CHAPTER 34
FLAMMABLE AND COMBUSTIBLE LIQUIDS

SECTION 3401
GENERAL

3401.1 Scope and application. Prevention, control and mitigation of dangerous conditions related to storage, use, dispensing, mixing and handling of flammable and combustible liquids shall be in accordance with Chapter 27 and this chapter.

3401.2 Nonapplicability. This chapter shall not apply to liquids as otherwise provided in other laws or regulations or chapters of this code, including:

1. Specific provisions for flammable liquids in motor fuel-dispensing facilities, repair garages, airports and marinas in Chapter 22.
2. Medicines, foodstuffs, cosmetics, and commercial, institutional and industrial products in the same concentration and packaging containing not more than 50 percent by volume of water-miscible liquids and with the remainder of the solution not being flammable, and alcoholic beverages in retail or wholesale sales or storage uses when packaged in individual containers not exceeding 1.3 gallons (5 L).
3. Storage and use of fuel oil in tanks and containers connected to oil-burning equipment. Such storage and use shall be in accordance with Section 603. For abandonment of fuel oil tanks, this chapter applies.
4. Refrigerant liquids and oils in refrigeration systems (see Section 606).
5. Storage and display of aerosol products complying with Chapter 28.
6. Storage and use of liquids that have no fire point when tested in accordance with ASTM D 92.
7. Liquids with a flashpoint greater than 95°F (35°C) in a water-miscible solution or dispersion with a water and inert (noncombustible) solids content of more than 80 percent by weight, which do not sustain combustion.
8. Liquids without flash points that can be flammable under some conditions, such as certain halogenated hydrocarbons and mixtures containing halogenated hydrocarbons.
9. The storage of distilled spirits and wines in wooden barrels and casks.

3401.3 Referenced documents. The applicable requirements of Chapter 27, other chapters of this code, the *International Building Code* and the *International Mechanical Code* pertaining to flammable liquids shall apply.

3401.4 Permits. Permits shall be required as set forth in Sections 105.6 and 105.7.

3401.5 Material classification. Flammable and combustible liquids shall be classified in accordance with the definitions in Section 3402.1.

When mixed with lower flash-point liquids, Class II or III liquids are capable of assuming the characteristics of the lower flash-point liquids. Under such conditions the appropriate provisions of this chapter for the actual flash point of the mixed liquid shall apply. When heated above their flash points, Class II and III liquids assume the characteristics of Class I liquids. Under such conditions, the appropriate provisions of this chapter for flammable liquids shall apply.

SECTION 3402
DEFINITIONS

3402.1 Definitions. The following words and terms shall, for the purposes of this chapter and as used elsewhere in this code, have the meanings shown herein.

ALCOHOL-BASED HAND RUB. An alcohol-containing preparation designed for application to the hands for reducing the number of viable microorganisms on the hands and containing ethanol or isopropanol in an amount not exceeding 70 percent by volume.

BULK PLANT OR TERMINAL. That portion of a property where flammable or combustible liquids are received by tank vessel, pipelines, tank car or tank vehicle and are stored or blended in bulk for the purpose of distributing such liquids by tank vessel, pipeline, tank car, tank vehicle, portable tank or container.

BULK TRANSFER. The loading or unloading of flammable or combustible liquids from or between tank vehicles, tank cars or storage tanks.

COMBUSTIBLE LIQUID. A liquid having a closed cup flash point at or above 100°F (38°C). Combustible liquids shall be subdivided as follows:

Class II. Liquids having a closed cup flash point at or above 100°F (38°C) and below 140°F (60°C).

Class IIIA. Liquids having a closed cup flash point at or above 140°F (60°C) and below 200°F (93°C).

Class IIIB. Liquids having closed cup flash points at or above 200°F (93°C).

The category of combustible liquids does not include compressed gases or cryogenic fluids.

FIRE POINT. The lowest temperature at which a liquid will ignite and achieve sustained burning when exposed to a test flame in accordance with ASTM D 92.

FLAMMABLE LIQUID. A liquid having a closed cup flash point below 100°F (38°C). Flammable liquids are further categorized into a group known as Class I liquids. The Class I category is subdivided as follows:

Class IA. Liquids having a flash point below 73°F (23°C) and having a boiling point below 100°F (38°C).

Class IB. Liquids having a flash point below 73°F (23°C) and having a boiling point at or above 100°F (38°C).

Class IC. Liquids having a flash point at or above 73°F (23°C) and below 100°F (38°C).

The category of flammable liquids does not include compressed gases or cryogenic fluids.

FLASH POINT. The minimum temperature in degrees Fahrenheit at which a liquid will give off sufficient vapors to form an ignitable mixture with air near the surface or in the container, but will not sustain combustion. The flash point of a liquid shall be determined by appropriate test procedure and apparatus as specified in ASTM D 56, ASTM D 93 or ASTM D 3278.

FUEL LIMIT SWITCH. A mechanism, located on a tank vehicle, that limits the quantity of product dispensed at one time.

LIQUID STORAGE ROOM. A room classified as a Group H-3 occupancy used for the storage of flammable or combustible liquids in a closed condition.

LIQUID STORAGE WAREHOUSE. A building classified as a Group H-2 or H-3 occupancy used for the storage of flammable or combustible liquids in a closed condition.

MOBILE FUELING. The operation of dispensing liquid fuels from tank vehicles into the fuel tanks of motor vehicles. Mobile fueling may also be known by the terms "Mobile fleet fueling," "Wet fueling" and "Wet hosing."

PROCESS TRANSFER. The transfer of flammable or combustible liquids between tank vehicles or tank cars and process operations. Process operations may include containers, tanks, piping and equipment.

REFINERY. A plant in which flammable or combustible liquids are produced on a commercial scale from crude petroleum, natural gasoline or other hydrocarbon sources.

REMOTE EMERGENCY SHUTOFF DEVICE. The combination of an operator-carried signaling device and a mechanism on the tank vehicle. Activation of the remote emergency shutoff device sends a signal to the tanker-mounted mechanism and causes fuel flow to cease.

REMOTE SOLVENT RESERVOIR. A liquid solvent container enclosed against evaporative losses to the atmosphere during periods when the container is not being utilized, except for a solvent return opening not larger than 16 square inches (10 322 mm^2). Such return allows pump-cycled used solvent to drain back into the reservoir from a separate solvent sink or work area.

SOLVENT DISTILLATION UNIT. An appliance that receives contaminated flammable or combustible liquids and which distills the contents to remove contaminants and recover the solvents.

TANK, PRIMARY. A listed atmospheric tank used to store liquid. See "Primary containment."

TANK, PROTECTED ABOVE GROUND. A tank listed in accordance with UL 2085 consisting of a primary tank provided with protection from physical damage and fire-resistive protection from a high-intensity liquid pool fire exposure. The tank may provide protection elements as a unit or may be an assembly of components, or a combination thereof.

SECTION 3403
GENERAL REQUIREMENTS

3403.1 Electrical. Electrical wiring and equipment shall be installed and maintained in accordance with the ICC *Electrical Code*.

3403.1.1 Classified locations for flammable liquids. Areas where flammable liquids are stored, handled, dispensed or mixed shall be in accordance with Table 3403.1.1. A classified area shall not extend beyond an unpierced floor, roof or other solid partition.

The extent of the classified area is allowed to be reduced, or eliminated, where sufficient technical justification is provided to the fire code official that a concentration in the area in excess of 25 percent of the lower flammable limit (LFL) cannot be generated.

3403.1.2 Classified locations for combustible liquids. Areas where Class II or III liquids are heated above their flash points shall have electrical installations in accordance with Section 3403.1.1.

Exception: Solvent distillation units in accordance with Section 3405.4.

3403.1.3 Other applications. The fire code official is authorized to determine the extent of the Class I electrical equipment and wiring location when a condition is not specifically covered by these requirements or the ICC *Electrical Code*.

3403.2 Fire protection. Fire protection for the storage, use, dispensing, mixing, handling and on-site transportation of flammable and combustible liquids shall be in accordance with this chapter and applicable sections of Chapter 9.

3403.2.1 Portable fire extinguishers and hose lines. Portable fire extinguishers shall be provided in accordance with Section 906. Hose lines shall be provided in accordance with Section 905.

3403.3 Site assessment. In the event of a spill, leak or discharge from a tank system, a site assessment shall be completed by the owner or operator of such tank system if the fire code official determines that a potential fire or explosion hazard exists. Such site assessments shall be conducted to ascertain potential fire hazards and shall be completed and submitted to the fire department within a time period established by the fire code official, not to exceed 60 days.

3403.4 Spill control and secondary containment. Where the maximum allowable quantity per control area is exceeded, and when required by Section 2704.2, rooms, buildings or areas used for storage, dispensing, use, mixing or handling of Class I, II and III-A liquids shall be provided with spill control and secondary containment in accordance with Section 2704.2.

TABLE 3403.1.1
CLASS I ELECTRICAL EQUIPMENT LOCATIONS[a]

LOCATION	GROUP D DIVISION	EXTENT OF CLASSIFIED AREA
Underground tank fill opening	1	Pits, boxes or spaces below grade level, any part of which is within the Division 1 or 2 classified area.
	2	Up to 18 inches above grade level within a horizontal radius of 10 feet from a loose-fill connection and within a horizontal radius of 5 feet from a tight-fill connection.
Vent—Discharging upward	1	Within 3 feet of open end of vent, extending in all directions.
	2	Area between 3 feet and 5 feet of open end of vent, extending in all directions.
Drum and container filling		
Outdoor or indoor with adequate ventilation	1	Within 3 feet of vent and fill opening, extending in all directions.
	2	Area between 3 feet and 5 feet from vent of fill opening, extending in all directions. Also up to 18 inches above floor or grade level within a horizontal radius of 10 feet from vent or fill opening.
Pumps, bleeders, withdrawal fittings, meters and similar devices		
Indoor	2	Within 5 feet of any edge of such devices, extending in all directions. Also up to 3 feet above floor or grade level within 25 feet horizontally from any edge of such devices.
Outdoor	2	Within 3 feet of any edge of such devices, extending in all directions. Also up to 18 inches horizontally from an edge of such devices.
Pits		
Without mechanical ventilation	1	Entire area within pit if any part is within a Division 1 or 2 classified area.
With mechanical ventilation	2	Entire area within pit if any part is within a Division 1 or 2 classified area.
Containing valves, fittings or piping, and not within a Division 1 or 2 classified area	2	Entire pit.
Drainage ditches, separators, impounding basins		
Indoor	1 or 2	Same as pits.
Outdoor	2	Area up to 18 inches above ditch, separator or basin. Also up to 18 inches above grade within 15 feet horizontal from any edge.
Tank vehicle and tank car[b]		
Loading through open dome	1	Within 3 feet of edge of dome, extending in all directions.
	2	Area between 3 feet and 15 feet from edge of dome, extending in all directions.
Loading through bottom connections with atmospheric venting	1	Within 3 feet of point of venting to atmosphere, extending in all directions.
	2	Area between 3 feet and 15 feet from point of venting to atmosphere, extending in all directions. Also up to 18 inches above grade within a horizontal radius of 10 feet from point of loading connection.
Office and restrooms	Ordinary	Where there is an opening to these rooms within the extent of an indoor classified location, the room shall be classified the same as if the wall, curb or partition did not exist.

(continued)

TABLE 3403.1.1—continued
CLASS I ELECTRICAL EQUIPMENT LOCATIONS[a]

LOCATION	GROUP D DIVISION	EXTENT OF CLASSIFIED AREA
Tank vehicle and tank car[b]–continued		
Loading through closed dome with atmospheric venting	1	Within 3 feet of open end of vent, extending in all directions.
	2	Area between 3 feet and 15 feet from open end of vent, extending in all directions. Also within 3 feet of edge of dome, extending in all directions.
Loading through closed dome with vapor control	2	Within 3 feet of point of connection of both fill and vapor lines, extending in all directions.
Bottom loading with vapor control or any bottom unloading	2	Within 3 feet of point of connection, extending in all directions. Also up to 18 inches above grade within a horizontal radius of 10 feet from point of connection.
Storage and repair garage for tank vehicles	1	Pits or spaces below floor level.
	2	Area up to 18 inches above floor or grade level for entire storage or repair garage.
Garages for other than tank vehicles	Ordinary	Where there is an opening to these rooms within the extent of an outdoor classified area, the entire room shall be classified the same as the area classification at the point of the opening.
Outdoor drum storage	Ordinary	
Indoor warehousing where there is no flammable liquid transfer	Ordinary	Where there is an opening to these rooms within the extent of an indoor classified area, the room shall be classified the same as if the wall, curb or partition did not exist.
Indoor equipment where flammable vapor/air mixtures could exist under normal operations	1	Area within 5 feet of any edge of such equipment, extending in all directions.
	2	Area between 5 feet and 8 feet of any edge of such equipment, extending in all directions. Also, area up to 3 feet above floor or grade level within 5 feet to 25 feet horizontally from any edge of such equipment.[c]
Outdoor equipment where flammable vapor/air mixtures could exist under normal operations	1	Area within 3 feet of any edge of such equipment, extending in all directions.
	2	Area between 3 feet and 8 feet of any edge of such equipment extending in all directions. Also, area up to 3 feet above floor or grade level within 3 feet to 10 feet horizontally from any edge of such equipment.
Tank—Above ground		
Shell, ends or roof and dike area	1	Area inside dike where dike height is greater than the distance from the tank to the dike for more than 50 percent of the tank circumference.
	2	Area within 10 feet from shell, ends or roof of tank. Area inside dikes to level of top of dike.
Vent	1	Area within 5 feet of open end of vent, extending in all directions.
	2	Area between 5 feet and 10 feet from open end of vent, extending in all directions.
Floating roof	1	Area above the roof and within the shell.

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm.

a. Locations as classified in the ICC *Electrical Code*.

b. When classifying extent of area, consideration shall be given to the fact that tank cars or tank vehicles can be spotted at varying points. Therefore, the extremities of the loading or unloading positions shall be used.

c. The release of Class I liquids can generate vapors to the extent that the entire building, and possibly a zone surrounding it, are considered a Class I, Division 2 location.

3403.5 Labeling and signage. The fire code official is authorized to require warning signs for the purpose of identifying the hazards of storing or using flammable liquids. Signage for identification and warning such as for the inherent hazard of flammable liquids or smoking shall be provided in accordance with this chapter and Sections 2703.5 and 2703.6.

3403.5.1 Style. Warning signs shall be of a durable material. Signs warning of the hazard of flammable liquids shall have white lettering on a red background and shall read: DANGER—FLAMMABLE LIQUIDS. Letters shall not be less than 3 inches (76 mm) in height and $^1/_2$ inch (12.7 mm) in stroke.

3403.5.2 Location. Signs shall be posted in locations as required by the fire code official. Piping containing flammable liquids shall be identified in accordance with ASME A13.1.

3403.5.3 Warning labels. Individual containers, packages and cartons shall be identified, marked, labeled and placarded in accordance with federal regulations and applicable state laws.

3403.5.4 Identification. Color coding or other approved identification means shall be provided on each loading and unloading riser for flammable or combustible liquids to identify the contents of the tank served by the riser.

3403.6 Piping systems. Piping systems, and their component parts, for flammable and combustible liquids shall be in accordance with this section.

3403.6.1 Nonapplicability. The provisions of Section 3403.6 shall not apply to gas or oil well installations; piping that is integral to stationary or portable engines, including aircraft, watercraft and motor vehicles; and piping in connection with boilers and pressure vessels regulated by the *International Mechanical Code*.

