discs should be provided so that the combined BTU rating of all relief devices is equal to or greater than the boiler BTU output rating. In addition, protection against an emergency low water condition (such as may originate from prolonged water discharge from a relief valve; water leakage from system; inoperative water feeder valve; or water line shut off) is recommended, as this is the only method to cause automatic cessation of burner firing in the event of low water.

f. Limiting controls and low-water shutoffs intended to prevent unsafe operation of heating equipment by opening an electrical circuit to the burner or oil shut-off device shall be so arranged as to effect the direct opening of that circuit, whether the switching mechanism is integral with the sensing element or remote from same.

Note: The purpose of this requirement is to avoid interposing in the limit control circuit other controls the failure of which may be the cause of an unsafe condition which the limit control is intended to prevent. However, a limit control may interrupt the pilot circuit of a magnetic type motor controller which in turn directly opens the safety circuit when it is necessary to interrupt a single phase circuit carrying a load greater than the capacity of available limit controls or to interrupt a multiphase circuit.

g. A water heater shall be provided with water pressure, temperature and vacuum relief devices. Means shall be provided to prevent siphoning in any boiler or tank to which any circulating water heater is attached.

Note: A cold water tube with a hole near the top is commonly accepted means to prevent siphoning.

h. Electric motor-driven oil burners of the type described in 5203.3 with integral oil pumps and electric motor-driven pump sets for use with such burners not equipped with integral pumps, shall be provided with a motor controller incorporating no-voltage protection to be wired into the power supply to the motor.

Note: On failure of voltage, such controllers cause and maintain the interruption of the power from the main circuit. These controllers are included in Underwriters' Laboratories, Inc. and Underwriters' Laboratories, Inc. and underwriters' Laboratories of Canada "Gas and Oil Equipment List" under the heading "Industrial Control Equipment".

i. In systems where either steam or air is used for atomizing the oil or where air for combustion is supplied by a source which may be interrupted without shutting off the oil supply, the oil and atomizing or air supply shall be interlocked in a manner to immediately shut off the oil supply upon failure of the atomizing or air supply.

Note: Burners listed by Underwriters' Laboratories, Inc. and Underwriters' Laboratories of Canada conform to this requirement.

j. When automatically operated burners are used in installations equipped with forced or induced draft fans or both, means shall be provided to immediately shut off the oil supply upon fan failure.

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Note: Oil-Fired Units listed by Underwriters' Laboratories, Inc. and Underwriters' Laboratories of Canada are so equipped.

k. Oil burners not equipped to provide safe automatic restarting after shut down shall require manual restarting after any control functions to extinguish the burner flame.

l. An acceptance test shall be conducted where more than one burner is fired in a single combustion chamber or one burner is adapted to firing two or more combustion chambers, to make sure that the primary safety control will function properly in the event of ignition failure or unsafe flame extinguishment at one or more burners.

1205.0—CONTROLS. For warm air heating, air conditioning, air cooling and ventilating systems of other than residential type

a. Each installation shall be equipped with a manual emergency stop control, located at a conveniently accessible point, for quick shutting down of the fan in case of fire.

b. In systems utilizing recirculation, serving more than one story of a building, or more than one fire section of a single story, fans shall be arranged to shut down automatically when the temperature of the air in the system becomes excessive, as from a fire. For this purpose an approved thermostatic device with a setting not in excess of 125 F. shall be located in the system at a suitable point in the return air duct ahead of the fresh air intake. Either the thermostatic device shall be of a type that is manually reset or the control system shall be so arranged that some manual operation is required to restart the fan after the thermostat has operated.

6-11-74 See next page for para c, d, e, f.

1206.0—OPERATING CONTROLS. (Cooking Equipment)

Deep fat fryers should be equipped with a separate high limit control in addition to the adjustable operating control (thermostat) to shut off fuel or energy in the event the fat exceeds a temperature of 425F.

1207.0—CONTROLS FOR HEAT PUMPS. (Refer to Chapter V, Sect. 512.5)

Except as otherwise provided heat pump systems that are equipped with supplemental heating units shall be equipped with a temperature limit control located not more than 2 feet downstream from all heat input devices and of a type that will limit outlet air temperature to 200 F.

1208.0—CONTROL CIRCUITS - GENERAL.

All control circuits shall be connected with one side to ground, with switch breaking the hot line.

1209.0—ROOM TEMPERATURE THERMOSTATS

(a) Locations:

Room temperature thermostats should be located in the natural circulating path of room air. The device should not be placed so that it is exposed to cold air infiltration, draft from outside openings such as windows and doors, air current from warm or cold air registers, or so that the natural circulation of the air is cut off such as behind doors, in shelves, or in corners.

Thermostats controlling floor furnaces shall not be located in a room or space which can be separated from the room or space in which the register of the floor furnace is located.

(b) Exposure:

A room temperature thermostat should not be exposed to heat from

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nearby radiators, fireplaces, radios, television sets, lamps, rays of the sun, or mounted on a wall containing pipes or warm air ducts, or a chimney or gas vent, which would affect its operation and prevent it from properly controlling the room temperature.

(c) Drafts:

Any hole in the plaster or panel through which the wires pass from the thermostat to the appliance being controlled shall be adequately sealed with suitable material to prevent drafts from affecting the thermostat.

