

Fire and Life-Safety Group (FLS)

Flammable and Combustible Liquids Storage Tank Removal and Replacement

By: the Fire and Life-Safety Group (FLS)

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The following is a summary of the fire code requirements for replacing and installing a new petroleum storage tank. These code requirements are based on the 2008 edition of the *Flammable and Combustible Liquids Code* (NFPA-30) and the 2009 edition of the *International Fire Code* (IFC). Please note that in addition to fire-safety requirements, environmental requirements (not listed in this document) are also to be followed. Please contact campus Environmental Health and Safety Department for environmental requirements.

I. REMOVAL AND DISPOSAL OF EXISTING TANKS

A. Section 3404.2.14.1 of the IFC states that removal of above-ground and underground tanks is to be in accordance with all of the following:

1. Flammable and combustible liquids are to be removed from the tank and connected piping.
2. Piping at tank openings that is not to be used further should be disconnected.
3. Piping is to be removed from the ground.
 - **Exception:** *Piping is allowed to be abandoned in place where the fire code official determines that removal is not practical. Abandoned piping should be capped and safeguarded as required by the fire code official.*
4. Tank openings are to be capped or plugged, leaving a 0.125 inch to 0.250 inch diameter opening for pressure equalization.
5. Tanks are to be purged of vapor and inerted prior to removal.
6. All exterior above-ground fill and vent piping is to be permanently removed.
 - **Exception:** *Piping associated with bulk plants, terminal facilities, and refineries.*

B. Section 3404.2.14.2 of the IFC states that tanks are to be disposed of in accordance with federal, state, and local regulations.

II. NEW TANK INSTALLATION REQUIREMENTS

A. Location Requirements

1. Section 3404.4.2.3 of the IFC states that the outdoor storage areas are to be protected against tampering or trespassers where necessary and should be kept free from weeds, debris, and other combustible materials not necessary to the storage.
2. Section 3404.4.2 of the IFC states that outdoor storage of liquids in containers and portable tanks is to be in accordance with the table listed below. Storage of liquids near buildings located on the same property is to be in accordance with this section.

Class of Liquid	Quantity (gallons)	Minimum Distance To Lot Line Of Property That Can Be Built Upon (feet)	Minimum Distance To Public Street , Public Alley, or Public Way (feet)
IA (pentane)	1,100	50	10
IB (gasoline; acetone)	2,200	50	10
IC (turpentine)	4,400	50	10
II (acetic acid; kerosene; fuel oil #2,4,5,6; diesel fuel)	8,800	25	5
III (phenol)	22,000	10	5

B. Tank Requirements

1. Tank Vent Requirements

i. Section 3404.2.7.3.6 of the IFC states that tanks and pressure vessels storing Class IB or IC liquids are to be equipped with venting devices which should be normally closed except when venting under pressure or vacuum conditions, or with listed flame arresters.

ii. Section 3404.2.7.4 of the IFC states that stationary, above-ground tanks are to be equipped with additional venting that will relieve excessive internal pressure caused by exposure to fires.

iii. Section 3404.2.9.7.3 of the IFC states that approved flame arresters or pressure vacuum breather valves are to be installed in normal vents.

iv. Section 22.7.1.1 of NFPA-30 states that every aboveground storage tank is to have emergency relief venting in the form of construction or a device or devices that will relieve excessive internal pressure caused by an exposure fire.

v. Section 22.7.3.2.1 of NFPA-30 states that emergency relief vent devices are to be vapor tight and should be permitted to be any one of the following:

1. Self-closing manway cover.
2. Manway cover provided with long bolts that permit the cover to lift under internal pressure.
3. Additional or larger relief valve or valves.

vi. Section 22.7.3.1 of NFPA-30 states that where entire dependence for emergency relief venting is placed upon pressure-relieving devices, the total venting capacity of both normal and emergency vents is to be sufficient to prevent rupture of the shell or bottom of a vertical tank or of the shell or heads of a horizontal tank.