3403.6.2 Design and fabrication of system components. Piping system components shall be designed and fabricated in accordance with Chapter 5 of NFPA 30, except as modified by this section.

3403.6.2.1 Special materials. Low-melting-point materials (such as aluminum, copper or brass), materials that soften on fire exposure (such as nonmetallic materials) and nonductile material (such as cast iron) shall be acceptable for use underground in accordance with ASME B31.9. When such materials are used outdoors in above-ground piping systems or within buildings, they shall be in accordance with ASME B31.9 and one of the following:

1. Suitably protected against fire exposure.
2. Located where leakage from failure would not unduly expose people or structures.
3. Located where leakage can be readily controlled by operation of accessible remotely located valves.

In all cases, nonmetallic piping shall be used in accordance with Section 5.3.6 of NFPA 30.

3403.6.3 Testing. Unless tested in accordance with the applicable section of ASME B31.9, piping, before being covered, enclosed or placed in use, shall be hydrostatically tested to 150 percent of the maximum anticipated pressure of the system, or pneumatically tested to 110 percent of the maximum anticipated pressure of the system, but not less than 5 pounds per square inch gauge (psig) (34.47 kPa) at the highest point of the system. This test shall be maintained for a sufficient time period to complete visual inspection of joints and connections. For a minimum of 10 minutes, there shall be no leakage or permanent distortion. Care shall be exercised to ensure that these pressures are not applied to vented storage tanks. Such storage tanks shall be tested independently from the piping.

3403.6.3.1 Existing piping. Existing piping shall be tested in accordance with this section when the fire code official has reasonable cause to believe that a leak exists. Piping that could contain flammable or combustible liquids shall not be tested pneumatically. Such tests shall be at the expense of the owner or operator.

Exception: Vapor-recovery piping is allowed to be tested using an inert gas.

3403.6.4 Protection from vehicles. Guard posts or other approved means shall be provided to protect piping, valves or fittings subject to vehicular damage in accordance with Section 312.

3403.6.5 Protection from corrosion and galvanic action. Where subject to external corrosion, piping, related fluid-handling components and supports for both underground and above-ground applications shall be fabricated from noncorrosive materials, and coated or provided with corrosion protection. Dissimilar metallic parts that promote galvanic action shall not be joined.

3403.6.6 Valves. Piping systems shall contain a sufficient number of manual control valves and check valves to operate the system properly and to protect the plant under both normal and emergency conditions. Piping systems in connection with pumps shall contain a sufficient number of such valves to control properly the flow of liquids in normal operation and in the event of physical damage or fire exposure.

3403.6.6.1 Backflow protections. Connections to pipelines or piping by which equipment (such as tank cars, tank vehicles or marine vessels) discharges liquids into storage tanks shall be provided with check valves or block valves for automatic protection against backflow where the piping arrangement is such that backflow from the system is possible. Where loading and unloading is done through a common pipe system, a check valve is not required. However, a block valve shall be provided which is located so as to be readily accessible or remotely operable.

3403.6.6.2 Manual drainage. Manual drainage-control valves shall be located at approved locations remote from the tanks, diked area, drainage system and impounding basin to ensure their operation in a fire condition.

3403.6.7 Connections. Above-ground tanks with connections located below normal liquid level shall be provided with internal or external isolation valves located as close as practical to the shell of the tank. Except for liquids whose chemical characteristics are incompatible with steel, such valves, when external, and their connections to the tank shall be of steel.

3403.6.8 Piping supports. Piping systems shall be substantially supported and protected against physical damage and excessive stresses arising from settlement, vibration, expansion, contraction or exposure to fire. The supports shall be protected against exposure to fire by one of the following:

1. Draining liquid away from the piping system at a minimum slope of not less than 1 percent.
2. Providing protection with a fire-resistance rating of not less than 2 hours.
3. Other approved methods.

3403.6.9 Flexible joints. Flexible joints shall be listed and approved and shall be installed on underground liquid, vapor and vent piping at all of the following locations:

1. Where piping connects to underground tanks.
2. Where piping ends at pump islands and vent risers.
3. At points where differential movement in the piping can occur.

3403.6.9.1 Fiberglass-reinforced plastic piping. Fiberglass-reinforced plastic (FRP) piping is not required to be provided with flexible joints in locations where both of the following conditions are present:

1. Piping does not exceed 4 inches (102 mm) in diameter.
2. Piping has a straight run of not less than 4 feet (1219 mm) on one side of the connection when such connections result in a change of direction.

In lieu of the minimum 4-foot (1219 mm) straight run length, approved and listed flexible joints are allowed to be used under dispensers and suction pumps, at submerged pumps and tanks, and where vents extend above-ground.

3403.6.10 Pipe joints. Joints shall be liquid tight and shall be welded, flanged or threaded except that listed flexible connectors are allowed in accordance with Section 3403.6.9. Threaded or flanged joints shall fit tightly by using approved methods and materials for the type of joint. Joints in piping systems used for Class I liquids shall be welded when located in concealed spaces within buildings.

Nonmetallic joints shall be approved and shall be installed in accordance with the manufacturer's instructions.

Pipe joints that are dependent on the friction characteristics or resiliency of combustible materials for liquid tightness of piping shall not be used in buildings. Piping shall be secured to prevent disengagement at the fitting.

3403.6.11 Bends. Pipe and tubing shall be bent in accordance with ASME B31.9.

SECTION 3404
STORAGE

3404.1 General. The storage of flammable and combustible liquids in containers and tanks shall be in accordance with this section and the applicable sections of Chapter 27.

3404.2 Tank storage. The provisions of this section shall apply to:

1. The storage of flammable and combustible liquids in fixed above-ground and underground tanks.
2. The storage of flammable and combustible liquids in fixed above-ground tanks inside of buildings.
3. The storage of flammable and combustible liquids in portable tanks whose capacity exceeds 660 gallons (2498 L).
4. The installation of such tanks and portable tanks.

3404.2.1 Change of tank contents. Tanks subject to change in contents shall be in accordance with Section 3404.2.7. Prior to a change in contents, the fire code official is authorized to require testing of a tank.

Tanks that have previously contained Class I liquids shall not be loaded with Class II or Class III liquids until such tanks and all piping, pumps, hoses and meters connected thereto have been completely drained and flushed.

3404.2.2 Use of tank vehicles and tank cars as storage tanks. Tank cars and tank vehicles shall not be used as storage tanks.

3404.2.3 Labeling and signs. Labeling and signs for storage tanks and storage tank areas shall comply with Sections 3404.2.3.1 and 3404.2.3.2.

3404.2.3.1 Smoking and open flame. Signs shall be posted in storage areas prohibiting open flames and smoking. Signs shall comply with Section 3403.5.

3404.2.3.2 Label or placard. Tanks more than 100 gallons (379 L) in capacity, which are permanently installed or mounted and used for the storage of Class I, II or IIIA liquids, shall bear a label and placard identifying the material therein. Placards shall be in accordance with NFPA 704.

Exceptions:

1. Tanks of 300-gallon (1136 L) capacity or less located on private property and used for heating and cooking fuels in single-family dwellings.
2. Tanks located underground.

3404.2.4 Sources of ignition. Smoking and open flames are prohibited in storage areas in accordance with Section 2703.7.

Exception: Areas designated as smoking and hot work areas, and areas where hot work permits have been issued in accordance with this code.

3404.2.5 Explosion control. Explosion control shall be provided in accordance with Section 911.

3404.2.6 Separation from incompatible materials. Storage of flammable and combustible liquids shall be separated

from incompatible materials in accordance with Section 2703.9.8.

Grass, weeds, combustible materials and waste Class I, II or IIIA liquids shall not be accumulated in an unsafe manner at a storage site.

3404.2.7 Design, construction and general installation requirements for tanks. The design, fabrication and construction of tanks shall comply with NFPA 30. Each tank shall bear a permanent nameplate or marking indicating the standard used as the basis of design.

3404.2.7.1 Materials used in tank construction. The materials used in tank construction shall be in accordance with NFPA 30.

3404.2.7.2 Pressure limitations for tanks. Tanks shall be designed for the pressures to which they will be subjected in accordance with NFPA 30.

3404.2.7.3 Tank vents for normal venting. Tank vents for normal venting shall be installed and maintained in accordance with Sections 3404.2.7.3.1 through 3404.2.7.3.6.

3404.2.7.3.1 Vent lines. Vent lines from tanks shall not be used for purposes other than venting unless approved.

3404.2.7.3.2 Vent-line flame arresters and venting devices. Vent-line flame arresters and venting devices shall be installed in accordance with their listings. Use of flame arresters in piping systems shall be in accordance with API 2028.

3404.2.7.3.3 Vent pipe outlets. Vent pipe outlets for tanks storing Class I, II or IIIA liquids shall be located such that the vapors are released at a safe point outside of buildings and not less than 12 feet (3658 mm) above the adjacent ground level. Vapors shall be discharged upward or horizontally away from adjacent walls to assist in vapor dispersion. Vent outlets shall be located such that flammable vapors will not be trapped by eaves or other obstructions and shall be at least 5 feet (1524 mm) from building openings or lot lines of properties that can be built upon. Vent outlets on atmospheric tanks storing Class IIIB liquids are allowed to discharge inside a building if the vent is a normally closed vent.

3404.2.7.3.4 Installation of vent piping. Vent piping shall be designed, sized, constructed and installed in accordance with Section 3403.6. Vent pipes shall be installed such that they will drain toward the tank without sags or traps in which liquid can collect. Vent pipes shall be installed in such a manner so as not to be subject to physical damage or vibration.

3404.2.7.3.5 Manifolding. Tank vent piping shall not be manifolded unless required for special purposes such as vapor recovery, vapor conservation or air pollution control.

3404.2.7.3.5.1 Above-ground tanks. For above-ground tanks, manifolded vent pipes shall be adequately sized to prevent system pressure limits from being exceeded when manifolded tanks are subject to the same fire exposure.

3404.2.7.3.5.2 Underground tanks. For underground tanks, manifolded vent pipes shall be sized to prevent system pressure limits from being exceeded when manifolded tanks are filled simultaneously.

3404.2.7.3.5.3 Tanks storing Class I liquids. Vent piping for tanks storing Class I liquids shall not be manifolded with vent piping for tanks storing Class II and III liquids unless positive means are provided to prevent the vapors from Class I liquids from entering tanks storing Class II and III liquids, to prevent contamination and possible change in classification of less volatile liquid.

3404.2.7.3.6 Tank venting for tanks and pressure vessels storing Class IB and IC liquids. Tanks and pressure vessels storing Class IB or IC liquids shall be equipped with venting devices which shall be normally closed except when venting under pressure or vacuum conditions, or with listed flame arresters. The vents shall be installed and maintained in accordance with Section 4.2.5.1 of NFPA 30 or API 2000.

3404.2.7.4 Emergency venting. Stationary, above-ground tanks shall be equipped with additional venting that will relieve excessive internal pressure caused by exposure to fires. Emergency vents for Class I, II and IIIA liquids shall not discharge inside buildings. The venting shall be installed and maintained in accordance with Section 4.2.5.2 of NFPA 30.

Exception: Tanks larger than 12,000 gallons (45 420 L) in capacity storing Class IIIB liquids which are not within the diked area or the drainage path of Class I or II liquids do not require emergency relief venting.

3404.2.7.5 Tank openings other than vents. Tank openings for other than vents shall comply with Sections 3404.2.7.5.1 through 3404.2.7.5.8.

3404.2.7.5.1 Connections below liquid level. Connections for tank openings below the liquid level shall be liquid tight.

3404.2.7.5.2 Filling, emptying and vapor recovery connections. Filling, emptying and vapor recovery connections to tanks containing Class I, II or IIIA liquids shall be located outside of buildings at a location free from sources of ignition and not less than 5 feet (1524 mm) away from building openings or lot lines of property that can be built on. Such openings shall be provided with a liquid-tight cap which shall be closed when not in use and properly identified.

3404.2.7.5.3 Piping, connections and fittings. Piping, connections, fittings and other appurtenances shall be installed in accordance with Section 3403.6.

3404.2.7.5.4 Manual gauging. Openings for manual gauging, if independent of the fill pipe, shall be provided with a liquid-tight cap or cover. Covers shall be kept closed when not gauging. If inside a building,

such openings shall be protected against liquid overflow and possible vapor release by means of a spring-loaded check valve or other approved device.

3404.2.7.5.5 Fill pipes and discharge lines. For top-loaded tanks, a metallic fill pipe shall be designed and installed to minimize the generation of static electricity by terminating the pipe within 6 inches (152 mm) of the bottom of the tank, and it shall be installed in a manner which avoids excessive vibration.

3404.2.7.5.5.1 Class I liquids. For Class I liquids other than crude oil, gasoline and asphalt, the fill pipe shall be designed and installed in a manner which will minimize the possibility of generating static electricity by terminating within 6 inches (152 mm) of the bottom of the tank.

3404.2.7.5.5.2 Underground tanks. For underground tanks, fill pipe and discharge lines shall enter only through the top. Fill lines shall be sloped toward the tank. Underground tanks for Class I liquids having a capacity greater than 1,000 gallons (3785 L) shall be equipped with a tight fill device for connecting the fill hose to the tank.

3404.2.7.5.6 Location of connections that are made or broken. Filling, withdrawal and vapor-recovery connections for Class I, II and IIIA liquids which are made and broken shall be located outside of buildings at a location away from sources of ignition and not less than 5 feet (1524 mm) away from building openings. Such connections shall be closed and liquid tight when not in use and shall be properly identified.

3404.2.7.5.7 Protection against vapor release. Tank openings provided for purposes of vapor recovery shall be protected against possible vapor release by means of a spring-loaded check valve or dry-break connections, or other approved device, unless the opening is a pipe connected to a vapor processing system. Openings designed for combined fill and vapor recovery shall also be protected against vapor release unless connection of the liquid delivery line to the fill pipe simultaneously connects the vapor recovery line. Connections shall be vapor tight.

3404.2.7.5.8 Overfill prevention. An approved means or method in accordance with Section 3404.2.9.6.6 shall be provided to prevent the overfill of all Class I, II and IIIA liquid storage tanks. Storage tanks in refineries, bulk plants or terminals regulated by Sections 3406.4 or 3406.7 shall have overfill protection in accordance with API 2350.

Exception: Outside above-ground tanks with a capacity of 1320 gallons (5000 L) or less.

3404.2.7.6 Repair, alteration or reconstruction of tanks and piping. The repair, alteration or reconstruction, including welding, cutting and hot tapping of storage tanks and piping that have been placed in service, shall be in accordance with NFPA 30.

3404.2.7.7 Design of supports. The design of the supporting structure for tanks shall be in accordance with the *International Building Code* and NFPA 30.

3404.2.7.8 Locations subject to flooding. Where a tank is located in an area where it is subject to buoyancy because of a rise in the water table, flooding or accumulation of water from fire suppression operations, uplift protection shall be provided in accordance with Sections 4.3.2.6 and 4.3.3.5 of NFPA 30.

3404.2.7.9 Corrosion protection. Where subject to external corrosion, tanks shall be fabricated from corrosion-resistant materials, coated or provided with corrosion protection in accordance with Section 4.2.6.1 of NFPA 30.

3404.2.7.10 Leak reporting. A consistent or accidental loss of liquid, or other indication of a leak from a tank system, shall be reported immediately to the fire department, the fire code official and other authorities having jurisdiction.

3404.2.7.10.1 Leaking tank disposition. Leaking tanks shall be promptly emptied, repaired and returned to service, abandoned or removed in accordance with Section 3404.2.13 or 3404.2.14.