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- (c) In systems between 2000 cfm and 15,000 cfm capacity, fans shall be arranged to shut down automatically when the temperature of the air in the system becomes excessive, as from a fire. For this purpose, approved fixed temperature thermostatic devices shall be provided as follows: —with a setting not in excess of 136 degrees F., at a suitable location in the return air stream prior to exhausting the building or being diluted by outside air, or with a setting not in excess of 50 degrees F, above the maximum operating temperature, at a suitable location in the main supply duct on the downstream side of the filters. Either of the thermostatic device shall be of the type that is manually reset or the control system shall be so arranged that some manual operation is required to restart the fan after the thermostatic device has operated. Smoke detectors approved for duct installation may be used in lieu of the thermostatic devices.
- (d) Except as required in 1205 (b), in systems of over 15,000 cfm capacity, smoke detectors approved for duct installation shall be installed and arranged to automatically shut down fans. For this purpose, smoke detectors approved for duct installation shall be provided as follows: At a suitable location in the return air stream prior to exhausting from the building or being diluted by outside air, or at a suitable location of the main supply duct on the downstream side of the filters. Smoke dampers shall be installed in such a manner as to restrict circulation of smoke, and arranged to close automatically when the system is not in operation, and also by operation by the smoke detecting apparatus and by the manual emergency fan stop.
- (e) Systems incorporating automatic exhaust rather than automatic fan shut down may be used in lieu of the requirements in (c) and (d), subject to the authority having jurisdiction. Automatic smoke detection shall be provided for such systems.
- (f) In systems of 15,000 cfm capacity, and under, effective means of detecting and controlling the spread of smoke in air conditioning systems is recommended in premises where the panic hazard is pronounced or where there are valuable contents particularly subject to smoke damage. [See also (b)].
- (g) Fire and smoke detectors covered by this standard are not to be construed as a substitute for complete area protection afforded by an approved fire detection system as covered by NFPA No. 71, 72A, 72B, 72C, 1972 Editions, and 72D, 1973 Edition. When such an approved fire detection system is installed in the building, the fire and smoke detectors in (b), (c) and (d) shall be connected thereto in accordance with approved practice so that actuation of any fire or smoke detector will sound the alarm as well as provide the function of controlling the ventilation system.

CHAPTER XIII—OIL STORAGE APPARATUS

1300—TANK STORAGE

1301.0—DESIGN AND CONSTRUCTION OF TANKS.

I. Materials.

- (a) Tanks shall be built of steel except as provided in 1301(b) through 1301(e).
- (b) Tanks for underground service may be built of material other than steel.
- (c) Tanks built of materials other than steel shall be designed to specifications embodying principles recognized as good engineering design for the material used and shall be approved by the authority having jurisdiction.
- (d) Unlined concrete tanks may be used for aboveground or underground service for fuel oils having a gravity of 40 degrees API or heavier. Concrete tanks shall be built in accordance with sound engineering practice.
- (e) Tanks may have combustible or noncombustible linings.

II. Fabrication.

- (a) Tanks may be of any shape or type consistent with sound engineering design.
- (b) Metal tanks shall be welded, riveted and caulked, brazed, or bolted, or constructed by use of a combination of these methods. Filler metal used in brazing shall be nonferrous metal or an alloy having a melting point above 1000 F and below that of the metal joined.
- (c) Tanks shall be used under substantially atmospheric pressure and shall be built in accordance with approved standards of design. Atmospheric tanks may be built in accordance with:
- (d) Underwriters' Laboratories, Inc. Subjects No. 142, Standard for Aboveground Tanks for Flammable Liquids, Second Edition, October 1953; No. 58, Standard for Underground Tanks for Flammable Liquids, Fifth Edition, December 1969; or No. 80, Standard for Inside Tanks for Oil-Burner Fuel, Fifth Edition, September 1968.
- (e) Underwriters' Laboratories of Canada Subjects No. C 142, Standard for Aboveground Tanks for Flammable Liquids, Second Edition, August 1955; No. C 58, Standard for Underground Tanks for Flammable Liquids, Third Edition, September 1956.
- (f) American Petroleum Institute Standards No. 12A, Specification for Oil Storage Tanks with Riveted Shells, Seventh Edition, September 1951 or No. 650, Welded Steel Tanks for Oil Storage, Second Edition, 1964.
- (g) Steel tanks designed for underground service not exceeding 2500 gallons capacity may be used aboveground.
- (h) Atmospheric tanks built according to Underwriters' Laboratories, Inc., or Underwriters' Laboratories of Canada standards in 1301. II(c) of this code may be used for operating pressures not exceeding 1 psig. Atmospheric aboveground tanks shall be limited to 2.5 psig under emergency venting conditions.
- (i) The tank shall be designed for the maximum static head which will be imposed when the vent or fill pipe is filled with oil. The maximum

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static head so imposed on tanks built in accordance with 1301 II(c) of this Code) shall not exceed 10 psig at the bottom of the tank.

- (j) Pressure tanks, if required to conform to 1301. II(i) above, shall be built in accordance with the principles of the Code for Unfired Pressure Vessels, Section VIII of the ASME Boiler and Pressure Vessel Code, 1962 edition. If such tanks are larger than 550 gallons or are to be buried underground, all openings in such tanks shall be located above the highest normal liquid level.

1302.0—INSTALLATION OF UNDERGROUND TANKS.