2. Tank Overfilling Prevention Requirement

i. Section 3404.2.9.7.6 of the IFC states that protected above-ground tanks are not to be filled in excess of 95 percent of their capacity. An overfill prevention system is to be provided for each tank. During tank-filling operations, the system is to comply with one of the following:

a. The system is to provide an independent means of notifying the person filling the tank that the fluid level has reached 90 percent of tank capacity by providing an audible or visual alarm signal, providing a tank level gauge marked at 90 percent of tank capacity, or other approved means. and Automatically shut off the flow of fuel to the tank when the quantity of liquid in the tank reaches 95 percent of the tank capacity. For rigid hose fuel-delivery systems, an approved means is to be provided to empty the fill hose into the tank after the automatic shutoff device is activated.

b. The system is to reduce the flow rate to not more than 15 gallons per minute so that at the reduced flow rate, the tank will not overfill for 30 minutes, and automatically shut off flow into the tank so that none of the fittings on the top of the tank are exposed to product because of overfilling.

3. Tank Opening Requirements

i. Section 22.13.1 of NFPA-30 states that each connection to an aboveground tank through which liquid can normally flow is to be provided with an internal or an external valve located as close as practical to the shell of the tank.

ii. Section 3404.2.9.7.9 of the IFC states that tank openings in protected above-ground tanks are to be through the top only.

4. Signage Requirements

i. Section 3404.2.3.1 of the IFC states that labeling and signs are to be posted in storage areas prohibiting open flames and smoking.

ii. Section 3404.2.3.2 of the IFC states that tanks more than 100 gallons in capacity, which are permanently installed or mounted and used for the storage of Class I, II, or IIIA liquids, are to bear a label and placard identifying the material therein. Placards should be in accordance with NFPA 704.

iii. Section 3404.2.9.7.6.1 of the IFC states that a permanent sign is to be provided at the fill point for the tank, documenting the filling procedure and the tank calibration chart.

- **Exception:** *Where climatic conditions are such that the sign may be obscured by ice or snow, or weathered beyond readability or otherwise impaired, said procedures and chart are to be located in the office window, lock box or other area accessible to the person filling the tank.*

5. Structural Requirements

i. Section 22.5.1.1 of NFPA-30 states that tank supports are to be designed and constructed in accordance with recognized engineering standards.

ii. Section 22.5.1.2 of NFPA-30 states that tanks are to be supported in a manner that prevents excessive concentration of loads on the supported portion of the shell.

iii. Section 22.5.2.1 of NFPA-30 states that tanks are to rest on the ground or on foundations made of concrete, masonry, piling, or steel.

iv. Section 22.5.2.2 of NFPA-30 states that tank foundations are to be designed to minimize the possibility of uneven settling of the tank and to minimize corrosion in any part of the tank resting on the foundation.

v. Section 22.5.2.3 of NFPA-30 states that where tanks storing Class I, Class II, or Class IIIA liquids are supported above their foundations, tank supports are to be of concrete, masonry, or protected steel.

- **Exception:** *Single wood timber supports (not cribbing), laid horizontally should be permitted to be used for outside aboveground tanks if not more than 12 in. high at their lowest point*

vi. Section 22.5.2.4 of NFPA-30 states that steel support structures or exposed piling for tanks storing Class I, Class II, or Class IIIA liquids are to be protected by materials having a fire resistance rating of not less than 2 hours.

Exceptions:

1. Steel saddles do not need to be protected if less than 12 in. high at their lowest point.
2. At the discretion of the authority having jurisdiction, water spray protection in accordance with NFPA 15, Standard for Water Spray Fixed Systems for Fire Protection, or NFPA 13, Standard for the Installation of Sprinkler Systems, is permitted to be used.

C. LEAKAGE PROTECTION

1. Above Ground Tanks

- i. Section 3404.2.9.7.4 of the IFC states that protected above-ground tanks are to be provided with secondary containment, drainage control, or diking.
- ii. Section 3404.2.9.7.8 of the IFC states that a spill container having a capacity of not less than 5 gallons is to be provided for each fill connection. For tanks with a top fill connection, spill containers are to be noncombustible and are to be fixed to the tank and equipped with a manual drain valve that drains into the primary tank. For tanks with a remote fill connection, a portable spill container is to be allowed.
- iii. Section 3404.2.10 of the IFC states that the area surrounding a tank or group of tanks is to be provided with drainage control or is to be diked to prevent accidental discharge of liquid from endangering adjacent tanks, adjoining property, or reaching waterways.