3404.2.7.11 Tank lining. Steel tanks are allowed to be lined only for the purpose of protecting the interior from corrosion or providing compatibility with a material to be stored. Only those liquids tested for compatibility with the lining material are allowed to be stored in lined tanks.

3404.2.8 Vaults. Vaults shall be allowed to be either above or below grade and shall comply with Sections 3404.2.8.1 through 3404.2.8.18.

3404.2.8.1 Listing required. Vaults shall be listed in accordance with UL 2245.

Exception: Where approved by the fire code official, below-grade vaults are allowed to be constructed on site, provided that the design is in accordance with the *International Building Code* and that special inspections are conducted to verify structural strength and compliance of the installation with the approved design in accordance with Section 1707 of the *International Building Code*. Installation plans for below-grade vaults that are constructed on site shall be prepared by, and the design shall bear the stamp of, a professional engineer. Consideration shall be given to soil and hydrostatic loading on the floors, walls and lid; anticipated seismic forces; uplifting by ground water or flooding; and to loads imposed from above such as traffic and equipment loading on the vault lid.

3404.2.8.2 Design and construction. The vault shall completely enclose each tank. There shall be no openings in the vault enclosure except those necessary for access to, inspection of, and filling, emptying and venting of the tank. The walls and floor of the vault shall be constructed of reinforced concrete at least 6 inches (152 mm) thick. The top of an above-grade vault shall be con-

structed of noncombustible material and shall be designed to be weaker than the walls of the vault, to ensure that the thrust of an explosion occurring inside the vault is directed upward before significantly high pressure can develop within the vault.

The top of an at-grade or below-grade vault shall be designed to relieve safely or contain the force of an explosion occurring inside the vault. The top and floor of the vault and the tank foundation shall be designed to withstand the anticipated loading, including loading from vehicular traffic, where applicable. The walls and floor of a vault installed below grade shall be designed to withstand anticipated soil and hydrostatic loading.

Vaults shall be designed to be wind and earthquake resistant, in accordance with the *International Building Code*.

3404.2.8.3 Secondary containment. Vaults shall be substantially liquid tight and there shall be no backfill around the tank or within the vault. The vault floor shall drain to a sump. For premanufactured vaults, liquid tightness shall be certified as part of the listing provided by a nationally recognized testing laboratory. For field-erected vaults, liquid tightness shall be certified in an approved manner.

3404.2.8.4 Internal clearance. There shall be sufficient clearance between the tank and the vault to allow for visual inspection and maintenance of the tank and its appurtenances. Dispensing devices are allowed to be installed on tops of vaults.

3404.2.8.5 Anchoring. Vaults and their tanks shall be suitably anchored to withstand uplifting by ground water or flooding, including when the tank is empty.

3404.2.8.6 Vehicle impact protection. Vaults shall be resistant to damage from the impact of a motor vehicle, or vehicle impact protection shall be provided in accordance with Section 312.

3404.2.8.7 Arrangement. Tanks shall be listed for above-ground use, and each tank shall be in its own vault. Compartmentalized tanks shall be allowed and shall be considered as a single tank. Adjacent vaults shall be allowed to share a common wall. The common wall shall be liquid and vapor tight and shall be designed to withstand the load imposed when the vault on either side of the wall is filled with water.

3404.2.8.8 Connections. Connections shall be provided to permit venting of each vault to dilute, disperse and remove vapors prior to personnel entering the vault.

3404.2.8.9 Ventilation. Vaults that contain tanks of Class I liquids shall be provided with an exhaust ventilation system installed in accordance with Section 2704.3. The ventilation system shall operate continuously or be designed to operate upon activation of the vapor or liquid detection system. The system shall provide ventilation at a rate of not less than 1 cubic foot per minute (cfm) per square foot of floor area [0.00508 $m^3/(s \cdot m^2)$], but not less than 150 cfm (0.071 m^3/s). The exhaust system shall be designed to provide air movement across all parts of the vault floor. Supply and exhaust ducts shall extend to within 3 inches (76 mm), but not more than 12 inches (305 mm), of the floor. The exhaust system shall be installed in accordance with the *International Mechanical Code*.

3404.2.8.10 Liquid detection. Vaults shall be equipped with a detection system capable of detecting liquids, including water, and activating an alarm.

3404.2.8.11 Monitoring and detection. Vaults shall be provided with approved vapor and liquid detection systems and equipped with on-site audible and visual warning devices with battery backup. Vapor detection systems shall sound an alarm when the system detects vapors that reach or exceed 25 percent of the lower explosive limit (LEL) of the liquid stored. Vapor detectors shall be located no higher than 12 inches (305 mm) above the lowest point in the vault. Liquid detection systems shall sound an alarm upon detection of any liquid, including water. Liquid detectors shall be located in accordance with the manufacturer's instructions. Activation of either vapor or liquid detection systems shall cause a signal to be sounded at an approved, constantly attended location within the facility serving the tanks or at an approved location. Activation of vapor detection systems shall also shut off dispenser pumps.

3404.2.8.12 Liquid removal. Means shall be provided to recover liquid from the vault. Where a pump is used to meet this requirement, the pump shall not be permanently installed in the vault. Electric-powered portable pumps shall be suitable for use in Class I, Division 1 locations, as defined in the ICC *Electrical Code*.

3404.2.8.13 Normal vents. Vent pipes that are provided for normal tank venting shall terminate at least 12 feet (3658 mm) above ground level.

3404.2.8.14 Emergency vents. Emergency vents shall be vapor tight and shall be allowed to discharge inside the vault. Long-bolt manhole covers shall not be allowed for this purpose.

3404.2.8.15 Accessway. Vaults shall be provided with an approved personnel accessway with a minimum dimension of 30 inches (762 mm) and with a permanently affixed, nonferrous ladder. Accessways shall be designed to be nonsparking. Travel distance from any point inside a vault to an accessway shall not exceed 20 feet (6096 mm). At each entry point, a warning sign indicating the need for procedures for safe entry into confined spaces shall be posted. Entry points shall be secured against unauthorized entry and vandalism.

3404.2.8.16 Fire protection. Vaults shall be provided with a suitable means to admit a fire suppression agent.

3404.2.8.17 Classified area. The interior of a vault containing a tank that stores a Class I liquid shall be designated a Class I, Division 1 location, as defined in the ICC *Electrical Code*.

3404.2.8.18 Overfill protection. Overfill protection shall be provided in accordance with Section

3404.2.9.6.6. The use of a float vent valve shall be prohibited.

3404.2.9 Above-ground tanks. Above-ground storage of flammable and combustible liquids in tanks shall comply with Section 3404.2 and Sections 3404.2.9.1 through 3404.2.9.6.10.

3404.2.9.1 Fire protection. Fire protection for above-ground tanks shall comply with Sections 3404.2.9.1.1 through 3404.2.9.1.4.

3404.2.9.1.1 Required foam fire protection systems. When required by the fire code official, foam fire protection shall be provided for above-ground tanks, other than pressure tanks operating at or above 1 pound per square inch gauge (psig) (6.89 kPa) when such tank, or group of tanks spaced less than 50 feet (15 240 mm) apart measured shell to shell, has a liquid surface area in excess of 1,500 square feet (139 m^2), and is in accordance with one of the following:

1. Used for the storage of Class I or II liquids.
2. Used for the storage of crude oil.
3. Used for in-process products and is located within 100 feet (30 480 mm) of a fired still, heater, related fractioning or processing apparatus or similar device at a processing plant or petroleum refinery as herein defined.
4. Considered by the fire code official as posing an unusual exposure hazard because of topographical conditions; nature of occupancy, proximity on the same or adjoining property, and height and character of liquids to be stored; degree of private fire protection to be provided; and facilities of the fire department to cope with flammable liquid fires.

3404.2.9.1.2 Foam fire protection system installation. Where foam fire protection is required, it shall be installed in accordance with NFPA 11 and NFPA 11A.

3404.2.9.1.2.1 Foam storage. Where foam fire protection is required, foam-producing materials shall be stored on the premises.

Exception: Storage of foam-producing materials off the premises is allowed as follows:

1. Such materials stored off the premises shall be of the proper type suitable for use with the equipment at the installation where required.
2. Such materials shall be readily available at the storage location at all times.
3. Adequate loading and transportation facilities shall be provided.
4. The time required to deliver such materials to the required location in the event of fire shall be consistent with the hazards and fire scenarios for which the foam supply is intended.
5. At the time of a fire, these off-premises supplies shall be accumulated in sufficient quantities before placing the equipment in operation to ensure foam production at an adequate rate without interruption until extinguishment is accomplished.

3404.2.9.1.3 Fire protection of supports. Supports or pilings for above-ground tanks storing Class I, II or IIIA liquids elevated more than 12 inches (305 mm) above grade shall have a fire-resistance rating of not less than 2 hours in accordance with the fire exposure criteria specified in ASTM E 1529.

Exceptions:

1. Structural supports tested as part of a protected above-ground tank in accordance with UL 2085.
2. Stationary tanks located outside of buildings when protected by an approved water-spray system designed in accordance with Chapter 9 and NFPA 15.
3. Stationary tanks located inside of buildings equipped throughout with an approved automatic sprinkler system designed in accordance with Section 903.3.1.1.

3404.2.9.1.4 Inerting of tanks with boilover liquids. Liquids with boilover characteristics shall not be stored in fixed roof tanks larger than 150 feet (45 720 mm) in diameter unless an approved gas enrichment or inerting system is provided on the tank.

Exception: Crude oil storage tanks in production fields with no other exposures adjacent to the storage tank.

3404.2.9.2 Supports, foundations and anchorage. Supports, foundations and anchorages for above-ground tanks shall be designed and constructed in accordance with NFPA 30 and the *International Building Code*.

3404.2.9.3 Stairs, platforms and walkways. Stairs, platforms and walkways shall be of noncombustible construction and shall be designed and constructed in accordance with NFPA 30 and the *International Building Code*.

3404.2.9.4 Above-ground tanks inside of buildings. Tanks storing Class I, II and IIIA liquids inside buildings shall be equipped with a device or other means to prevent overflow into the building including, but not limited to: a float valve; a preset meter on the fill line; a valve actuated by the weight of the tanks contents; a low head pump which is incapable of producing overflow; or a liquid-tight overflow pipe at least one pipe size larger than the fill pipe and discharging by gravity back to the outside source of liquid or to an approved location.

3404.2.9.5 Above-ground tanks outside of buildings. Above-ground tanks outside of buildings shall comply with Sections 3404.2.9.5.1 through 3404.2.9.5.3.

3404.2.9.5.1 Locations where above-ground tanks are prohibited. Storage of Class I and II liquids in above-ground tanks outside of buildings is prohibited within the limits established by law as the limits of districts in which such storage is prohibited (see Section 3 of the Sample Ordinance for Adoption of the *International Fire Code* on page v).

3404.2.9.5.1.1 Location of tanks with pressures 2.5 psig or less. Above-ground tanks operating at pressures not exceeding 2.5 psig (17.2 kPa) for storage of Class I, II or IIIA liquids, which are designed with a floating roof, a weak roof-to-shell seam or equipped with emergency venting devices limiting pressure to 2.5 psig (17.2 kPa), shall be located in accordance with Table 4.3.2.1.1(a) of NFPA 30.

Exceptions:

1. Vertical tanks having a weak roof-to-shell seam and storing Class IIIA liquids are allowed to be located at one-half the distances specified in Table 4.3.2.1.1(a) of NFPA 30, provided the tanks are not within a diked area or drainage path for a tank storing Class I or II liquids.
2. Liquids with boilover characteristics and unstable liquids in accordance with Sections 3404.2.9.5.1.3 and 3404.2.9.5.1.4.
3. For protected above-ground tanks in accordance with Section 3404.2.9.6 and tanks in at-grade or above-grade vaults in accordance with Section 3404.2.8, the distances in Table 4.3.2.1.1(b) of NFPA 30 shall apply and shall be reduced by one-half, but not to less than 5 feet (1524 mm).

3404.2.9.5.1.2 Location of tanks with pressures exceeding 2.5 psig. Above-ground tanks for the storage of Class I, II or IIIA liquids operating at pressures exceeding 2.5 psig (17.2 kPa) or equipped with emergency venting allowing pressures to exceed 2.5 psig (17.2 kPa) shall be located in accordance with Table 4.3.2.1.2 of NFPA 30.

Exception: Liquids with boilover characteristics and unstable liquids in accordance with Sections 3404.2.9.5.1.4 and 3404.2.9.5.1.5.

3404.2.9.5.1.3 Location of tanks for boilover liquids. Above-ground tanks for storage of liquids with boilover characteristics shall be located in accordance with Table 4.3.2.1.3 of NFPA 30.

3404.2.9.5.1.4 Location of tanks for unstable liquids. Above-ground tanks for the storage of unstable liquids shall be located in accordance with Table 4.3.2.1.4 of NFPA 30.

3404.2.9.5.1.5 Location of tanks for Class IIIB liquids. Above-ground tanks for the storage of Class IIIB liquids, excluding unstable liquids, shall be located in accordance with Table 4.3.2.1.5 of NFPA 30, except when located within a diked area or drainage path for a tank or tanks storing Class I or II liquids. Where a Class IIIB liquid storage tank is within the diked area or drainage path for a Class I or II liquid, distances required by Section 3404.2.9.5.1.1 shall apply.

3404.2.9.5.1.6 Reduction of separation distances to adjacent property. Where two tank properties of diverse ownership have a common boundary, the fire code official is authorized to, with the written consent of the owners of the two properties, apply the distances in Sections 3404.2.9.5.1.2 through 3404.2.9.5.1.5 assuming a single property.

3404.2.9.5.2 Separation between adjacent stable or unstable liquid tanks. The separation between tanks containing stable liquids shall be in accordance with Table 4.3.2.2.1 of NFPA 30. Where tanks are in a diked area containing Class I or II liquids, or in the drainage path of Class I or II liquids, and are compacted in three or more rows or in an irregular pattern, the fire code official is authorized to require greater separation than specified in Table 4.3.2.2.1 of NFPA 30 or other means to make tanks in the interior of the pattern accessible for fire-fighting purposes.

Exception: Tanks used for storing Class IIIB liquids are allowed to be spaced 3 feet (914 mm) apart unless within a diked area or drainage path for a tank storing Class I or II liquids.

The separation between tanks containing unstable liquids shall not be less than one-half the sum of their diameters.

3404.2.9.5.3 Separation between adjacent tanks containing flammable or combustible liquids and LP-gas. The minimum horizontal separation between an LP-gas container and a Class I, II or IIIA liquid storage tank shall be 20 feet (6096 mm) except in the case of Class I, II or IIIA liquid tanks operating at pressures exceeding 2.5 psig (17.2 kPa) or equipped with emergency venting allowing pressures to exceed 2.5 psig (17.2 kPa), in which case the provisions of Section 3404.2.9.5.2 shall apply.

An approved means shall be provided to prevent the accumulation of Class I, II or IIIA liquids under adjacent LP-gas containers such as by dikes, diversion curbs or grading. When flammable or combustible liquid storage tanks are within a diked area, the LP-gas containers shall be outside the diked area and at least 10 feet (3048 mm) away from the centerline of the wall of the diked area.

Exceptions:

1. Liquefied petroleum gas containers of 125 gallons (473 L) or less in capacity installed adjacent to fuel-oil supply tanks of 660 gallons (2498 L) or less in capacity.
2. Horizontal separation is not required between above-ground LP-gas containers

and underground flammable and combustible liquid tanks.