- (a) Only a tank complying with the construction provisions of Standard No. 58 or No. C 58 of 1301. II(c) or as provided in 1301. II(j), shall be buried underground.
- (b) Excavation for underground tanks shall be made with due care to avoid undermining of foundations of existing structures. Underground tanks or tanks under buildings shall be so located with respect to existing building foundations and supports that the loads carried by the latter cannot be transmitted to the tank. The distance from any part of a tank storing fuel oil to the nearest wall of any basement, pit or property line shall be not less than one foot.
- (c) An underground tank shall be set on a firm foundation and surrounded with at least 6 inches of noncorrosive inert materials such as clean sand, earth or gravel well tamped in place. The tank shall be placed in the hole with care since dropping or rolling the tank into the hole can break a weld, puncture or damage the tank metal or scrape off the protective coating of coated tanks. A tank shall be covered with a minimum of 2 feet of earth, or shall be covered with not less than 1 foot of earth on top of which shall be placed a slab of reinforced concrete not less than 4 inches thick. When underground tanks are, or are likely to be subjected to traffic, they shall be protected against damage from vehicles passing over them by at least 3 feet of earth cover, or 18 inches of well tamped earth, plus 6 inches of reinforced concrete or 8 inches of asphaltic concrete. When asphaltic or reinforced concrete paving is used as part of the protection, it shall extend at least 1 foot horizontally beyond the tank in all directions.
- (d) Corrosion protection for the tank and its associated buried piping shall be provided by one or more of the following methods: (1) use of protective coatings or wrappings, (2) cathodic protection, or (3) corrosion resistant materials of construction.

Table 1

Capacity of Tank, U. S. Gallons	Diameter of Vent, Iron Pipe Size
500 or less	1¼ inches
501 to 3,000	1½ inches
3,001 to 10,000	2 inches
10,001 to 20,000	2½ inches
20,001 to 35,000	3 inches

Note: Where tanks are filled by the use of a pump through tight connections, special consideration should be given to the size of the vent pipe to insure that it is adequate to prevent the development of abnormal pressure in the tank during filling. This may be accomplished by providing a vent pipe not less in size than the discharge of the pump.

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- (e) Underground tanks shall be equipped with an open vent or an automatically operated vent, arranged to discharge to the open air. Vent openings and vent pipes shall be of ample size to prevent abnormal pressure in the tank during filling but not smaller than the pipe size specified in Table 1 of this Chapter.
- (f) Except as provided in 1320.8, all connections to an underground tank shall be made through the top of the tank.
- (g) An underground tank shall be provided with means for gauging. (see Section 1317.0 of this Chapter.)

1303.0—INSTALLATION OF UNENCLOSED SUPPLY TANK INSIDE BUILDING.

I. An unenclosed supply tank inside of a building shall conform to the following provisions:

- (a) A supply tank not larger than ten gallons shall be specifically approved for the purpose.
- (b) An approved safety can may be used as storage tank.
- (c) A supply tank larger than ten gallons but not larger than 550 gallons shall meet the construction provisions of Standard UL 80 or ULC 80 of 1301.0 II (c), or as provided in 1301.0 II(j).
- (d) A supply tank shall be of such size and shape that it can be installed in and removed from the building as a unit.

II. The size and location of unenclosed tanks inside of any building or any one portion of a building separated from other portions by a fire wall shall be in accordance with the following:

- (a) Not more than six supply tanks or not more than six safety cans may be located in any one or more stories of a building. No such supply tank or safety can shall have an individual capacity exceeding ten gallons.
- (b) A supply or storage tank located above the lowest story, cellar or basement shall not exceed 60 gallons capacity and the total capacity of tanks so located shall not exceed 60 gallons.
- (c) A supply tank shall be not larger than 550 gallons. Not more than one 550 gallon tank or two tanks of aggregate capacity of 550 gallons or less shall be connected to one oil burning appliance and the aggregate capacity of such tanks installed in the lowest story, cellar or basement of a building shall not exceed 1,100 gallons, unless separation is provided for each 550 gallons of tank capacity. Such separation shall consist of an unpierced masonry wall or partition extending from the lowest floor to the ceiling above the tank or tanks and shall have a fire resistance rating of not less than two hours.

III. Details:—

- (a) An unenclosed supply tank not larger than ten gallons shall be placed not less than two feet horizontally from any source of heat either in or external to the appliance being served but in any case shall be located so that the temperature of the oil in the tank will not exceed 25 degrees F above toom temperature.
- (b) An unenclosed supply tank larger than ten gallons shall be placed not less than five feet horizontally from any fire or flame either in or external to the appliance being served by the tank.
- (c) An unenclosed supply tank shall be securely supported by rigid non-combustible supports to prevent settling, sliding or lifting.

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- (d) When a supply tank larger than ten gallons capacity is provided with an opening in the bottom for use as a burner supply connection or as a drain, the tank shall be pitched toward the opening with a slope of not less than $\frac{1}{4}$ inch per foot of length.
- (e) A shutoff valve shall be provided immediately adjacent to the burner supply connection at the bottom of a supply tank.
- (f) A supply tank larger than ten gallons capacity shall be provided with an open vent pipe not smaller than the pipe size specified in Table 1 and a fill pipe, both terminating outside the building.

Note: Where tanks are filled by the use of a pump through tight connections special consideration should be given to the size of the vent pipe to insure that it is adequate to prevent the development of abnormal pressure in the tank during filling. This may be accomplished by providing a vent pipe not less in size than the discharge of the pump.

