Public Input No. 111-NFPA 1-2021 [Global Input]

Delete sections 50.8.7 through 50.8.11 and replace with the supplied information.

Additional Proposed Changes

File Name	Description	Approved
NFPA1FoodTruckR1.docx	Mobile Food Facility New Chapter for NFPA 58 and NFPA 1	

Statement of Problem and Substantiation for Public Input

Recognizing a need to address proper installation and use of propane systems in the burgeoning mobile food facility market, a working group was appointed to make changes to the LP-Gas Code specific for propane systems on mobile food facilities. The text supplied with this PI was the result of several meetings of three sub-working groups, each addressing the issues with a specific area; containers, piping, and appliances. A subsection also took on procedures and training. Participants on the working group included food truck builders, equipment suppliers, propane industry representatives, consultants, and authorities having jurisdiction. The result is a comprehensive listing of requirements and information for propane systems on mobile food facilities.
This document is for a proposed new chapter in NFPA 58, the LP-Gas Code. It has tentatively passed the First Draft stage of the revision cycle, depending on the formal ballot results. Section numbering shown is for the proposed new chapter and would have to be adapted to the numbering system for NFPA 1. Including this information in the Commercial Cooking Equipment, Mobile and Temporary Cooking operations will provide a comprehensive listing of requirements and information in the Fire Code.

Submitter Information Verification

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Committee:	FCC-HAZ

Committee Statement

Resolution: CI-29-NFPA 1-2021

Statement: The committee is considering to add language around mobile cooking operations or referencing the appropriate reference standard (NFPA 58, NFPA 96). A task group has been formed to look at this topic (See CI 28).

Chapter 16 Mobile Food Facilities

16.1* Scope. This chapter shall apply to LP-Gas containers, piping systems, materials, appliances, and their installation in mobile food facilities for other than engine fuel.

16.1.1 Definition - Mobile Food Facility. A movable commercial or retail food facility.

16.2 Containers.

16.2.1 General.

16.2.1.1 ASME Containers shall be designed, fabricated, tested, and marked (or stamped) in accordance with the regulations of the ASME *Boiler and Pressure Vessel Code*, Section VIII, "Rules for the Construction of Unfired Pressure Vessels", except for UG-125 through UG-136 with a minimum MAWP of 250 psi.

16.2.1.1.1 Adherence to applicable ASME Code case interpretations and addenda that have been adopted and published by ASME 180 calendar days prior to the effective date of this code shall be considered as compliant with the ASME Code.

16.2.1.1.2 Where containers fabricated to earlier editions of regulations, rules, or codes listed in 5.2.1.1, and of the Interstate Commerce Commission (ICC) Rules for Construction of Unfired Pressure Vessels, prior to April 1, 1967, are used, the requirements of Section 1.4 shall apply.

16.2.1.2 Cylinders shall be containers designed, constructed, tested, and marked in accordance with U.S. Department of Transportation specifications, Title 49, Code of Federal Regulations, or in accordance with a valid DOT special permit with a minimum service pressure of 240 psi.

16.2.1.3 A cylinder with an expired requalification date shall not be refilled until it is requalified by the methods prescribed in DOT regulations.

16.2.1.4 The LP-Gas tubing or hose connecting the container to the vehicle piping systems shall not extend outside the enclosure or touch the ground.

16.3 Installation of LP-Gas Containers and Container Appurtenances.

16.3.1* The maximum storage capacity of LP-Gas on food trucks shall be in accordance with Table 16.3.1.

Table 16.3.1 Maximum capacity of propane storage on food trucks

Total Appliance Input Btu/hr.	Maximum aggregate water capacity Cylinders[a]		Maximum aggregate water capacity, ASME containers	
	lb.	kg.	gal	m^3
< 300,000	478[b]	217[b]	50	0.2
300,000 to 700,000	717[c]	326[c]	100	0.38

> 700,000	717[c]	326[c]	500	1.9

[a] Maximum individual cylinder volume, 239 lb water capacity

[b] 478 lb. (217 kg) water capacity is a nominal propane capacity of 200 lb. (91 kg.)

[c] 717 lb. (326 kg.) water capacity is a nominal propane capacity of 300 lb. (136 kg.)

***A.16.3.1** The maximum quantities are consistent with regulations of *Department of Transportation (DOT)* Regulations for to Hazardous Materials in *commerce* and the *Materials of Trade exemption*.

The combined materials of trade, including the weight of the containers (aggregate gross weight) of all materials of trade on a motor vehicle may not exceed 440 pounds (200 kg).

16.3.2 ASME containers and DOT cylinders shall be installed either on the outside of the vehicle or in a recess or vented cabinet.