3404.2.9.6 Additional requirements for protected above-ground tanks. In addition to the requirements of this chapter for above-ground tanks, the installation of protected above-ground tanks shall be in accordance with Sections3404.2.9.6.1 through 3404.2.9.6.10.

3404.2.9.6.1 Tank construction. The construction of a protected above-ground tank and its primary tank shall be in accordance with Section 3404.2.7.

3404.2.9.6.2 Normal and emergency venting. Normal and emergency venting for protected above-ground tanks shall be provided in accordance with Sections 3404.2.7.3 and 3404.2.7.4. The vent capacity reduction factor shall not be allowed.

3404.2.9.6.3 Flame arresters. Approved flame arresters or pressure vacuum breather valves shall be installed in normal vents.

3404.2.9.6.4 Secondary containment. Protected above-ground tanks shall be provided with secondary containment, drainage control or diking in accordance with Section 2704.2. A means shall be provided to establish the integrity of the secondary containment in accordance with NFPA 30.

3404.2.9.6.5 Vehicle impact protection. Where protected above-ground tanks, piping, electrical conduit or dispensers are subject to vehicular impact, they shall be protected therefrom, either by having the impact protection incorporated into the system design in compliance with the impact test protocol of UL 2085, or by meeting the provisions of Section 312, or where necessary, a combination of both. Where guard posts or other approved barriers are provided, they shall be independent of each above-ground tank.

3404.2.9.6.6 Overfill prevention. Protected above-ground tanks shall not be filled in excess of 95 percent of their capacity. An overfill prevention system shall be provided for each tank. During tank-filling operations, the system shall comply with one of the following:

1. The system shall:
   1.1. 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
   1.2. Automatically shut off the flow of fuel to the tank when the quantity of liquid in the tank reaches 95 percent of tank capacity. For rigid hose fuel-delivery systems, an approved means shall be provided to empty the fill hose into the tank after the automatic shutoff device is activated.
2. The system shall reduce the flow rate to not more than 15 gallons per minute (0.95 L/sec) 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.

3404.2.9.6.6.1 Information signs. A permanent sign shall 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 shall be located in the office window, lock box or other area accessible to the person filling the tank.

3404.2.9.6.6.2 Determination of available tank capacity. The filling procedure shall require the person filling the tank to determine the gallonage (literage) required to fill it to 90 percent of capacity before commencing the fill operation.

3404.2.9.6.7 Fill pipe connections. The fill pipe shall 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 shall be installed in the fill pipe not more than 12 inches (305 mm) from the fill hose connection.

3404.2.9.6.8 Spill containers. A spill container having a capacity of not less than 5 gallons (19 L) shall be provided for each fill connection. For tanks with a top fill connection, spill containers shall be noncombustible and shall 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 shall be allowed.

3404.2.9.6.9 Tank openings. Tank openings in protected above-ground tanks shall be through the top only.

3404.2.9.6.10 Antisiphon devices. Approved antisiphon devices shall 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.

3404.2.10 Drainage and diking. The area surrounding a tank or group of tanks shall be provided with drainage control or shall be diked to prevent accidental discharge of liquid from endangering adjacent tanks, adjoining property or reaching waterways.

Exceptions:

1. 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.

2. Drainage control and diking is not required for listed secondary containment tanks.

3404.2.10.1 Volumetric capacity. The volumetric capacity of the diked area shall not be less than the greatest amount of liquid that can be released from the largest tank within the diked area. The capacity of the diked area enclosing more than one tank shall be calculated by deducting the volume of the tanks other than the largest tank below the height of the dike.

3404.2.10.2 Diked areas containing two or more tanks. Diked areas containing two or more tanks shall be subdivided in accordance with NFPA 30.

3404.2.10.3 Protection of piping from exposure fires. Piping shall not pass through adjacent diked areas or impounding basins, unless provided with a sealed sleeve or otherwise protected from exposure to fire.

3404.2.10.4 Combustible materials in diked areas. Diked areas shall be kept free from combustible materials, drums and barrels.

3404.2.10.5 Equipment, controls and piping in diked areas. Pumps, manifolds and fire protection equipment or controls shall not be located within diked areas or drainage basins or in a location where such equipment and controls would be endangered by fire in the diked area or drainage basin. Piping above ground shall be minimized and located as close as practical to the shell of the tank in diked areas or drainage basins.

Exceptions:

1. Pumps, manifolds and piping integral to the tanks or equipment being served which is protected by intermediate diking, berms, drainage or fire protection such as water spray, monitors or resistive coating.
2. Fire protection equipment or controls which are appurtenances to the tanks or equipment being protected, such as foam chambers or foam piping and water or foam monitors and hydrants, or hand and wheeled extinguishers.

3404.2.11 Underground tanks. Underground storage of flammable and combustible liquids in tanks shall comply with Section 3404.2 and Sections 3404.2.11.1 through 3404.2.11.5.2.

3404.2.11.1 Contents. Underground tanks shall not contain petroleum products containing mixtures of a nonpetroleum nature, such as ethanol or methanol blends, without evidence of compatibility.

3404.2.11.2 Location. Flammable and combustible liquid storage tanks located underground, either outside or under buildings, shall be in accordance with all of the following:

1. Tanks shall be located with respect to existing foundations and supports such that the loads carried by the latter cannot be transmitted to the tank.
2. The distance from any part of a tank storing liquids to the nearest wall of a basement, pit, cellar, or lot line shall not be less than 3 feet (914 mm).
3. A minimum distance of 1 foot (305 mm), shell to shell, shall be maintained between underground tanks.

3404.2.11.3 Depth and cover. Excavation for underground storage tanks shall be made with due care to avoid undermining of foundations of existing structures. Underground tanks shall be set on firm foundations and surrounded with at least 6 inches (152 mm) of noncorrosive inert material, such as clean sand.

3404.2.11.4 Overfill protection and prevention systems. Fill pipes shall be equipped with a spill container and an overfill prevention system in accordance with NFPA 30.

3404.2.11.5 Leak prevention. Leak prevention for underground tanks shall comply with Sections 3404.2.11.5.1 and 3404.2.11.5.2.

3404.2.11.5.1 Inventory control. Daily inventory records shall be maintained for underground storage tank systems.

3404.2.11.5.2 Leak detection. Underground storage tank systems shall be provided with an approved method of leak detection from any component of the system that is designed and installed in accordance with NFPA 30.

3404.2.12 Testing. Tank testing shall comply with Sections 3404.2.12.1 and 3404.2.12.2.

3404.2.12.1 Acceptance testing. Prior to being placed into service, tanks shall be tested in accordance with Section 4.4 of NFPA 30.

3404.2.12.2 Testing of underground tanks. Before being covered or placed in use, tanks and piping connected to underground tanks shall be tested for tightness in the presence of the fire code official. Piping shall be tested in accordance with Section 3403.6.3. The system shall not be covered until it has been approved.

3404.2.13 Abandonment and status of tanks. Tanks taken out of service shall be removed in accordance with Section 3404.2.14, or safeguarded in accordance with Sections 3404.2.13.1 through 3404.2.13.2.3 and API 1604.

3404.2.13.1 Underground tanks. Underground tanks taken out of service shall comply with Sections 3404.2.13.1.1 through 3404.2.13.1.5.

3404.2.13.1.1 Temporarily out of service. Underground tanks temporarily out of service shall have the fill line, gauge opening, vapor return and pump con-

nection secure against tampering. Vent lines shall remain open and be maintained in accordance with Sections 3404.2.7.3 and 3404.2.7.4.

3404.2.13.1.2 Out of service for 90 days. Underground tanks not used for a period of 90 days shall be safeguarded in accordance with all the following or be removed in accordance with Section 3404.2.14:

1. Flammable or combustible liquids shall be removed from the tank.
2. All piping, including fill line, gauge opening, vapor return and pump connection, shall be capped or plugged and secured from tampering.
3. Vent lines shall remain open and be maintained in accordance with Sections 3404.2.7.3 and 3404.2.7.4.

3404.2.13.1.3 Out of service for one year. Underground tanks that have been out of service for a period of one year shall be removed from the ground in accordance with Section 3404.2.14 or abandoned in place in accordance with Section 3404.2.13.1.4.

3404.2.13.1.4 Tanks abandoned in place. Tanks abandoned in place shall be as follows:

1. Flammable and combustible liquids shall be removed from the tank and connected piping.
2. The suction, inlet, gauge, vapor return and vapor lines shall be disconnected.
3. The tank shall be filled completely with an approved inert solid material.

   Exception: Residential heating oil tanks of 1,100 gallons (4164 L) or less, provided the fill line is permanently removed to a point below grade to prevent refilling of the tank.
4. Remaining underground piping shall be capped or plugged.
5. A record of tank size, location and date of abandonment shall be retained.
6. All exterior above-grade fill piping shall be permanently removed when tanks are abandoned or removed.

3404.2.13.1.5 Reinstallation of underground tanks. Tanks which are to be reinstalled for flammable or combustible liquid service shall be in accordance with this chapter, ASME *Boiler and Pressure Vessel Code* (Section VIII), API 12-P, API 1615, UL 58 and UL 1316.

3404.2.13.2 Above-ground tanks. Above-ground tanks taken out of service shall comply with Sections 3404.2.13.2.1 through 3404.2.13.2.3.

3404.2.13.2.1 Temporarily out of service. Above-ground tanks temporarily out of service shall have all connecting lines isolated from the tank and be secured against tampering.

Exception: In-place fire protection (foam) system lines.

3404.2.13.2.2 Out of service for 90 days. Above-ground tanks not used for a period of 90 days shall be safeguarded in accordance with Section 3404.2.13.1.2 or removed in accordance with Section 3404.2.14.

Exceptions:

1. Tanks and containers connected to oil burners that are not in use during the warm season of the year or are used as a backup heating system to gas.
2. In-place, active fire protection (foam) system lines.

3404.2.13.2.3 Out of service for one year. Above-ground tanks that have been out of service for a period of one year shall be removed in accordance with Section 3404.2.14.

Exception: Tanks within operating facilities.

3404.2.14 Removal and disposal of tanks. Removal and disposal of tanks shall comply with Sections 3404.2.14.1 and 3404.2.14.2.

3404.2.14.1 Removal. Removal of above-ground and underground tanks shall be in accordance with all of the following:

1. Flammable and combustible liquids shall be removed from the tank and connected piping.
2. Piping at tank openings that is not to be used further shall be disconnected.
3. Piping shall 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 shall be capped and safeguarded as required by the fire code official.
4. Tank openings shall be capped or plugged, leaving a 0.125-inch to $^1/_4$-inch-diameter (3.2 mm to 6.4 mm) opening for pressure equalization.
5. Tanks shall be purged of vapor and inerted prior to removal.
6. All exterior above-grade fill and vent piping shall be permanently removed.

   Exception: Piping associated with bulk plants, terminal facilities and refineries.

3404.2.14.2 Disposal. Tanks shall be disposed of in accordance with federal, state and local regulations.

3404.3 Container and portable tank storage. Storage of flammable and combustible liquids in closed containers that do not exceed 60 gallons (227 L) in individual capacity and portable tanks that do not exceed 660 gallons (2498 L) in individual capacity, and limited transfers incidental thereto, shall comply with this section.

3404.3.1 Design, construction and capacity of containers and portable tanks. The design, construction and capacity of containers for the storage of Class I, II and IIIA liquids

shall be in accordance with this section and Section 6.2 of NFPA 30.

3404.3.1.1 Approved containers. Only approved containers and portable tanks shall be used.

3404.3.2 Liquid storage cabinets. Where other sections of this code require that liquid containers be stored in storage cabinets, such cabinets and storage shall be in accordance with Sections 3404.3.2.1 through 3404.3.2.3.

3404.3.2.1 Design and construction of storage cabinets. Design and construction of liquid storage cabinets shall be in accordance with this section.

3404.3.2.1.1 Materials. Cabinets shall be listed in accordance with UL 1275, or constructed of approved wood or metal in accordance with the following:

1. Unlisted metal cabinets shall be constructed of steel having a thickness of not less than 0.044 inch (1.12 mm) (18 gage). The cabinet, including the door, shall be double walled with $1^1/_2$-inch (38 mm) airspace between the walls. Joints shall be riveted or welded and shall be tight fitting.
2. Unlisted wooden cabinets, including doors, shall be constructed of not less than 1-inch (25 mm) exterior grade plywood. Joints shall be rabbeted and shall be fastened in two directions with wood screws. Door hinges shall be of steel or brass. Cabinets shall be painted with an intumescent-type paint.

3404.3.2.1.2 Labeling. Cabinets shall be provided with a conspicuous label in red letters on contrasting background which reads: FLAMMABLE—KEEP FIRE AWAY.

3404.3.2.1.3 Doors. Doors shall be well fitted, self-closing and equipped with a three-point latch.

3404.3.2.1.4 Bottom. The bottom of the cabinet shall be liquid tight to a height of at least 2 inches (51 mm).

3404.3.2.2 Capacity. The combined total quantity of liquids in a cabinet shall not exceed 120 gallons (454 L).

3404.3.3 Indoor storage. Storage of flammable and combustible liquids inside buildings in containers and portable tanks shall be in accordance with this section.

Exceptions:

1. Liquids in the fuel tanks of motor vehicles, aircraft, boats or portable or stationary engines.
2. The storage of distilled spirits and wines in wooden barrels or casks.

3404.3.3.1 Portable fire extinguishers. Approved portable fire extinguishers shall be provided in accordance with specific sections of this chapter and Section 906.

3404.3.3.2 Incompatible materials. Materials that will react with water or other liquids to produce a hazard shall not be stored in the same room with flammable and combustible liquids in accordance with Section 2703.9.8.

3404.3.3.3 Clear means of egress. Storage of any liquids, including stock for sale, shall not be stored near or be allowed to obstruct physically the route of egress.

3404.3.3.4 Empty containers or portable tank storage. The storage of empty tanks and containers previously used for the storage of flammable or combustible liquids, unless free from explosive vapors, shall be stored as required for filled containers and portable tanks. Portable tanks and containers, when emptied, shall have the covers or plugs immediately replaced in openings.

3404.3.3.5 Shelf storage. Shelving shall be of approved construction, adequately braced and anchored. Seismic requirements shall be in accordance with the *International Building Code*.

3404.3.3.5.1 Use of wood. Wood of at least 1 inch (25 mm) nominal thickness is allowed to be used as shelving, racks, dunnage, scuffboards, floor overlay and similar installations.

3404.3.3.5.2 Displacement protection. Shelves shall be of sufficient depth and provided with a lip or guard to prevent individual containers from being displaced.

Exception: Shelves in storage cabinets or on laboratory furniture specifically designed for such use.

3404.3.3.5.3 Orderly storage. Shelf storage of flammable and combustible liquids shall be maintained in an orderly manner.

3404.3.3.6 Rack storage. Where storage on racks is allowed elsewhere in this code, a minimum 4-foot-wide (1219 mm) aisle shall be provided between adjacent rack sections and any adjacent storage of liquids. Main aisles shall be a minimum of 8 feet (2438 mm) wide.

3404.3.3.7 Pile or palletized storage. Solid pile and palletized storage in liquid warehouses shall be arranged so that piles are separated from each other by at least 4 feet (1219 mm). Aisles shall be provided and arranged so that no container or portable tank is more than 20 feet (6096 mm) from an aisle. Main aisles shall be a minimum of 8 feet (2438 mm) wide.

3404.3.3.8 Limited combustible storage. Limited quantities of combustible commodities are allowed to be stored in liquid storage areas where the ordinary combustibles, other than those used for packaging the liquids, are separated from the liquids in storage by a minimum of 8 feet (2438 mm) horizontally, either by open aisles or by open racks, and where protection is provided in accordance with Chapter 9.