- (g) A supply tank provided with fill and vent pipes shall be equipped with a gauging device. (See Section 1317.0).
- (h) Any unused opening in a tank equipped with fill and vent pipes shall be closed vapor tight by a pipe plug or cap screwed up tightly.
- (i) Two supply tanks connected to the same burner as permitted by 1303.II(c) may be cross-connected and provided with a single fill and a single vent pipe as described on last page of this chapter, Section 1320.

1304.0—INSTALLATION OF ENCLOSED SUPPLY TANKS INSIDE BUILDINGS.

- (a) A supply tank larger than 550 gallons capacity shall be enclosed when installed inside of a building.
- (b) Tankage inside of a building in excess of that permitted in unenclosed tanks by 1303.II(c) shall be enclosed.
- (c) Only a tank meeting the construction provisions of Standards No. 58 or No. C 58 and No. 80 or No. C 80 of 1301.II(c), or as provided in 1301.(j) shall be installed enclosed inside of a building.
- (d) The nominal gross capacity of enclosed tanks inside a building shall not exceed:
 1. 10,000 gallons in buildings of other than fire-resistive construction.
 2. 15,000 gallons in buildings of fire-resistive construction.
 3. 50,000 gallons with an individual tank capacity not exceeding 25,000 gallons in any building; provided that the tank or tanks are enclosed as specified in 1304.(g), and in addition are located in a room cut off vertically and horizontally from other floors of the main building by construction having a fire resistance rating of two hours.
- (e) The tank shall be supported at least four inches above the floor by masonry saddles at least 12 inches thick, spaced not more than eight feet on centers and extending the full width of the tank.
- (f) All connections to an enclosed supply tank having a capacity of more than 550 gallons shall be made through the top of the tank, and the transfer of oil shall be by pump only and through continuous piping to and from the consuming appliances.

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- (g) The walls of tank enclosures shall be constructed of solid masonry units or poured concrete construction having a fire-resistance rating of not less than three hours and bonded to the floor. The floor shall be of concrete or other fire-resistive construction. The top shall be of reinforced concrete at least five inches thick or equivalent fire-resistive construction, except that where the floor or roof construction above the enclosure is concrete or other fire-resistive construction, the walls may be extended to and bonded to the underside of the construction above in lieu of a separate top. At least 15 inches clearance shall be left around the tank for the purpose of inspection and repair.
- (h) Each tank enclosure shall be provided with an opening closed by a self-closing Class A fire door and a noncombustible liquid-tight sill or ramp at least six inches high. If the sill or ramp is more than six inches high, the walls to a height corresponding to the level of oil that will be retained shall be built to withstand the lateral pressure due to the liquid head.
- (i) Provision shall be made for adequate ventilation of such enclosures prior to entering for inspection or repair of tanks.
- (j) An enclosed supply tank shall be equipped with an open vent or an automatically operated vent, terminating outside the building. Vent openings and vent pipes shall be of ample size to prevent abnormal pressure in the tank during filling but not smaller than the pipe size specified in Table 1.
- (k) An enclosed supply tank shall be provided with a gauging device. (See Section 1317.0)

1305.0—INSTALLATION OF OUTSIDE ABOVEGROUND TANKS NOT LARGER THAN 550 GALLONS

- (a) The provisions of this Section do not apply to Centralized Oil Distribution Systems. (See Section 1320.0)
- (b) Tankage not in excess of that permitted by 1303.2 may be installed outside aboveground in a built-up area. The tanks may be adjacent to buildings but the distance to the line of adjoining property shall be in accordance with Table 2, Section 1307.(c). Such tanks shall be suitably protected from the weather and from physical damage incident to outside use. The tanks shall not block normal means of egress.
- (c) A tank not larger than 60 gallons capacity may be an ICC-5 Shipping Container (drum) and so marked, a listed safety can, or a tank meeting the provisions of Standard UL 80 or ULC 80 of 1301.11 or as provided in 1301.17.
- (d) A tank other than an ICC-5 Shipping Container having a capacity of not more than 550 gallons shall meet the provisions of Standard UL 80 or ULC 80 of 1301.11, or as provided in 1301.17
- (e) A supply or storage tank located above the lowest story, cellar or basement shall not exceed 60 gallons capacity and the total capacity of tanks so located shall not exceed 60 gallons.
- (f) Not more than one 550 gallon tank or two tanks of aggregate capacity of 550 gallons or less shall be connected to one oil-burning appliance.
- (g) Two supply tanks connected to the same burner as permitted by 1305.1 above may be cross-connected and provided with a single fill and a single vent as described in Sect. 1320, but when so connected they shall be on a common slab and rigidly secured one to the other.

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- (h) Tanks having a capacity of 550 gallons or less shall be securely supported by rigid noncombustible supports to prevent settling, sliding or lifting.
- (i) The filling of a portable container from a storage tank larger than 60 gallons shall be by means of a hand pump only.
- (j) A shutoff valve shall be provided in the burner supply line immediately adjacent to the gravity feed connection of a supply tank.
- (k) For Above-Ground Residential Oil Storage Tanks—Use either of these methods for adequate support:
 - 1. Pipe supports, securely anchored in poured concrete. (And do not fill tank until concrete has taken the final set).
 - 2. Tank stand with saddle type supports and bottom sections fabricated in triangular design, bottoms connected with structural member.
- (l) A tank not larger than 550 gallons capacity shall be equipped with an vent not smaller than the pipe size specified in Table 1302.0.
- (m) A tank shall be provided with a means to determine the liquid level. (See Section 1317.0)
- (n) The fill opening shall be of such size and so located as to permit ready filling in a manner which will avoid spillage.