16.3.2.1 Cabinets shall be vaportight to the inside of the vehicle but accessible from and vented to the outside.

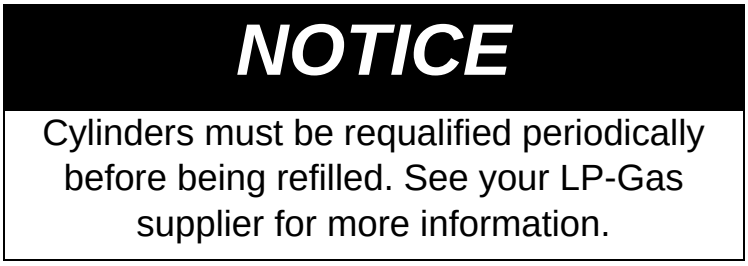
16.3.2.2 Cabinet vents shall be located near the top and bottom of the enclosure and 3 ft (1 m) horizontally away from any opening into the vehicle below the level of the vents. [6.26.3.3]

16.3.2.3 Container cabinets shall be labeled LP-Gas only in a minimum of 1-inch height letters.

(A)*

The label in Exhibit 16.3.2.3 (A) shall be located in all cylinder cabinets. The word "NOTICE' shall be white Arial italics font ½ inch high or larger on a black or Pantone 285 C background, and all other text shall be black Arial font ¼ inch high or larger on a white background.

Exhibit 16.3.2.3 (A).



(B) The label shall be visible when the cylinder is installed in the cabinet.

16.3.4 Containers shall be installed with road clearance in accordance with 11.8.3.

16.3.5 Main shutoff valves on a container for liquid and vapor shall be accessible without the use of tools, or other equipment shall be provided to shut off the container valves.

16.3.6 Containers shall be installed to prevent their jarring loose and slipping or rotating,

16.3.6.1 The container fastenings shall be designed and constructed to withstand, without permanent visible deformation, static loading in any direction equal to four times the weight of the container filled with fuel.

16.3.7 All container valves, appurtenances, and connections, shall be installed to minimize damage from accidental contact with stationary objects; from loose objects, stones, mud, or ice thrown up from the ground or floor; and from damage due to overturn or similar vehicular accident.

16.3.8 After a container is permanently installed on a vehicle, container markings shall be readable either directly or with a portable lamp and mirror.

16.4 Additional Requirements for installation of cylinders and portable ASME containers.

16.4.1 Cylinders shall have permanent protection for valves and connections by any of the following means:

(1) A ventilated cap

(2) A ventilated collar

(3) A cylinder valve providing inherent protection as defined by DOT in 49 CFR 173.301 (h) (3)

16.4.1.1 Cylinders 4 – 40 lb. LP-Gas capacity shall be equipped with a CGA connection number 791, or CGA connection number 810 outlet connection.

16.4.1.2 Cylinders shall have a label with information on the potential hazards of LP-Gas.

16.4.1.3 Cylinders once installed shall have permanent protection for cylinder valves and connections.

16.4.1.4 Field welding on cylinders shall not be permitted

16.4.2 Installation of ASME containers.

16.4.2.1 ASME containers shall be installed in food trucks in accordance with 11.8.1 and 11.8.2.

16.4.2.2 Field welding on ASME containers shall be limited to attachments to nonpressure parts such as saddle plates, wear plates, or brackets applied by the container manufacturer.

16.4.2.3 Container brackets and supports shall be connected to truck members that have no relative motion while the truck in in motion.

16.5. Installation of Pressure Relief Discharge Systems.

16.5.1 The pressure relief valve discharge from ASME containers on vehicles shall be installed in accordance with the following:

(1) The discharge shall not directly impinge on the vehicle.

(2) The discharge shall be directed away from serving windows.

16.5.2 Where the pressure relief valve discharge is piped away, the pipeaway system shall be in accordance with the following:

(A) The breakaway adapter shall have a melting point of not less than 1500°F (816°C).

(B) The adapter either shall be either of the following:

(i) an integral part of the pressure relief valve

(ii) a separate adapter intended for the service and attached directly to the pressure relief valve.

(C) The pipeaway system shall be designed and installed to prevent failure due to thermal or mechanical stress.

(D) Where used nonmetallic hose shall be all of the following:

(i) as short as practical

(ii) be able to withstand the downstream pressure from the relief valve in the fully open position,

(iii) be fabricated of materials resistant to the action of LP-Gas.

(F) The pipeaway system shall have a protective cover to minimize the possibility of the entrance of water or dirt into either the relief valve or its discharge system.

(G) No portion of the system shall have an internal diameter less than the internal diameter of the recommended breakaway adapter.

(H) The breakaway adapter shall be either of the following:

(i) threaded for direct connection to the relief valve and not interfere with the operation of the relief valve

(ii) an integral part of the pressure relief valve and break away without impairing the function of the relief valve.

(I) The pipeaway system connections shall be in accordance with the following

(i) mechanically secured

(ii) not depend on adhesives or sealing compounds

(iii) not be routed between a bumper system and the vehicle body.