3404.3.3.9 Idle combustible pallets. Storage of empty or idle combustible pallets inside an unprotected liquid storage area shall be limited to a maximum pile size of 2,500 square feet (232 m^2) and to a maximum storage height of 6 feet (1829 mm). Storage of empty or idle combustible pallets inside a protected liquid storage area shall comply with NFPA 13 and NFPA 230. Pallet storage shall be separated from liquid storage by aisles that are at least 8 feet (2438 mm) wide.

3404.3.3.10 Containers in piles. Containers in piles shall be stacked in such a manner as to provide stability and to prevent excessive stress on container walls. Portable tanks stored more than one tier high shall be designed to nest securely, without dunnage. Material-handling equipment shall be suitable to handle containers and tanks safely at the upper tier level.

3404.3.4 Quantity limits for storage. Liquid storage quantity limitations shall comply with Sections 3404.3.4.1 through 3404.3.4.4.

3404.3.4.1 Maximum allowable quantity per control area. For occupancies other than Group M wholesale and retail sales uses, indoor storage of flammable and combustible liquids shall not exceed the maximum allowable quantities per control area indicated in Table 2703.1.1(1) and shall not exceed the additional limitations set forth in this section.

For Group M occupancy wholesale and retail sales uses, indoor storage of flammable and combustible liquids shall not exceed the maximum allowable quantities per control area indicated in Table 3404.3.4.1.

Storage of hazardous production material flammable and combustible liquids in Group H-5 occupancies shall be in accordance with Chapter 18.

3404.3.4.2 Occupancy quantity limits. The following limits for quantities of stored flammable or combustible liquids shall not be exceeded:

1. Group A occupancies: Quantities in Group A occupancies shall not exceed that necessary for demonstration, treatment, laboratory work, maintenance purposes and operation of equipment, and shall not exceed quantities set forth in Table 2703.1.1(1).
2. Group B occupancies: Quantities in drinking, dining, office and school uses within Group B occupancies shall not exceed that necessary for demonstration, treatment, laboratory work, maintenance purposes and operation of equipment, and shall not exceed quantities set forth in Table 2703.1.1(1).
3. Group E occupancies: Quantities in Group E occupancies shall not exceed that necessary for demonstration, treatment, laboratory work, maintenance purposes and operation of equipment, and shall not exceed quantities set forth in Table 2703.1.1(1).
4. Group F occupancies: Quantities in dining, office, and school uses within Group F occupancies shall not exceed that necessary for demonstration, laboratory work, maintenance purposes and operation of equipment, and shall not exceed quantities set forth in Table 2703.1.1(1).
5. Group I occupancies: Quantities in Group I occupancies shall not exceed that necessary for demonstration, laboratory work, maintenance purposes and operation of equipment, and shall not exceed quantities set forth in Table 2703.1.1(1).
6. Group M occupancies: Quantities in dining, office, and school uses within Group M occupancies shall not exceed that necessary for demonstration, laboratory work, maintenance purposes and operation of equipment, and shall not exceed quantities set forth in Table 2703.1.1(1). The maximum allowable quantities for storage in whole-

TABLE 3404.3.4.1
MAXIMUM ALLOWABLE QUANTITY PER CONTROL AREA OF FLAMMABLE AND COMBUSTIBLE LIQUIDS IN WHOLESALE AND RETAIL SALES OCCUPANCIES[a]

TYPE OF LIQUID	MAXIMUM ALLOWABLE QUANTITY PER CONTROL AREA (gallons)		
	Sprinklered[b] per footnote densities and arrangements	Sprinklered per Tables 3404.3.6.3(4) through 3404.3.6.3(8) and Table 3404.3.7.5.1	Nonsprinklered
Class IA	60	60	30
Class IB, IC, II and IIIA	7,500[c]	15,000[c]	1,600
Class IIIB	Unlimited	Unlimited	13,200

For SI: 1 foot = 304.8 mm, 1 square foot = 0.0929 m^2, 1 gallon = 3.785 L, 1 gallon per minute per square foot = 40.75 L/min/m^2.

a. Control areas shall be separated from each other by not less than a 1-hour fire barrier wall.

b. To be considered as sprinklered, a building shall be equipped throughout with an approved automatic sprinkler system with a design providing minimum densities as follows:
   1. For uncartoned commodities on shelves 6 feet or less in height where the ceiling height does not exceed 18 feet, quantities are those allowed with a minimum sprinkler design density of Ordinary Hazard Group 2.
   2. For cartoned, palletized or racked commodities where storage is 4 feet 6 inches or less in height and where the ceiling height does not exceed 18 feet, quantities are those allowed with a minimum sprinkler design density of 0.21 gallon per minute per square foot over the most remote 1,500-square-foot area.

c. Where wholesale and retail sales or storage areas exceed 50,000 square feet in area, the maximum allowable quantities are allowed to be increased by 2 percent for each 1,000 square feet of area in excess of 50,000 square feet, up to a maximum of 100 percent of the table amounts. A control area separation is not required. The cumulative amounts, including amounts attained by having an additional control area, shall not exceed 30,000 gallons.

sale and retail sales areas shall be in accordance with Section 3404.3.4.1.

7. Group R occupancies: Quantities in Group R occupancies shall not exceed that necessary for maintenance purposes and operation of equipment, and shall not exceed quantities set forth in Table 2703.1.1(1).
8. Group S occupancies: Quantities in dining and office uses within Group S occupancies shall not exceed that necessary for demonstration, laboratory work, maintenance purposes and operation of equipment, and shall not exceed quantities set forth in Table 2703.1.1(1).

3404.3.4.3 Quantities exceeding limits for control areas. Quantities exceeding those allowed in control areas set forth in Section 3404.3.4.1 shall be in liquid storage rooms or liquid storage warehouses in accordance with Sections 3404.3.7 and 3404.3.8.

3404.3.4.4 Liquids for maintenance and operation of equipment. In all occupancies, quantities of flammable and combustible liquids in excess of 10 gallons (38 L) used for maintenance purposes and the operation of equipment shall be stored in liquid storage cabinets in accordance with Section 3404.3.2. Quantities not exceeding 10 gallons (38 L) are allowed to be stored outside of a cabinet when in approved containers located in private garages or other approved locations.

3404.3.5 Storage in control areas. Storage of flammable and combustible liquids in control areas shall be in accordance with Sections 3404.3.5.1 through 3404.3.5.4.

3404.3.5.1 Basement storage. Class I liquids shall be allowed to be stored in basements in amounts not exceeding the maximum allowable quantity per control area for use-open systems in Table 2703.1.1(1), provided that automatic suppression and other fire protection are provided in accordance with Chapter 9. Class II and IIIA liquids shall also be allowed to be stored in basements, provided that automatic suppression and other fire protection are provided in accordance with Chapter 9.

3404.3.5.2 Storage pile heights. Containers having less than a 30-gallon (114 L) capacity which contain Class I or II liquids shall not be stacked more than 3 feet (914.4 mm) or two containers high, whichever is greater, unless stacked on fixed shelving or otherwise satisfactorily secured. Containers of Class I or II liquids having a capacity of 30 gallons (114 L) or more shall not be stored more than one container high. Containers shall be stored in an upright position.

3404.3.5.3 Storage distance from ceilings and roofs. Piles of containers or portable tanks shall not be stored closer than 3 feet (914 mm) to the nearest beam, chord, girder or other obstruction, and shall be 3 feet (914 mm) below sprinkler deflectors or discharge orifices of water spray or other overhead fire protection system.

3404.3.5.4 Combustible materials. In areas that are inaccessible to the public, Class I, II and IIIA liquids shall not be stored in the same pile or rack section as ordinary combustible commodities unless such materials are packaged together as kits.

3404.3.6 Wholesale and retail sales uses. Flammable and combustible liquids in Group M occupancy wholesale and retail sales uses shall be in accordance with Sections 3404.3.6.1 through 3404.3.6.5, or Sections 6.4.3.3, 6.5.6.7, 6.8.2, Tables 6.8.2(a) through (f), and Figures 6.8.2(a) through (d) of NFPA 30.

3404.3.6.1 Container type. Containers for Class I liquids shall be metal.

Exception: In sprinklered buildings, an aggregate quantity of 120 gallons (454 L) of water-miscible Class IB and Class IC liquids is allowed in nonmetallic containers, each having a capacity of 16 ounces (0.473 L) or less.

3404.3.6.2 Container capacity. Containers for Class I liquids shall not exceed a capacity of 5 gallons (19 L).

Exception: Metal containers not exceeding 55 gallons (208 L) are allowed to store up to 240 gallons (908 L) of the maximum allowable quantity per control area of Class IB and IC liquids in a control area. The building shall be equipped throughout with an approved automatic sprinkler system in accordance with Table 3404.3.4.1. The containers shall be provided with plastic caps without cap seals and shall be stored upright. Containers shall not be stacked or stored in racks and shall not be located in areas accessible to the public.

3404.3.6.3 Fire protection and storage arrangements. Fire protection and container storage arrangements shall be in accordance with Table 3404.3.6.3(1) or the following:

1. Storage on shelves shall not exceed 6 feet (1829 mm) in height, and shelving shall be metal.
2. Storage on pallets or in piles greater than 4 feet 6 inches (1372 mm) in height, or where the ceiling exceeds 18 feet (5486 mm) in height, shall be protected in accordance with Table 3404.3.6.3(4), and the storage heights and arrangements shall be limited to those specified in Table 3404.3.6.3(2).
3. Storage on racks greater than 4 feet 6 inches (1372 mm) in height, or where the ceiling exceeds 18 feet (5486 mm) in height shall be protected in accordance with Tables 3404.3.6.3(5), 3404.3.6.3(6), and 3404.3.6.3(7) as appropriate, and the storage heights and arrangements shall be limited to those specified in Table 3404.3.6.3(3).

Combustible commodities shall not be stored above flammable and combustible liquids.

3404.3.6.4 Warning for containers. All cans, containers and vessels containing flammable liquids or flammable liquid compounds or mixtures offered for sale shall be provided with a warning indicator, painted or printed on the container and stating that the liquid is flammable, and shall be kept away from heat and an open flame.

3404.3.6.5 Storage plan. When required by fire the code official, aisle and storage plans shall be submitted in accordance with Chapter 27.

3404.3.7 Liquid storage rooms. Liquid storage rooms shall comply with Sections 3404.3.7.1 through 3404.3.7.5.2.

3404.3.7.1 General. Quantities of liquids exceeding those set forth in Section 3404.3.4.1 for storage in control areas shall be stored in a liquid storage room complying with this section and constructed and separated as required by the *International Building Code*.

3404.3.7.2 Quantities and arrangement of storage. The quantity limits and storage arrangements in liquid storage rooms shall be in accordance with Tables 3404.3.6.3(2) and 3404.3.6.3(3) and Sections 3404.3.7.2.1 through 3404.3.7.2.3.

3404.3.7.2.1 Mixed storage. Where two or more classes of liquids are stored in a pile or rack section:

1. The quantity in that pile or rack shall not exceed the smallest of the maximum quantities for the classes of liquids stored in accordance with Table 3404.3.6.3(2) or 3404.3.6.3(3); and

TABLE 3404.3.6.3(1)
MAXIMUM STORAGE HEIGHT IN CONTROL AREA

TYPE OF LIQUID	NONSPRINKLERED AREA (feet)	SPRINKLERED AREA (feet)	SPRINKLERED[a] WITH IN-RACK PROTECTION (feet)
Flammable liquids:			
Class IA	4	4	4
Class IB	4	8	12
Class IC	4	8	12
Combustible liquids:			
Class II	6	8	12
Class IIIA	8	12	16
Class IIIB	8	12	20

For SI: 1 foot = 304.8 mm.

a. In-rack protection shall be in accordance with Table 3404.3.6.3(5), 3404.3.6.3(6) or 3404.3.6.3(7).

TABLE 3404.3.6.3(2)
STORAGE ARRANGEMENTS FOR PALLETIZED OR SOLID-PILE STORAGE IN LIQUID STORAGE ROOMS AND WAREHOUSES

CLASS	STORAGE LEVEL	MAXIMUM STORAGE HEIGHT			MAXIMUM QUANTITY PER PILE (gallons)		MAXIMUM QUANTITY PER ROOM[a] (gallons)	
		Drums	Containers[b] (feet)	Portable tanks (feet)	Containers	Portable tanks	Containers	Portable tanks
IA	Ground floor	1	5	Not Allowed	3,000	Not Allowed	12,000	Not Allowed
	Upper floors	1	5	Not Allowed	2,000	Not Allowed	8,000	Not Allowed
	Basements	0	Not Allowed	Not Allowed	Not Allowed	Not Allowed	Not Allowed	Not Allowed
IB	Ground floor	1	6.5	7	5,000	20,000	15,000	40,000
	Upper floors	1	6.5	7	3,000	10,000	12,000	20,000
	Basements	0	Not Allowed	Not Allowed	Not Allowed	Not Allowed	Not Allowed	Not Allowed
IC	Ground floor[d]	1	6.5[c]	7	5,000	20,000	15,000	40,000
	Upper floors	1	6.5[c]	7	3,000	10,000	12,000	20,000
	Basements	0	Not Allowed	Not Allowed	Not Allowed	Not Allowed	Not Allowed	Not Allowed
II	Ground floor[d]	3	10	14	10,000	40,000	25,000	80,000
	Upper floors	3	10	14	10,000	40,000	25,000	80,000
	Basements	1	5	7	7,500	20,000	7,500	20,000
III	Ground floor	5	20	14	15,000	60,000	50,000	100,000
	Upper floors	5	20	14	15,000	60,000	50,000	100,000
	Basements	3	10	7	10,000	20,000	25,000	40,000

For SI: 1 foot = 304.8 mm, 1 gallon = 3.785 L.

a. See Section 3404.3.8.1 for unlimited quantities in liquid storage warehouses.

b. Storage heights are allowed to be increased for Class IB, IC, II and III liquids in metal containers having a capacity of 5 gallons or less where an automatic AFFF-water protection system is provided in accordance with Table 3404.3.7.5.1.

c. These height limitations are allowed to be increased to 10 feet for containers having a capacity of 5 gallons or less.

d. For palletized storage of unsaturated polyester resins (UPR) in relieving-style metal containers with 50 percent or less by weight Class IC or II liquid and no Class IA or IB liquid, height and pile quantity limits shall be permitted to be 10 feet and 15,000 gallons, respectively, provided that such storage is protected by sprinklers in accordance with NFPA 30 and that the UPR storage area is not located in the same containment area or drainage path for other Class I or II liquids.

2. The height of storage in that pile or rack shall not exceed the smallest of the maximum heights for the classes of liquids stored in accordance with Table 3404.3.6.3(2) or 3404.3.6.3(3).

3404.3.7.2.2 Separation and aisles. Piles shall be separated from each other by at least 4-foot (1219 mm) aisles. Aisles shall be provided so that all containers are 20 feet (6096 mm) or less from an aisle. Where the storage of liquids is on racks, a minimum 4-foot-wide (1219 mm) aisle shall be provided between adjacent rows of racks and adjacent storage of liquids. Main aisles shall be a minimum of 8 feet (2438 mm) wide.

Additional aisles shall be provided for access to doors, required windows and ventilation openings, standpipe connections, mechanical equipment and switches. Such aisles shall be at least 3 feet (914 mm) in width, unless greater widths are required for separation of piles or racks, in which case the greater width shall be provided.