1306.0—INSTALLATION OF OUTSIDE ABOVEGROUND TANKS LARGER THAN 550 GALLONS

- (a) A tank having a capacity of more than 550 gallons shall meet the construction provisions of Standard UL 142 or ULC 142 (a) of 1301.II(c), or as provided in 1301.II(j), or shall comply with 1301.II(c) except that a tank having a capacity less than 2,500 gallons constructed according to Standard UL 58 or ULC 58 of 1301.II(c) may be used.
- (b) A tank shall be provided with a means to determine the liquid level. (See Section 1317.0)

1307.0—LOCATION WITH RESPECT TO PROPERTY LINES, PUBLIC WAYS, OR NEAREST IMPORTANT BUILDING OR GROUP OF BUILDINGS.

- (a) Every aboveground tank for the storage of fuel oils and equipped with emergency venting which will not permit pressures to exceed 2.5 psig shall be located in accordance with Table 2, this Chapter.
- (b) Every aboveground tank for the storage of fuel oils operating at pressures exceeding 2.5 psig or equipped with emergency venting which will permit pressures to exceed 2.5 psig shall be located in accordance with Table, this Section.
- (c) Reference table for minimum distances used in Table 2 shall be as shown in this Section.
- (d) Where two tank properties of diverse ownership having a common boundary, the authority having jurisdiction may, with the written consent of the owners of the two properties, substitute the distances provided in 1308(a) through 1308(c) for the minimum distances set forth in 1307.0(a through c)

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Table 2

Type of Tank	Protection	Minimum Distance in Feet from Property Line Which May be Built Upon, including the Opposite Side of a Public Way	Minimum Distance in Feet from Nearest Side of Any Public Way or from Nearest Important Building or Group of Buildings
Floating Roof	Protection for Exposures*	$\frac{1}{2}$ times diameter of tank but need not exceed 90 feet	$\frac{1}{6}$ times diameter of tank but need not exceed 30 feet
	None	Diameter of tank but need not exceed 175 feet	$\frac{1}{6}$ times diameter of tank but need not exceed 30 feet
Vertical with Weak Roof to Shell Seam	Approved foam or inerting system on the tank	$\frac{1}{2}$ times diameter of tank but need not exceed 90 feet and shall not be less than 5 feet	$\frac{1}{6}$ times diameter of tank but need not exceed 30 feet and shall not be less than 5 feet
	Protection for Exposures*	Diameter of tank but need not exceed 175 feet	$\frac{1}{3}$ times diameter of tank but need not exceed 60 feet
	None	2 times diameter of tank but need not exceed 350 feet	$\frac{1}{3}$ times diameter of tank but need not exceed 60 feet
Horizontal and Vertical, with Emergency Relief Venting to Limit Pressures to 2.5 psig	Approved inerting system on the tank or approved foam system on vertical tanks	$\frac{1}{2}$ times Table 4 but shall not be less than 5 feet	$\frac{1}{2}$ times Table 4 but shall not be less than 5 feet
	Protection for Exposures*	Table 4	Table 4
	None	2 times Table 4	Table 4

*Protection for exposures shall mean fire protection for structures on property adjacent to tanks. When acceptable to the authority having jurisdiction, such structures located (1) within the jurisdiction of any public fire department or (2) within or adjacent to plants having private brigades shall be considered as having adequate protection for exposures.

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Table 3

Type of Rank	Protection	Minimum Distance in Feet from Property Line Which May be Built Upon, Including the Opposite Side of a Public Way	Minimum Distance in Feet from Nearest Side of Any Public Way or from Nearest Important Building or Group of Buildings
Any Type	Protection for Exposures	1½ times Table 4 but shall not be less than 25 feet	1½ times Table 4 but shall not be less than 25 feet
	None	3 times Table 4 but shall not be less than 50 feet	1½ times Table 4 but shall not be less than 25 feet

*Special consideration may be given to tanks equipped with automatic depressuring systems.

- (e) Where end failure of horizontal pressure tanks and vessels may expose property, the tank shall be placed with the longitudinal axis parallel to the nearest important exposure.

Table 4

Capacity of Tank		Minimum Distance in Feet from Property Line Which May be Built Upon, Including the Opposite Side of a Public Way	Minimum Distance in Feet from Nearest Side of Any Public Way or from nearest Important Building or Group of Buildings
U. S. Gallons	Approx. Imperial Gallons		
275 or less	250 or less	5	5
276 to 750	251 to 625	10	5
751 to 12,000	626 to 10,000	15	5
12,001 to 30,000	10,001 to 25,000	20	5
30,001 to 50,000	25,001 to 40,000	30	10

Note: Refer to Table 5 of the Flammable and Combustible Liquids Code, NFPA No. 30, for tanks larger than 50,000 gallons.

1308.0—SPACING (SHELL-TO-SHELL) BETWEEN ABOVEGROUND TANKS.

- (a) The location of a tank with respect to any such other tank except tanks of 550 gallons capacity or less shall be such that the distance between them shall be not less than three feet.
- (b) The distance between adjacent tanks shall not be less than one-sixth the sum of their diameters except when the diameter of one tank is less than one-half the diameter of the adjacent tank, the distance between the two tanks shall not be less than one-half the diameter of the smaller tank.