Exceptions:

- The fire code official is authorized to alter or waive these requirements based on a technical report which demonstrates that such tank or group of tanks does not constitute a hazard to other tanks, waterways, or adjoining property, after consideration of special features such as topographical conditions, nature of occupancy, and proximity to buildings on the same or adjacent property, capacity, and construction of proposed tanks and character of liquids to be stored, and nature and quantity of private and public fire protection provided.
- Drainage control and diking is not required for listed secondary containment tanks.

- iv. Section 3404.2.10.1 of the IFC states that the volumetric capacity of the diked area should not be less than the greatest amount of liquid that can be released from the largest tank within the diked area.
- v. Section 3404.2.10.4 of the IFC states that diked areas should be kept free from combustible materials, drums, and barrels.

2. Underground Tanks

- i. Section 3404.2.11.5.1 of the IFC states that daily inventory records are to be maintained for underground storage tank systems.
- ii. Section 3404.2.11.5.2 of the IFC states that underground storage tank systems are to be provided with an approved method of leak detection from any component of the system.

D. Tank Protection

1. Section 3404.2.7.9 of the IFC states that where subject to external corrosion, tanks should be fabricated from corrosion-resistant materials, coated or provided with corrosion protection. Section 3404.2.9.6.5 of the IFC states that where protected above-ground tanks, piping, electrical conduit, or dispensers are subject to vehicular impact, they should be protected there from, either by having the impact protection incorporated into the system design in compliance with the impact test protocol of UL 2085.
2. Section 3404.4.5 of the IFC states that guard posts or other means should be provided to protect exterior storage tanks from vehicular damage. When guard posts are installed, the posts should be installed in accordance with Section 312.

E. Vent Piping Requirements

1. Section 3404.2.7.3.4 of the IFC states that vent pipes should be installed such that they will drain toward the tank without sags or traps in which liquid can collect. Vent pipes should be installed in such a manner so as not to be subject to physical damage or vibration.
2. Section 3404.2.7.3.3 of the IFC states that vent pipe outlets for tanks storing Class I, II, or IIIA liquids should be located such that the vapors are released at a safe point outside of buildings and not less than 12 feet above the adjacent ground level. Vapors should be discharged upward or horizontally away from adjacent walls to assist in vapor dispersion. Vent outlets should be located such that flammable vapors will not be trapped by eaves or other obstructions and shall be at least 5 feet from building openings or lot lines of properties that can be built upon.
3. Section 3404.2.7.3.5 of the IFC states that tank vent piping should not be manifolded unless required for special purposes such as vapor recovery, vapor conservation, or air pollution control.
4. Section 3404.2.7.3.5.1 of the IFC states that for above-ground tanks, manifolded vent pipes should be adequately sized to prevent system pressure limits from being exceeded when manifolded tanks are subject to the same fire exposure.

F. Fill Piping Requirements

1. Section 3404.2.7.5.5 of the IFC states that for top-loaded tanks, a metallic fill pipe should be designed and installed to minimize the generation of static electricity by terminating the pipe within 6 inches of the bottom of the tank, and it should be installed in a manner which avoids excessive vibration.
2. Section 3404.2.9.7.7 of the IFC states that the fill pipe should be provided with a means for making a direct connection to the tank vehicle's fuel delivery hose so that the delivery of fuel is not exposed to the open air during the filling operation. Where any portion of the fill pipe exterior to the tank extends below the level of the top of the tank, a check valve should be installed in the fill pipe not more than 12 inches from the fill hose connection.
3. Section 3404.2.9.7.10 of the IFC states that approved antisiphon devices should be installed in each external pipe connected to the protected above-ground tank when the pipe extends below the level of the top of the tank.