3404.3.7.2.3 Stabilizing and supports. Containers and piles shall be separated by pallets or dunnage to provide stability and to prevent excessive stress to container walls. Portable tanks stored over one tier shall be designed to nest securely without dunnage.

Requirements for portable tank design shall be in accordance with Chapter 6 of NFPA 30. Shelving, racks, dunnage, scuffboards, floor overlay and similar installations shall be of noncombustible construction or of wood not less than a 1-inch (25 mm) nominal thickness. Adequate material-handling equipment shall be available to handle tanks safely at upper tier levels.

3404.3.7.3 Spill control and secondary containment. Liquid storage rooms shall be provided with spill control and secondary containment in accordance with Section 2704.2.

3404.3.7.4 Ventilation. Liquid storage rooms shall be ventilated in accordance with Section 2704.3.

3404.3.7.5 Fire protection. Fire protection for liquid storage rooms shall comply with Sections 3404.3.7.5.1 and 3404.3.7.5.2.

3404.3.7.5.1 Fire-extinguishing systems. Liquid storage rooms shall be protected by automatic sprinkler systems installed in accordance with Chapter 9 and Tables 3404.3.6.3(4) through 3404.3.6.3(7) and Table 3404.3.7.5.1. In-rack sprinklers shall also comply with NFPA 13.

Automatic foam-water systems and automatic aqueous film-forming foam (AFFF) water sprinkler systems shall not be used except when approved.

Protection criteria developed from fire modeling or full-scale fire testing conducted at an approved testing laboratory are allowed in lieu of the protection as shown in Tables 3404.3.6.3(2) through 3404.3.6.3(7) and Table 3404.3.7.5.1 when approved.

3404.3.7.5.2 Portable fire extinguishers. A minimum of one approved portable fire extinguisher complying with Section 906 and having a rating of not less than 20-B shall be located not less than 10 feet (3048 mm) or more than 50 feet (15 240 mm) from any Class I or II liquid storage area located outside of a liquid storage room.

A minimum of one portable fire extinguisher having a rating of not less than 20-B shall be located outside of, but not more than 10 feet (3048 mm) from, the door opening into a liquid storage room.

TABLE 3404.3.6.3(3)
STORAGE ARRANGEMENTS FOR RACK STORAGE IN LIQUID STORAGE ROOMS AND WAREHOUSES

CLASS	TYPE RACK	STORAGE LEVEL	MAXIMUM STORAGE HEIGHT (feet)	MAXIMUM QUANTITY PER ROOM[a] (gallons)
			Containers	Containers
IA	Double row or Single row	Ground floor Upper floors Basements	25 15 Not Allowed	7,500 4,500 Not Allowed
IB IC	Double row or Single row	Ground floor Upper floors Basements	25 15 Not Allowed	15,000 9,000 Not Allowed
II	Double row or Single row	Ground floor Upper floors Basements	25 25 15	24,000 24,000 9,000
III	Multirow Double row Single row	Ground floor Upper floors Basements	40 20 20	48,000 48,000 24,000

For SI: 1 foot = 304.8 mm, 1 gallon = 3.785 L.
a. See Section 3404.3.8.1 for unlimited quantities in liquid storage warehouses.

TABLE 3404.3.6.3(4)
AUTOMATIC SPRINKLER PROTECTION FOR SOLID-PILE AND PALLETIZED STORAGE OF LIQUIDS IN CONTAINERS AND PORTABLE TANKS[a]

STORAGE CONDITIONS		CEILING SPRINKLER DESIGN AND DEMAND					
			Area (square feet)				
Class liquid	Container size and arrangement	Density (gpm/ft^2)	High-temperature sprinklers	Ordinary temperature sprinklers	Maximum spacing (square feet)	MINIMUM HOSE STREAM DEMAND (gpm)	MINIMUM DURATION SPRINKLERS AND HOSE STREAMS (hours)
IA	5 gallons or less, with or without cartons, palletized or solid pile[b]	0.30	3,000	5,000	100	750	2
	Containers greater than 5 gallons, on end or side, palletized or solid pile	0.60	5,000	8,000	80	750	
IB, IC and II	5 gallons or less, with or without cartons, palletized or solid pile[b]	0.30	3,000	5,000	100	500	2
	Containers greater than 5 gallons on pallets or solid pile, one high	0.25	5,000	8,000	100		
II	Containers greater than 5 gallons on pallets or solid pile, more than one high, on end or side	0.60	5,000	8,000	80	750	2
IB, IC and II	Portable tanks, one high	0.30	3,000	5,000	100	500	2
II	Portable tanks, two high	0.60	5,000	8,000	80	750	2
III	5 gallons or less, with or without cartons, palletized or solid pile	0.25	3,000	5,000	120	500	1
	Containers greater than 5 gallons on pallets or solid pile, on end or sides, up to three high	0.25	3,000	5,000	120	500	1
III	Containers greater than 5 gallons, on pallets or solid pile, on end or sides, up to 18 feet high	0.35	3,000	5,000	100	750	2
	Portable tanks, one high	0.25	3,000	5,000	120	500	1
	Portable tanks, two high	0.50	3,000	5,000	80	750	2

For SI: 1 foot = 304.8 mm, 1 gallon = 3.785 L, 1 square foot = 0.0929 m^2, 1 gallon per minute = 3.785 L/m, 1 gallon per minute per square foot = 40.75 $L/min/m^2$.

a. The design area contemplates the use of Class II standpipe systems. Where Class I standpipe systems are used, the area of application shall be increased by 30 percent without revising density.

b. For storage heights above 4 feet or ceiling heights greater than 18 feet, an approved engineering design shall be provided in accordance with Section 104.7.2.

TABLE 3404.3.6.3(5)
AUTOMATIC SPRINKLER PROTECTION REQUIREMENTS FOR RACK STORAGE OF LIQUIDS IN CONTAINERS OF 5-GALLON CAPACITY OR LESS WITH OR WITHOUT CARTONS ON CONVENTIONAL WOOD PALLETS[a]

CLASS LIQUID	CEILING SPRINKLER DESIGN AND DEMAND			IN-RACK SPRINKLER ARRANGEMENT AND DEMAND					MINIMUM HOSE STREAM DEMAND (gpm)	MINIMUM DURATION SPRINKLER AND HOSE STREAM (hours)
	Density (gpm/ft²)	Area (square feet)		Maximum spacing	Racks up to 9 feet deep	Racks more than 9 feet to 12 feet deep	30 psi (standard orifice)	Number of sprinklers operating		
		High-temperature sprinklers	Ordinary temperature sprinklers				14 psi (large orifice)			
I (maximum 25-foot height) Option 1	0.40	3,000	5,000	80 ft²/head	1. Ordinary temperature, quick-response sprinklers, maximum 8 feet 3 inches horizontal spacing 2. One line sprinklers above each level of storage 3. Locate in longitudinal flue space, staggered vertical 4. Shields required where multi-level	1. Ordinary temperature, quick-response sprinklers, maximum 8 feet 3 inches horizontal spacing 2. One line sprinklers above each level of storage 3. Locate in transverse flue spaces, staggered vertical and within 20 inches of aisle 4. Shields required where multilevel	30 psi (0.5-inch orifice)	1. Eight sprinklers if only one level 2. Six sprinklers each on two levels if only two levels 3. Six sprinklers each on top three levels, if three or more levels 4. Hydraulically most remote	750	2
I (maximum 25-foot height) Option 2	0.55	2,000[b]	Not Applicable	100 ft²/head	1. Ordinary temperature, quick-response sprinklers, maximum 8 feet 3 inches horizontal spacing 2. See 2 above 3. See 3 above 4. See 4 above	1. Ordinary temperature, quick-response sprinklers, maximum 8 feet 3 inches horizontal spacing 2. See 2 above 3. See 3 above 4. See 4 above	14 psi (0.53-inch orifice)	See 1 through 4 above	500	2
I and II (maximum 14-foot storage height) (maximum three tiers)	0.55[c]	2,000[b, d]	Not Applicable	100 ft²/head	Not Applicable None for maximum 6-foot-deep racks	Not Applicable	Not Applicable	Not Applicable	500	2
II (maximum 25-foot height)	0.30	3,000	5,000	100 ft²/head	1. Ordinary temperature sprinklers 8 feet apart horizontally 2. One line sprinklers between levels at nearest 10-foot vertical intervals 3. Locate in longitudinal flue space, staggered vertical 4 Shields required where multi-level	1. Ordinary temperature sprinklers 8 feet apart horizontally 2. Two lines between levels at nearest 10-foot vertical intervals 3. Locate in transverse flue spaces, staggered vertical and within 20 inches of aisle 4. Shields required where multilevel	30 psi	Hydraulically most remote—six sprinklers at each level, up to a maximum of three levels	750	2
III (40-foot height)	0.25	3,000	5,000	120 ft²/head	Same as for Class II liquids	Same as for Class II liquids	30 psi	Same as for Class II liquids	500	2

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 square foot = 0.0929 m², 1 pound per square inch = 6.895 kPa, 1 gallon = 3.785 L, 1 gallon per minute = 3.785 L/m, 1 gallon per minute per square foot = 40.75 L/min/m².

a. The design area contemplates the use of Class II standpipe systems. Where Class I standpipe systems are used, the area of application shall be increased by 30 percent without revising density.

b. Using listed or approved extra-large orifices, high-temperature quick-response or standard element sprinklers under a maximum 30-foot ceiling with minimum 7.5-foot aisles.

c. For friction lid cans and other metal containers equipped with plastic nozzles or caps, the density shall be increased to 0.65 gpm per square foot using listed or approved extra-large orifice, high-temperature quick-response sprinklers.

d. Using listed or approved extra-large orifice, high-temperature quick-response or standard element sprinklers under a maximum 18-foot ceiling with minimum 7.5-foot aisles and metal containers.

TABLE 3404.3.6.3(6)
AUTOMATIC SPRINKLER PROTECTION REQUIREMENTS FOR RACK STORAGE OF LIQUIDS IN CONTAINERS GREATER THAN 5-GALLON CAPACITY[a]

CLASS LIQUID	CEILING SPRINKLER DESIGN AND DEMAND			IN-RACK SPRINKLER ARRANGEMENT AND DEMAND					MINIMUM HOSE STREAM DEMAND (gpm)	MINIMUM DURATION SPRINKLER AND HOSE STREAM (hours)
	Density (gpm/ ft^2)	Area (square feet)		Maximum spacing	On-side storage racks up to 9-foot-deep racks	On-end storage (on pallets) up to 9-foot-deep racks	Minimum nozzle pressure	Number of sprinklers operating		
		High-temperature sprinklers	Ordinary temperature sprinklers							
IA (maximum 25-foot height)	0.60	3,000	5,000	80 ft^2/head	1. Ordinary temperature sprinklers 8 feet apart horizontally 2. One line sprinklers above each tier of storage 3. Locate in longitudinal flue space, staggered vertical 4. Shields required where multilevel	1. Ordinary temperature sprinklers 8 feet apart horizontally 2. One line sprinklers above each tier of storage 3. Locate in longitudinal flue space, staggered vertical 4. Shields required where multilevel	30 psi	Hydraulically most remote—six sprinklers at each level	1,000	2
IB, IC and II (maximum 25-foot height)	0.60	3,000	5,000	100 ft^2/head	1. See 1 above 2. One line sprinklers every three tiers of storage 3. See 3 above 4. See 4 above	1. See 1 above 2. See 2 above 3. See 3 above 4. See 4 above	30 psi	Hydraulically most remote—six sprinklers at each level	750	2
III (maximum 40-foot height)	0.25	3,000	5,000	120 ft^2/head	1. See 1 above 2. One line sprinklers every sixth level (maximum) 3. See 3 above 4. See 4 above	1. See 1 above 2. One line sprinklers every third level (maximum) 3. See 3 above 4. See 4 above	15 psi	Hydraulically most remote—six sprinklers at each level	500	1

For SI: 1 foot = 304.8 mm, 1 square foot = 0.0929 m^2, 1 pound per square inch = 6.895 kPa, 1 gallon = 3.785 L, 1 gallon per minute = 3.785 L/m, 1 gallon per minute per square foot = 40.75 L/min/m^2.

a. The design assumes the use of Class II standpipe systems. Where a Class I standpipe system is used, the area of application shall be increased by 30 percent without revising density.

TABLE 3404.3.6.3(7)
AUTOMATIC AFFF WATER PROTECTION REQUIREMENTS FOR RACK STORAGE OF LIQUIDS IN CONTAINERS GREATER THAN 5-GALLON CAPACITY[a,b]

CLASS LIQUID	CEILING SPRINKLER DESIGN AND DEMAND			IN-RACK SPRINKLER ARRANGEMENT AND DEMAND[c]				DURATION AFFF SUPPLY (minimum)	DURATION WATER SUPPLY (hours)
	Density (gpm/ft^2)	Area (square feet)		On-end storage of drums on pallets, up to 25 feet	Minimum nozzle pressure (psi)	Number of sprinklers operating	Hose stream demand[d] (gpm)		
		High-temperature sprinklers	Ordinary temperature sprinklers						
IA, IB, IC and II	0.30	1,500	2,500	1. Ordinary temperature sprinkler up to 10 feet apart horizontally 2. One line sprinklers above each level of storage 3. Locate in longitudinal flue space, staggered vertically 4. Shields required for multilevel	30	Three sprinklers per level	500	15	2

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 square foot = 0.0929 m^2, 1 pound per square inch = 6.895 kPa, 1 gallon = 3.785 L, 1 gallon per minute = 3.785 L/m, 1 gallon per minute per square foot = 40.75 $L/min/m^2$.

a. System shall be a closed-head wet system with approved devices for proportioning aqueous film-forming foam.

b. Except as modified herein, in-rack sprinklers shall be installed in accordance with NFPA 13.

c. The height of storage shall not exceed 25 feet.

d. Hose stream demand includes $1^1/_2$-inch inside hand hose, when required.

TABLE 3404.3.6.3(8)
AUTOMATIC SPRINKLER PROTECTION REQUIREMENTS FOR CLASS I LIQUID STORAGE OF 1-GALLON CAPACITY OR LESS WITH UNCARTONED OR CASE-CUT SHELF DISPLAY UP TO 6.5 FEET, AND PALLETIZED STORAGE ABOVE IN A DOUBLE-ROW RACK ARRAY[a]

STORAGE HEIGHT	CEILING SPRINKLER DESIGN AND DEMAND				IN-RACK SPRINKLER ARRANGEMENT AND DEMAND				MINIMUM HOSE STREAM DEMAND (gpm)	MINIMUM DURATION SPRINKLERS AND HOSE STREAM (hours)
	Density (gpm/ft^2)	Area (square feet)		Maximum spacing	Racks up to 9 feet deep	Racks 9 to 12 feet	Minimum nozzle pressure	Number of sprinklers operating		
		High temperature	Ordinary temperature							
Maximum 20-foot storage height	0.60	2,000[b]	Not Applicable	100 ft^2/head	1. Ordinary temperature, quick-response sprinklers, maximum 8 feet 3 inches horizontal spacing 2. One line of sprinklers at the 6-foot level and the 11.5-foot level of storage 3. Locate in longitudinal flue space, staggered vertical 4. Shields required where multilevel	Not Applicable	30 psi (standard orifice) or 14 psi (large orifice)	1. Six sprinklers each on two levels 2. Hydraulically most remote 12 sprinklers	500	2

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 square foot = 0.0929 m^2, 1 pound per square inch = 6.895 kPa, 1 gallon = 3.785 L, 1 gallon per minute = 3.785 L/m, 1 gallon per minute per square foot = 40.75 $L/min/m^2$.

a. This table shall not apply to racks with solid shelves.

b. Using extra-large orifice sprinklers under a ceiling 30 feet or less in height. Minimum aisle width is 7.5 feet.