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- (c) The minimum separation between a liquefied petroleum gas container and a fuel oil tank shall be 20 feet. Suitable means shall be taken to prevent the accumulation of fuel oil under adjacent liquefied petroleum gas containers such as by diversion curbs or grading. When fuel oil tanks are within a dyked area, the liquefied petroleum containers shall be outside the diked area and at least 10 feet away from the center line of the wall of the diked area. The foregoing provisions shall not apply when liquefied petroleum gas containers of 125 gallons or less capacity are installed adjacent to fuel oil supply tanks of 550 gallons or less capacity.

1309.0—LOCATION OF OUTSIDE ABOVEGROUND TANKS WITH RESPECT TO IMPORTANT BUILDINGS ON SAME PROPERTY.

- (a) Every outside aboveground tank shall be separated from nearest important building or group of buildings on the same property by distance equal to that specified in 1307(a) or 1307(b) whichever is applicable. The appropriate distance column in Table 2, 3 or 4 that shall be used shall be the one reading: Minimum Distance in Feet from Nearest Side of Any Public Way or from Nearest Important Building or Group of Buildings."

1310.0—NORMAL VENTING FOR ABOVEGROUND TANKS.

- (a) Atmospheric tanks shall be adequately vented to prevent the development of vacuum or pressure sufficient to distort the roof of a cone roof tank or exceeding the design pressure in the case of other atmospheric tanks, as a result on emptying, and atmospheric temperature changes.
- (b) Normal vents shall be sized either in accordance with (1) the American Petroleum Institute Guide for Tank Venting, RP-2000; or (2) other accepted standard; or (3) shall be at least as large as the filling or withdrawal connection, whichever is larger but in no case less than 1¼ inch nominal inside diameter.

1311.0—EMERGENCY RELIEF VENTING FOR FIRE EXPOSURE FOR ABOVEGROUND TANKS.

Every aboveground tank shall have some form of construction or device that will relieve excessive internal pressure caused by exposure fires.

- (a) In a vertical tank the construction referred to in 1310(a) may take the form of a floating roof, lifter roof; a weak roof-to-shell seam, or other approved pressure relieving construction. The weak roof-to-shell seam shall be constructed to fail preferential to any other seam.
- (b) Where emergency venting is not provided in accordance with 1311.(a), the total capacity of both normal and emergency venting devices shall be not less than that derived from Table 5. (See Appendix A of NFPA No. 30, Flammable and Combustible Liquids Code.) The wetted area of the tank shall be calculated on the basis of 55 percent of the total exposed area of a sphere or spheroid, 75 per cent of the total exposed area of a horizontal tank and the first 30 feet abovegrade of the exposed shell area of a vertical tank.

Note: See Appendix A of NFPA No. 30, Flammable and Combustible Liquids Code, for calculation to determine exposed areas of typical types of vessels.

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Table 5
Wetted Area Versus Cubic Feet Free Air per Hour
(14.7 psia and 60 Degrees F.)

Sq. Ft.	CFH	Sq. Ft.	CFH	Sq. Ft.	CFH
20	21,100	200	211,000	1,000	524,000
30	31,600	250	239,000	1,200	557,000
40	42,100	300	265,000	1,400	587,000
50	52,700	350	288,000	1,600	614,000
60	63,200	400	312,000	1,800	639,000
70	73,700	500	354,000	2,000	662,000
80	84,200	600	392,000	2,400	704,000
90	94,800	700	428,000	2,800	742,000
100	105,500	800	462,000	and over	
120	126,000	900	493,000		
140	147,000	1,000	524,000		
160	168,000				
180	190,000				
200	211,000				

Note: Interpolate for intermediate values.

PIPING, PUMPS AND VALVES.

1312.0—PIPING MATERIALS AND DESIGN.

- (a) All piping shall be steel or brass pipe, or brass or copper tubing. Aluminum tubing shall not be used between the fuel oil tank and the burner unit. Wall thicknesses of steel pipe shall be in accordance with design methods outlined in Section 3 of the American Standard Code for Pressure Piping ASA B31.1-1955. Listed flexible metal hose may be used to reduce the effect of jarring and vibration or where rigid connections are impracticable and shall be installed in full compliance with its listing.
- (b) Piping used in the installation of oil burners and appliances other than conversion range oil burners shall be not smaller than $\frac{3}{8}$ inch iron pipe size or $\frac{3}{8}$ OD tubing. Copper tubing shall have 0.035 inch nominal and 0.032 inch minimum wall thickness.
- (c) Pipe shall be connected with standard fittings and tubing with fittings of listed type. Pipe connectors made of combustible materials or depending upon the frictional characteristics of combustible materials shall not be used inside of buildings or aboveground outside of buildings. If used below ground outside of buildings, connectors shall be of listed type and installed in accordance with their listing. All threaded joints and connections shall be made tight with suitable lubricant or pipe compound. Unions requiring gaskets or packings, right or left couplings, and sweat fittings employing solder having a melting point of less than 1000 Degrees F. shall not be used in oil lines. Cast iron fittings shall not be used.
- (d) Piping shall be substantially supported and protected against physical damage and where necessary protected against corrosion. All buried piping shall be protected against corrosion. Drop pipes from shop piping mains to burners are subject to physical damage and it may be necessary to enclose them in heavier pipe or the equivalent means to safeguard against breakage.