TABLE 3404.3.7.5.1
AUTOMATIC AFFF-WATER PROTECTION REQUIREMENTS FOR SOLID-PILE AND PALLETIZED STORAGE OF LIQUIDS IN METAL CONTAINERS OF 5-GALLON CAPACITY OR LESS[a,b]

PACKAGE TYPE	CLASS LIQUID	CEILING SPRINKLER DESIGN AND DEMAND					STORAGE HEIGHT (feet)	HOSE DEMAND (gpm)[c]	DURATION AFFF SUPPLY (minimum)	DURATION WATER SUPPLY (hours)
		Density (gpm/ft^2)	Area (square feet)	Temperature rating	Maximum spacing	Orifice size (inch)				
Cartoned	IB, IC, II and III	0.40	2,000	286°F	100 ft^2/head	0.531	11	500	15	2
Uncartoned	IB, IC, II and III	0.30	2,000	286°F	100 ft^2/head	0.5 or 0.531	12	500	15	2

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 square foot = 0.0929 m^2, 1 gallon per minute = 3.785 L/m, 1 gallon per minute per square foot = 40.75 L/min/m^2, °C. = [(°F)-32]/1.8.

a. System shall be a closed-head wet system with approved devices for proportioning aqueous film-forming foam.

b. Maximum ceiling height of 30 feet.

c. Hose stream demand includes $1^1/_2$-inch inside hand hose, when required.

3404.3.8 Liquid storage warehouses. Buildings used for storage of flammable or combustible liquids in quantities exceeding those set forth in Section 3404.3.4 for control areas and Section 3404.3.7 for liquid storage rooms shall comply with Sections 3404.3.8.1 through 3404.3.8.5 and shall be constructed and separated as required by the *International Building Code*.

3404.3.8.1 Quantities and storage arrangement. The total quantities of liquids in a liquid storage warehouse shall not be limited. The arrangement of storage shall be in accordance with Table 3404.3.6.3(2) or 3404.3.6.3(3).

3404.3.8.1.1 Mixed storage. Mixed storage shall be in accordance with Section 3404.3.7.2.1.

3404.3.8.1.2 Separation and aisles. Separation and aisles shall be in accordance with Section 3404.3.7.2.2.

3404.3.8.2 Spill control and secondary containment. Liquid storage warehouses shall be provided with spill control and secondary containment as set forth in Section 2704.2.

3404.3.8.3 Ventilation. Liquid storage warehouses storing containers greater than 5 gallons (19 L) in capacity shall be ventilated at a rate of not less than 0.25 cfm/sq. ft. (0.075 m^3/min per m^2) of floor area over the storage area.

3404.3.8.4 Fire-extinguishing systems. Liquid storage warehouses shall be protected by automatic sprinkler systems installed in accordance with Chapter 9 and Tables 3404.3.6.3(4) through 3404.3.6.3(7) and Table 3404.3.7.5.1, or Section 4.8.2 and Tables 4.8.2(a) through (f) of NFPA 30. In-rack sprinklers shall also comply with NFPA 13.

Automatic foam-water systems and automatic AFFF water sprinkler systems shall not be used except when approved.

Protection criteria developed from fire modeling or full-scale fire testing conducted at an approved testing laboratory are allowed in lieu of the protection as shown in Tables 3404.3.6.3(2) through 3404.3.6.3(7) and Table 3404.3.7.5.1 when approved.

3404.3.8.5 Warehouse hose lines. In liquid storage warehouses, either $1^1/_2$-inch (38 mm) lined or 1-inch (25 mm) hard rubber hand hose lines shall be provided in sufficient number to reach all liquid storage areas and shall be in accordance with Section 903 or Section 905.

3404.4 Outdoor storage of containers and portable tanks. Storage of flammable and combustible liquids in closed containers and portable tanks outside of buildings shall be in accordance with Section 3403 and Sections 3404.4.1 through 3404.4.8. Capacity limits for containers and portable tanks shall be in accordance with Section 3404.3.

3404.4.1 Plans. Storage shall be in accordance with approved plans.

3404.4.2 Location on property. Outdoor storage of liquids in containers and portable tanks shall be in accordance with Table 3404.4.2. Storage of liquids near buildings located on the same property shall be in accordance with this section.

3404.4.2.1 Mixed liquid piles. Where two or more classes of liquids are stored in a single pile, the quantity in the pile shall not exceed the smallest of maximum quantities for the classes of material stored.

3404.4.2.2 Access. Storage of containers or portable tanks shall be provided with fire apparatus access roads in accordance with Chapter 5.

3404.4.2.3 Security. The storage area shall be protected against tampering or trespassers where necessary and shall be kept free from weeds, debris and other combustible materials not necessary to the storage.

3404.4.2.4 Storage adjacent to buildings. A maximum of 1,100 gallons (4163 L) of liquids stored in closed containers and portable tanks is allowed adjacent to a building located on the same premises and under the same management, provided that:

1. The building does not exceed one story in height. Such building shall be of fire-resistance-rated construction with noncombustible exterior surfaces or noncombustible construction and shall be used principally for the storage of liquids; or
2. The exterior building wall adjacent to the storage area shall have a fire-resistance rating of not less

than 2 hours, having no openings to above-grade areas within 10 feet (3048 mm) horizontally of such storage and no openings to below-grade areas within 50 feet (15 240 mm) horizontally of such storage.

The quantity of liquids stored adjacent to a building protected in accordance with Item 2 is allowed to exceed 1,100 gallons (4163 L), provided that the maximum quantity per pile does not exceed 1,100 gallons (4163 L) and each pile is separated by a 10-foot-minimum (3048 mm) clear space along the common wall.

Where the quantity stored exceeds 1,100 gallons (4163 L) adjacent to a building complying with Item 1, or the provisions of Item 1 cannot be met, a minimum distance in accordance with Table 3404.4.2, column 7 ("Minimum Distance to Lot Line of Property That Can Be Built Upon") shall be maintained between buildings and the nearest container or portable tank.

3404.4.3 Spill control and secondary containment. Storage areas shall be provided with spill control and secondary containment in accordance with Section 3403.4.

Exception: Containers stored on approved containment pallets in accordance with Section 2704.2.3 and containers stored in cabinets and lockers with integral spill containment.

3404.4.4 Security. Storage areas shall be protected against tampering or trespassers by fencing or other approved control measures.

3404.4.5 Protection from vehicles. Guard posts or other means shall be provided to protect exterior storage tanks from vehicular damage. When guard posts are installed, the posts shall be installed in accordance with Section 312.

3404.4.6 Clearance from combustibles. The storage area shall be kept free from weeds, debris and combustible materials not necessary to the storage. The area surrounding an exterior storage area shall be kept clear of such materials for a minimum distance of 15 feet (4572 mm).

3404.4.7 Weather protection. Weather protection for outdoor storage shall be in accordance with Section 2704.13.

3404.4.8 Empty containers and tank storage. The storage of empty tanks and containers previously used for the storage of flammable or combustible liquids, unless free from explosive vapors, shall be stored as required for filled containers and tanks. Tanks and containers when emptied shall have the covers or plugs immediately replaced in openings.

SECTION 3405
DISPENSING, USE, MIXING AND HANDLING

3405.1 Scope. Dispensing, use, mixing and handling of flammable liquids shall be in accordance with Section 3403 and this section. Tank vehicle and tank car loading and unloading and other special operations shall be in accordance with Section 3406.

Exception: Containers of organic coatings having no fire point and which are opened for pigmentation are not required to comply with this section.

3405.2 Liquid transfer. Liquid transfer equipment and methods for transfer of Class I, II and IIIA liquids shall be approved and be in accordance with Sections 3405.2.1 through 3405.2.6.

3405.2.1 Pumps. Positive-displacement pumps shall be provided with pressure relief discharging back to the tank, pump suction or other approved location, or shall be provided with interlocks to prevent over-pressure.

3405.2.2 Pressured systems. Where gases are introduced to provide for transfer of Class I liquids, or Class II and III liquids transferred at temperatures at or above their flash points by pressure, only inert gases shall be used. Controls, including pressure relief devices, shall be provided to limit the pressure so that the maximum working pressure of tanks, containers and piping systems cannot be exceeded. Where devices operating through pressure within a tank or container are used, the tank or container shall be a pressure vessel approved for the intended use. Air or oxygen shall not be used for pressurization.

Exception: Air transfer of Class II and III liquids at temperatures below their flash points.

TABLE 3404.4.2
OUTDOOR LIQUID STORAGE IN CONTAINERS AND PORTABLE TANKS

CLASS OF LIQUID	CONTAINER STORAGE—MAXIMUM PER PILE		PORTABLE TANK STORAGE—MAXIMUM PER PILE		MINIMUM DISTANCE BETWEEN PILES OR RACKS (feet)	MINIMUM DISTANCE TO LOT LINE OF PROPERTY THAT CAN BE BUILT UPON[c,d] (feet)	MINIMUM DISTANCE TO PUBLIC STREET, PUBLIC ALLEY OR PUBLIC WAY[d] (feet)
	Quantity[a,b] (gallons)	Height (feet)	Quantity[a,b] (gallons)	Height (feet)			
IA	1,100	10	2,200	7	5	50	10
IB	2,200	12	4,400	14	5	50	10
IC	4,400	12	8,800	14	5	50	10
II	8,800	12	17,600	14	5	25	5
III	22,000	18	44,000	14	5	10	5

For SI: 1 foot = 304.8 mm, 1 gallon 3.785 L.

a. For mixed class storage, see Section 3404.4.2.

b. For storage in racks, the quantity limits per pile do not apply, but the rack arrangement shall be limited to a maximum of 50 feet in length and two rows or 9 feet in depth.

c. If protection by a public fire department or private fire brigade capable of providing cooling water streams is not available, the distance shall be doubled.

d. When the total quantity stored does not exceed 50 percent of the maximum allowed per pile, the distances are allowed to be reduced 50 percent, but not less than 3 feet.

3405.2.3 Piping, hoses and valves. Piping, hoses and valves used in liquid transfer operations shall be approved or listed for the intended use.

3405.2.4 Class I, II and III liquids. Class I and II liquids or Class III liquids that are heated up to or above their flash points shall be transferred by one of the following methods:

Exception: Liquids in containers not exceeding a 5.3-gallon (20 L) capacity.

1. From safety cans complying with UL 30.
2. Through an approved closed piping system.
3. From containers or tanks by an approved pump taking suction through an opening in the top of the container or tank.
4. For Class IB, IC, II and III liquids, from containers or tanks by gravity through an approved self-closing or automatic-closing valve when the container or tank and dispensing operations are provided with spill control and secondary containment in accordance with Section 3403.4. Class IA liquids shall not be dispensed by gravity from tanks.
5. Approved engineered liquid transfer systems.

3405.2.5 Manual container filling operations for Class I liquids. Class I liquids and Class II or III liquids heated to or above their flash points shall not be transferred into containers unless the nozzle and containers are electrically interconnected. Acceptable methods of electrical interconnection include:

1. Metallic floor plates on which containers stand while filling, when such floor plates are electrically connected to the fill stem; or
2. Where the fill stem is bonded to the container during filling by means of a bond wire.

3405.2.6 Automatic container-filling operations for Class I liquids. Container-filling operations for Class I liquids involving conveyor belts or other automatic-feeding operations shall be designed to prevent static accumulations.

3405.3 Use, dispensing and mixing inside of buildings. Indoor use, dispensing and mixing of flammable and combustible liquids shall be in accordance with Sections 3405.2 and 3405.3.1 through 3405.3.5.3.

3405.3.1 Closure of mixing or blending vessels. Vessels used for mixing or blending of Class I liquids and Class II or III liquids heated up to or above their flash points shall be provided with self-closing, tight-fitting, noncombustible lids that will control a fire within such vessel.

Exception: Where such devices are impractical, approved automatic or manually controlled fire-extinguishing devices shall be provided.

3405.3.2 Bonding of vessels. Where differences of potential could be created, vessels containing Class I liquids or liquids handled at or above their flash points shall be electrically connected by bond wires, ground cables, piping or similar means to a static grounding system to maintain equipment at the same electrical potential to prevent sparking.

3405.3.3 Heating, lighting and cooking appliances. Heating, lighting and cooking appliances which utilize Class I liquids shall not be operated within a building or structure.

Exception: Operation in single-family dwellings.

3405.3.4 Location of processing vessels. Processing vessels shall be located with respect to distances to lot lines of adjoining property which can be built on, in accordance with Tables 3405.3.4(1) and 3405.3.4(2).

Exception: Where the exterior wall facing the adjoining lot line is a blank wall having a fire-resistance rating of not less than 4 hours, the fire code official is authorized to modify the distances. The distance shall not be less than that set forth in the *International Building Code*, and when Class IA or unstable liquids are involved, explosion control shall be provided in accordance with Section 911.

3405.3.5 Quantity limits for use. Liquid use quantity limitations shall comply with Sections 3405.3.5.1 through 3405.3.5.3.

3405.3.5.1 Maximum allowable quantity per control area. Indoor use, dispensing and mixing of flammable and combustible liquids shall not exceed the maximum allowable quantity per control area indicated in Table 2703.1.1(1) and shall not exceed the additional limitations set forth in Section 3405.3.5.

Exception: Cleaning with Class I, II and IIIA liquids shall be in accordance with Section 3405.3.6.

Use of hazardous production material flammable and combustible liquids in Group H-5 occupancies shall be in accordance with Chapter 18.

3405.3.5.2 Occupancy quantity limits. The following limits for quantities of flammable and combustible liquids used, dispensed or mixed based on occupancy classification shall not be exceeded.

Exception: Cleaning with Class I, II, or IIIA liquids shall be in accordance with Section 3405.3.6.

1. Group A occupancies: Quantities in Group A occupancies shall not exceed that necessary for demonstration, treatment, laboratory work, maintenance purposes and operation of equipment, and shall not exceed quantities set forth in Table 2703.1.1(1).
2. Group B occupancies: Quantities in drinking, dining, office and school uses within Group B occupancies shall not exceed that necessary for demonstration, treatment, laboratory work, maintenance purposes and operation of equipment, and shall not exceed quantities set forth in Table 2703.1.1(1).

TABLE 3405.3.4(1)
SEPARATION OF PROCESSING VESSELS FROM LOT LINES

PROCESSING VESSELS WITH EMERGENCY RELIEF VENTING	LOCATION[a]	
	Stable liquids	Unstable liquids
Not in excess of 2.5 psig	Table 3405.3.4(2)	2.5 times Table 3405.3.4(2)
Over 2.5 psig	1.5 times Table 3405.3.4(2)	4 times Table 3405.3.4(2)

For SI: 1 pound per square inch gauge = 6.895 kPa.

a. Where protection of exposures by a public fire department or private fire brigade capable of providing cooling water streams on structures is not provided, distances shall be doubled.

TABLE 3405.3.4(2)
REFERENCE TABLE FOR USE WITH TABLE 3405.3.4(1)

TANK CAPACITY (gallons)	MINIMUM DISTANCE FROM LOT LINE OF A LOT WHICH IS OR CAN BE BUILT UPON, INCLUDING THE OPPOSITE SIDE OF A PUBLIC WAY (feet)	MINIMUM DISTANCE FROM NEAREST SIDE OF ANY PUBLIC WAY OR FROM NEAREST IMPORTANT BUILDING ON THE SAME PROPERTY (feet)
275 or less	5	5
276 to 750	10	5
751 to 12,000	15	5
12,001 to 30,000	20	5
30,001 to 50,000	30	10
50,001 to 100,000	50	15
100,001 to 500,000	80	25
500,001 to 1,000,000	100	35
1,000,001 to 2,000,000	135	45
2,000,001 to 3,000,000	165	55
3,000,001 or more	175	60

For SI: 1 foot = 304.8 mm, 1 gallon = 3.785 L.