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- (e) Proper allowance shall be made for expansion, contraction, jarring and vibration. Pipe lines, other than tubing, connected to underground tanks, except straight fill lines and test wells, shall be provided with double swing joints, flexible connectors or otherwise arranged to permit the tanks to settle without impairing the tightness of the pipe connections.

1313.0—FILL AND RETURN PIPING.

- (a) A fill pipe shall terminate outside of a building at a point at least two feet from any building opening at the same or lower level. A fill pipe shall terminate in a manner designed to minimize spilling when the filling hose is disconnected. Fill opening shall be equipped with a tight metal cover designed to discourage tampering.
- (b) A return line from a burner or pump to a supply tank shall enter the top of the tank.
- (c) Cross connections, except between two supply tanks not exceeding 550 gallons aggregate capacity, permitting gravity flow from one tank to another shall be prohibited.
- (d) An auxiliary tank shall be filled by a pump transferring the oil through continuous piping from the supply tank.
- (e) An auxiliary tank shall be located at a level above the top of the supply tank from which it is filled.
- (f) An auxiliary tank shall be provided with an overflow pipe draining to the supply tank and extending into the top of the supply tank not more than one inch. This requirement does not apply to an auxiliary tank specifically listed for use without an overflow pipe.
- (g) An overflow pipe from an auxiliary tank and a return line from a burner or pump shall have no valves or obstructions.

1314.0—SUPPLY CONNECTIONS.

- (a) All piping, except the burner supply line from a tank having a capacity not over 550 gallons and the cross connection between two tanks having an aggregate capacity of 550 gallons or less, shall be connected into the top of a supply tank. When two tanks are cross connected, the tops of the tanks shall be on the same horizontal plane. See Figures 5 and 6, of this chapter.
- (b) The burner supply connection to a tank having a capacity of more than 550 gallons or to two or more tanks having an aggregate capacity of more than 550 gallons shall be connected into the top of each tank, except as permitted by 1314.6 or 1320.8.
- (c) A transfer pump or an automatic pump may be used to deliver oil from a supply tank to a burner or to an auxiliary tank. Except as permitted by 1314.(f) and 1320.0, a transfer pump shall not be connected to a tank having a capacity over 550 gallons or to two tanks having an aggregate capacity of over 550 gallons.
- (d) The pressure at the oil supply inlet to an appliance shall be not greater than 3 psi.
- (e) Where supply tanks are set below the level of the burner, the oil piping shall be so laid as to pitch toward the supply tank without traps.
- (f) For commercial and industrial installations the oil supply from tanks

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of any capacity permitted by this Code may be in accordance with the following:

1. The burner supply line may 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 may be used.

1315.0—VENT PIPING.

- (a) Vent pipes shall be so laid as to drain toward one tank without sags or traps in which liquid can collect. They shall be located so that they will not be subjected to physical damage aboveground. Vent pipes from tanks may be connected into one outlet pipe. The outlet pipe shall at least be 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. The lower end of a vent pipe shall enter the tank through the top and shall extend into the tank not more than one inch.
- (b) Vent pipes shall terminate outside of buildings at a point not less than two feet measured vertically or horizontally from any building opening. Outer ends of vent pipes shall terminate in a weather-proof vent cap or fitting or be provided with a weather-proof hood. All 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 four mesh. Vent pipes shall terminate sufficiently above the ground to avoid being obstructed with snow and ice. Vent pipes from tanks containing heaters shall be extended to a location where oil vapors discharging from the vent will be readily diffused. If the static head with a vent pipe filled with oil exceeds 10 psi, the tank shall be designed for the maximum static head which will be imposed.
- (c) Vent pipes shall not be cross connected with fill pipes, return lines from burners or overflow lines from auxiliary tanks.

1316.0—PRESSURIZED TANK FEED.

- (a) Air or other gases shall not be used to pressurize tanks.

1317.0—OIL GAUGING.

- (a) All 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.
- (b) Test wells shall not be installed inside buildings. For outside service they shall be equipped with a tight metal cover designed to discourage tampering.

Note: The gauging of inside tanks by means of measuring sticks is a pronounced hazard and should not be permitted.

- (c) 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 from the fuel supply system.

Note: An inside tank provided with fill and vent pipes should be provided with a device to indicate either visually or audibly at the fill point when the oil in the tank has reached a predetermined safe level.

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- (d) No tank used in connection with any oil burner shall be equipped with a glass gauge or any gauge which, when broken, will permit the escape of oil from the tank.

1318.0—OIL PUMPS.

- (a) An oil pump not a part of a listed burner shall be a positive displacement type which automatically shuts off the oil supply when stopped.
- (b) An automatic pump not an integral part of a burner shall be a listed type installed in full compliance with its listing.

1319.0—VALVES.

- (a) A readily accessible manual shutoff valve shall be installed at each point where required to properly control the flow of fuel in normal operation and where required to avoid oil spillage during servicing. The valve shall be installed to close against the supply.

Note: An automatically operated device designed to shut off the oil supply in case of fire in the immediate vicinity of the burner should be provided.