3. Group E occupancies: Quantities in Group E occupancies shall not exceed that necessary for demonstration, treatment, laboratory work, maintenance purposes and operation of equipment and shall not exceed quantities set forth in Table 2703.1.1(1).

4. Group F occupancies: Quantities in dining, office and school uses within Group F occupancies shall not exceed that necessary for demonstration, laboratory work, maintenance purposes and operation of equipment, and shall not exceed quantities set forth in Table 2703.1.1(1).

5. Group I occupancies: Quantities in Group I occupancies shall not exceed that necessary for demonstration, laboratory work, maintenance purposes and operation of equipment, and shall not exceed quantities set forth in Table 2703.1.1(1).

6. Group M occupancies: Quantities in dining, office and school uses within Group M occupancies shall not exceed that necessary for demonstration, laboratory work, maintenance purposes and operation of equipment, and shall not exceed quantities set forth in Table 2703.1.1(1).

7. Group R occupancies: Quantities in Group R occupancies shall not exceed that necessary for maintenance purposes and operation of equipment, and shall not exceed quantities set forth in Table 2703.1.1(1).

8. Group S occupancies: Quantities in dining and office uses within Group S occupancies shall not exceed that necessary for demonstration, laboratory work, maintenance purposes and operation of equipment and shall not exceed quantities set forth in Table 2703.1.1(1).

3405.3.5.3 Quantities exceeding limits for control areas. Quantities exceeding the maximum allowable quantity per control area indicated in Sections 3405.3.5.1 and 3405.3.5.2 shall be in accordance with the following:

1. For open systems, indoor use, dispensing and mixing of flammable and combustible liquids shall be within a room or building complying with the *International Building Code* and Sections 3405.3.7.1 through 3405.3.7.5.

2. For closed systems, indoor use, dispensing and mixing of flammable and combustible liquids shall be within a room or building complying with

the *International Building Code* and Sections 3405.3.7 through 3405.3.7.4 and 3405.3.7.6.

3405.3.6 Cleaning with flammable and combustible liquids. Cleaning with Class I, II and IIIA liquids shall be in accordance with this section.

Exceptions:

1. Dry cleaning shall be in accordance with Chapter 12.
2. Spray-nozzle cleaning shall be in accordance with Section 1503.3.5.

3405.3.6.1 Cleaning operations. Class IA liquids shall not be used for cleaning. Cleaning with Class IB, IC or II liquids shall be conducted as follows:

1. In a room or building in accordance with Section 3405.3.7; or
2. In a machine listed and approved for the purpose in accordance with Section 3405.3.6.2.

   Exception: Materials used in commercial and industrial process-related cleaning operations in accordance with other provisions of this code and not involving facilities maintenance cleaning operations.

3405.3.6.2 Listed and approved machines. Parts cleaning and degreasing conducted in listed and approved machines in accordance with Section 3405.3.6.1 shall be in accordance with Sections 3405.3.6.2.1 through 3405.3.6.2.7.

3405.3.6.2.1 Solvents. Solvents shall be classified and shall be compatible with the machines within which they are used.

3405.3.6.2.2 Machine capacities. The quantity of solvent shall not exceed the listed design capacity of the machine for the solvent being used with the machine.

3405.3.6.2.3 Solvent quantity limits. Solvent quantities shall be limited as follows:

1. Machines without remote solvent reservoirs shall be limited to quantities set forth in Section 3405.3.5.
2. Machines with remote solvent reservoirs using Class I liquids shall be limited to quantities set forth in Section 3405.3.5.
3. Machines with remote solvent reservoirs using Class II liquids shall be limited to 35 gallons (132 L) per machine. The total quantities shall not exceed an aggregate of 240 gallons (908 L) per control area in buildings not equipped throughout with an approved automatic sprinkler system and an aggregate of 480 gallons (1817 L) per control area in buildings equipped throughout with an approved automatic sprinkler system in accordance with Section 903.3.1.1.
4. Machines with remote solvent reservoirs using Class IIIA liquids shall be limited to 80 gallons (303 L) per machine.

3405.3.6.2.4 Immersion soaking of parts. Work areas of machines with remote solvent reservoirs shall not be used for immersion soaking of parts.

3405.3.6.2.5 Separation. Multiple machines shall be separated from each other by a distance of not less than 30 feet (9144 mm) or by a fire barrier with a minimum 1-hour fire-resistance rating.

3405.3.6.2.6 Ventilation. Machines shall be located in areas adequately ventilated to prevent accumulation of vapors.

3405.3.6.2.7 Installation. Machines shall be installed in accordance with their listings.

3405.3.7 Rooms or buildings for quantities exceeding the maximum allowable quantity per control area. Where required by Section 3405.3.5.3 or 3405.3.6.1, rooms or buildings used for use, dispensing or mixing of flammable and combustible liquids shall be in accordance with Sections 3405.3.7.1 through 3405.3.7.6.3.

3405.3.7.1 Construction, location and fire protection. Rooms or buildings classified in accordance with the *International Building Code* as Group H-2 or H-3 occupancies based on use, dispensing or mixing of flammable or combustible liquids shall be constructed in accordance with the *International Building Code*.

3405.3.7.2 Basements. In rooms or buildings classified in accordance with the *International Building Code* as Group H-2 or H-3, dispensing or mixing of flammable or combustible liquids shall not be conducted in basements.

3405.3.7.3 Fire protection. Rooms or buildings classified in accordance with the *International Building Code* as Group H-2 or H-3 occupancies shall be equipped with an approved automatic fire-extinguishing system in accordance with Chapter 9.

3405.3.7.4 Doors. Interior doors to rooms or portions of such buildings shall be self-closing fire doors in accordance with the *International Building Code*.

3405.3.7.5 Open systems. Use, dispensing and mixing of flammable and combustible liquids in open systems shall be in accordance with Sections 3405.3.7.5.1 through 3405.3.7.5.3.

3405.3.7.5.1 Ventilation. Continuous mechanical ventilation shall be provided at a rate of not less than 1 cubic foot per minute per square foot [0.00508 $m^3/(s \times m^2)$] of floor area over the design area. Provisions shall be made for introduction of makeup air in such a manner to include all floor areas or pits where vapors can collect. Local or spot ventilation shall be provided when needed to prevent the accumulation of hazardous vapors. Ventilation system design shall comply with the *International Building Code* and *International Mechanical Code*.

Exception: Where natural ventilation can be shown to be effective for the materials used, dispensed or mixed.

3405.3.7.5.2 Explosion control. Explosion control shall be provided in accordance with Section 911.

3405.3.7.5.3 Spill control and secondary containment. Spill control shall be provided in accordance with Section 3403.4 where Class I, II or IIIA liquids are dispensed into containers exceeding a 1.3-gallon (5 L) capacity or mixed or used in open containers or systems exceeding a 5.3-gallon (20 L) capacity. Spill control and secondary containment shall be provided in accordance with Section 3403.4 when the capacity of an individual container exceeds 55 gallons (208 L) or the aggregate capacity of multiple containers or tanks exceeds 100 gallons (378.5 L).

3405.3.7.6 Closed systems. Use or mixing of flammable or combustible liquids in closed systems shall be in accordance with Sections 3405.3.7.6.1 through 3405.3.7.6.3.

3405.3.7.6.1 Ventilation. Closed systems designed to be opened as part of normal operations shall be provided with ventilation in accordance with Section 3405.3.7.5.1.

3405.3.7.6.2 Explosion control. Explosion control shall be provided when an explosive environment can occur as a result of the mixing or use process. Explosion control shall be designed in accordance with Section 911.

Exception: When process vessels are designed to contain fully the worst-case explosion anticipated within the vessel under process conditions considering the most likely failure.

3405.3.7.6.3 Spill control and secondary containment. Spill control shall be provided in accordance with Section 3403.4 when flammable or combustible liquids are dispensed into containers exceeding a 1.3-gallon (5 L) capacity or mixed or used in open containers or systems exceeding a 5.3-gallon (20 L) capacity. Spill control and secondary containment shall be provided in accordance with Section 3403.4 when the capacity of an individual container exceeds 55 gallons (208 L) or the aggregate capacity of multiple containers or tanks exceeds 1,000 gallons (3785 L).

3405.3.8 Use, dispensing and handling outside of buildings. Outside use, dispensing and handling shall be in accordance with Sections 3405.3.8.1 through 3405.3.8.3.

Dispensing of liquids into motor vehicle fuel tanks at motor fuel-dispensing facilities shall be in accordance with Chapter 22.

3405.3.8.1 Spill control and drainage control. Outside use, dispensing and handling areas shall be provided with spill control as set forth in Section 3403.4.

3405.3.8.2 Location on property. Dispensing activities which exceed the quantities set forth in Table 3405.3.8.2 shall not be conducted within 15 feet (4572 mm) of buildings or combustible materials or within 25 feet (7620 mm) of building openings, lot lines, public streets, public alleys or public ways. Dispensing activities that exceed the quantities set forth in Table 3405.3.8.2 shall not be conducted within 15 feet (4572 mm) of storage of Class I, II or III liquids unless such liquids are stored in tanks which are listed and labeled as 2-hour protected tank assemblies in accordance with UL 2085.

Exceptions:

1. The requirements shall not apply to areas where only the following are dispensed: Class III liquids; liquids that are heavier than water; water-miscible liquids; and liquids with viscosities greater than 10,000 centipoise (cp) (10 Pa · s).
2. Flammable and combustible liquid dispensing in refineries, chemical plants, process facilities, gas and crude oil production facilities and oil blending and packaging facilities, terminals and bulk plants.

TABLE 3405.3.8.2
MAXIMUM ALLOWABLE QUANTITIES FOR DISPENSING OF FLAMMABLE AND COMBUSTIBLE LIQUIDS IN OUTDOOR CONTROL AREAS[a,b]

CLASS OF LIQUID	QUANTITY (gallons)
Flammable	
Class IA	10
Class IB	15
Class IC	20
Combination Class IA, IB and IC	30[c]
Combustible	
Class II	30
Class IIIA	80
Class IIIB	3,300

For SI: 1 gallon = 3.785 L.

a. For definition of "Outdoor Control Area," see Section 2702.1.

b. The fire code official is authorized to impose special conditions regarding locations, types of containers, dispensing units, fire control measures and other factors involving fire safety.

c. Containing not more than the maximum allowable quantity per control area of each individual class.

3405.3.8.3 Location of processing vessels. Processing vessels shall be located with respect to distances to lot lines which can be built on in accordance with Table 3405.3.4(1).

Exception: In refineries and distilleries.

3405.3.8.4 Weather protection. Weather protection for outdoor use shall be in accordance with Section 2705.3.9.

3405.4 Solvent distillation units. Solvent distillation units shall comply with Sections 3405.4.1 through 3405.4.9.

3405.4.1 Unit with a capacity of 60 gallons or less. Solvent distillation units used to recycle Class I, II or IIIA liquids having a distillation chamber capacity of 60 gallons (227 L) or less shall be listed, labeled and installed in accordance with Section 3405.4 and UL 2208.

Exceptions:

1. Solvent distillation units installed in dry cleaning plants in accordance with Chapter 12.

2. Solvent distillation units used in continuous through-put industrial processes where the source of heat is remotely supplied using steam, hot water, oil or other heat transfer fluids, the temperature of which is below the auto-ignition point of the solvent.
3. Solvent distillation units listed for and used in laboratories.
4. Approved research, testing and experimental processes.

3405.4.2 Units with a capacity exceeding 60 gallons. Solvent distillation units used to recycle Class I, II or IIIA liquids, having a distillation chamber capacity exceeding 60 gallons (227 L) shall be used in locations that comply with the use and mixing requirements of Section 3405 and other applicable provisions in this chapter.

3405.4.3 Prohibited processing. Class I, II and IIIA liquids also classified as unstable (reactive) shall not be processed in solvent distillation units.

Exception: Appliances listed for the distillation of unstable (reactive) solvents.

3405.4.4 Labeling. A permanent label shall be affixed to the unit by the manufacturer. The label shall indicate the capacity of the distillation chamber, and the distance the unit shall be placed away from sources of ignition. The label shall indicate the products for which the unit has been listed for use or refer to the instruction manual for a list of the products.

3405.4.5 Manufacturer's instruction manual. An instruction manual shall be provided. The manual shall be readily available for the user and the fire code official. The manual shall include installation, use and servicing instructions. It shall identify the liquids for which the unit has been listed for distillation purposes along with each liquid's flash point and auto-ignition temperature. For units with adjustable controls, the manual shall include directions for setting the heater temperature for each liquid to be instilled.

3405.4.6 Location. Solvent distillation units shall be used in locations in accordance with the listing. Solvent distillation units shall not be used in basements.

3405.4.7 Storage of liquids. Distilled liquids and liquids awaiting distillation shall be stored in accordance with Section 3404.

3405.4.8 Storage of residues. Hazardous residue from the distillation process shall be stored in accordance with Section 3404 and Chapter 27.

3405.4.9 Portable fire extinguishers. Approved portable fire extinguishers shall be provided in accordance with Section 906. At least one portable fire extinguisher having a rating of not less than 40-B shall be located not less than 10 feet (3048 mm) or more than 30 feet (9144 mm) from any solvent distillation unit.

3405.5 Alcohol-based hand rubs classified as Class I or II liquids. The use of wall-mounted dispensers containing alcohol-based hand rubs classified as Class I or II liquids shall be in accordance with all of the following:

1. The maximum capacity of each dispenser shall be 68 ounces (2 L).
2. The minimum separation between dispensers shall be 48 inches (1219 mm).
3. The dispensers shall not be installed directly adjacent to, directly above or below an electrical receptacle, switch, appliance, device or other ignition source. The wall space between the dispenser and the floor shall remain clear and unobstructed.
4. Dispensers shall be mounted so that the bottom of the dispenser is a minimum of 42 inches (1067 mm) and a maximum of 48 inches (1219 mm) above the finished floor.
5. Dispensers shall not release their contents except when the dispenser is manually activated.
6. Storage and use of alcohol-based hand rubs shall be in accordance with the applicable provisions of Sections 3404 and 3405.
7. Dispensers installed in occupancies with carpeted floors shall only be allowed in smoke compartments or fire areas equipped throughout with an approved automatic sprinkler system in accordance with Section 903.3.1.1 or 903.3.1.2.

3405.5.1 Corridor installations. Where wall-mounted dispensers containing alcohol-based hand rubs are installed in corridors, they shall be in accordance with all of the following:

1. Aerosol containers shall not be allowed in corridors.
2. The maximum capacity of each dispenser shall be 41 ounces (1.2 L).
3. The maximum quantity allowed in a corridor within a control area shall be 10 gallons (37.85 L).
4. The minimum corridor width shall be 72 inches (1829 mm).
5. Projections into a corridor shall be in accordance with Section 1003.3.3.

SECTION 3406
SPECIAL OPERATIONS

3406.1 General. This section shall cover the provisions for special operations which include, but are not limited to, storage, use, dispensing, mixing or handling of flammable and combustible liquids. The following special operations shall be in accordance with Sections 3401, 3403, 3404 and 3405, except as provided in Section 3406.

1. Storage and dispensing of flammable and combustible liquids on farms and construction sites.