- (b) Where a shutoff is installed in the discharge line of an oil pump 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 and arranged to return surplus oil to the supply tank or to bypass it around the pump, unless the pump includes an internal bypass.
- (c) Any fuel oil line incorporating a heater shall be provided with a relief valve arranged to discharge to the return line when any valve, pump, or other device may prevent the release of excessive pressure because of the expansion of the oil when heated.
- (d) Where oil is supplied to a burner requiring uniform flow by gravity feed 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 insure uniform delivery of oil to the burner. The vent opening of such constant level valve shall be connected by piping or tubing to the outside of the building, unless the constant level valve is provided with an antiflooding device. Vent piping or tubing of constant level valves shall not be connected to tanks or tank vents.

1320.0—CENTRALIZED OIL DISTRIBUTION SYSTEMS.

- (a) A centralized oil distribution system shall conform to 1320.0 and all other applicable provisions of this Standard.
- (b) The installation and maintenance of the distribution system shall be supervised by a qualified company acceptable to the authorities having jurisdiction.
- (c) Plans showing the relative location of tanks, pumps, valves, piping and structure to be supplied by the system shall be approved by and filed with the authority having jurisdiction.
- (d) Oil may be fed from the supply tank or tanks by gravity or by transfer pump. All distribution piping outside of diked areas shall be underground.
- (e) The capacity of a single tank or the aggregate capacity of two or more tanks supplying a centralized oil distribution system shall be not more than 20,000 gallons except that underground tanks installed in

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accordance with 1302.0 may be of any capacity permitted by this Standard.

- (f) Atmospheric tanks located entirely aboveground shall be built in accordance with the requirement for aboveground tanks included in 1301.IIc. Atmospheric tanks located underground or partially underground shall be built in accordance with the requirements for underground tanks included in 1301.IIc.
- (g) Aboveground and partially buried tanks shall be diked in accordance with 2563 of NFPA No. 31 except that the volumetric capacity of the diked area shall be not less than the total volume above the adjacent grade level of all tanks within the diked area.
- (h) A distribution main may be connected to a tank or tanks having aggregate capacity of not more than 20,000 gallons at a point below the liquid level. When the distribution main is so connected, a readily accessible internal or external shut-off valve shall be installed in the main as close as practical to the tank. If external and aboveground, the shut-off valve and its tank connections shall be made of steel. Connections between the tank(s) and the distribution main shall be made with double swing joints, flexible connectors or otherwise arranged to permit the tank(s) to settle without damaging the system. Such connections when aboveground shall be located within the diked area.
- (i) Only appliances equipped with primary safety controls specifically listed for the appliance shall be connected to a centralized oil distribution system.
- (j) A readily accessible manual shut-off valve shall be installed in each branch line which enters a building, mobile home, travel trailer, or other structure. This valve may be either inside or outside of such structure. If outside, the valve shall be protected from weather and damage. If inside, the valve shall be located directly adjacent to the point at which the supply line enters the structure.

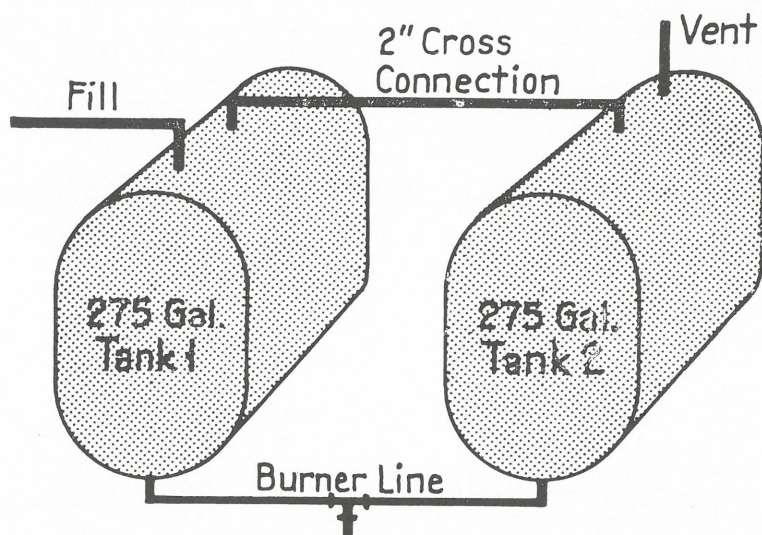


Figure 5

Recommended Arrangement of Two Fuel Oil Tanks of Not More Than 550 Gallons Aggregate Capacity

In this arrangement of two tanks only one fill pipe and one vent pipe are used. During filling oil enters tank No. 1. The displaced vapors pass through the cross connection at top into tank No. 2. The expansion zone for both tanks is obviously in tank No. 2 until the tanks equalize after filling is completed.

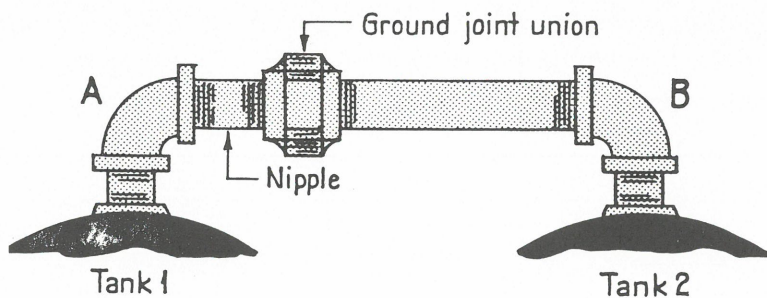


Figure 6

This shows the detail of the cross connection which can be used in Figure 5. (From NFPA No. 31).