(J) The pipeaway shall terminate at a location on the vehicle directed away from serving windows.

16.5.3 Where a pipeaway system is not installed, the pressure relief valve shall have a protective cover.

16.5.4 Fuse plug pressure relief devices shall not be used.

16.6 Pipe, Tubing and Fittings.
16.6.1 Design Pressure and Limitations
16.6.1.1 LP-Gas Vapor piping for between the first stage pressure regulator and appliances shall be designed for a pressure rating of at least 125 psig (0.9 MPag).
16.6.1.2 Piping for Liquid LP-Gas shall be designed for a pressure rating of at least 350 psig (2.4 MPg).

16.6.1.3 Liquid LP-Gas shall be permitted only where a vaporizer is installed.

16.6.2 Pipe Materials. Pipe shall be steel (black or galvanized), brass, copper, or austenitic stainless steel.

16.6.2.1 Pipe shall comply with one of the following:

(1) Steel pipe: ASTM A53/A53M, *Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless*
(2) Steel pipe: ASTM A106/A106M, *Standard Specification for Seamless Carbon Steel Pipe for High-Temperature Service*
(3) Brass pipe: ASTM B43, *Standard Specification for Seamless Red Brass Pipe, Standard Sizes*
(4) Copper pipe: ASTM B42, *Standard Specification for Seamless Copper Pipe, Standard Sizes*
(5) Stainless pipe: ASTM A312/A312M, *Standard Specification for Seamless, Welded, and Heavily Cold Worked Austenitic Stainless Steel Pipes*

16.6.3 Pipe Fittings

16.6.3.1 Pipe fittings shall be steel, austenitic stainless steel, brass, copper, malleable iron, or ductile (nodular) iron.

16.6.3.2 Pipe fittings shall have a minimum pressure rating as specified in 16.6.1

16.6.3.2.1 Pipe fittings shall comply with one of the following:

(1) Metallic welded, threaded, flanged, press-connected, and brazed pipe joints shall be permitted.
(2) Cast-iron pipe fittings shall not be used.
(3) Brazing filler material shall have a melting point that exceeds 1000°F (538°C).

16.6.3.3 Press-connected joints shall comply with ANSI/CSA 6.32 (LC4a), *Press-Connect Metallic Fittings for Use in Fuel Gas Distribution Systems* for vehicle use

16.6.3.4 Fittings and flanges shall be designed for a pressure rating equal to or greater than the required working pressure of the service for which they are used.

16.6.3.5 Gaskets used to retain LP-Gas in flanged connections in piping shall be resistant to the action of LP-Gas.

16.6.3.6 Gaskets shall be either of the following:

(1) made of metal or material confined in metal having a melting point over 1500°F (816°C)
(2) be protected against fire exposure.

16.6.3.7 When a flange is opened, the gasket shall be replaced.

16.6.3.8 Aluminum O-rings and spiral-wound metal gaskets shall be permitted to be used.

16.6.3.9 Nonmetallic gaskets used in insulating fittings shall be permitted to be used.

16.6.4 Tube Materials. Tubing shall be steel, stainless steel, brass, or copper

16.6.4.1 Tubing shall comply with one of the following:

(1) Brass tubing: ASTM B135/B135M, *Standard Specification for Seamless Brass Tube*
(2) Copper tubing:
   i. Type K or L: ASTM B88, *Standard Specification for Seamless Copper Water Tube*
   ii. ASTM B280, *Standard Specification for Seamless Copper Tube for Air Conditioning and Refrigeration Field Service*

(3) Corrugated stainless steel tubing: ANSI LC1/CSA 6.26 *Fuel Gas Piping Systems Using Corrugated Stainless Steel Tubing* for vehicle use.
(4) Steel tubing: ASTM A106 *Seamless Carbon Steel Pipe*

16.6.4.2 Steel tubing complying with ASTM A106 *Seamless Carbon Steel Pipe* shall have a minimum wall thickness of 0.049 in. (1.2 mm).

16.6.5 Tube Fittings Tube fittings shall have a minimum pressure rating as specified in 16.6.1

16.6.5.1 Tube fittings shall comply with one of the following:
(1) Metallic welded, press-connected, and brazed pipe joints shall be permitted.
(2) Fittings shall be designed for a pressure rating equal to or greater than the required working pressure of the service for which they are used.
(3) Press-connected joints shall comply with ANSI/CSA 6.32 (LC4a), *Press-Connect Metallic Fittings for Use in Fuel Gas Distribution Systems*.
(4) Brass flare nuts shall be stress-relieved or of the forged type.
(5) CSST fittings shall be listed to ANSI LC 1/CSA 6.26.

16.6.6 Sizing of vapor piping systems

16.6.6.1 Gas piping systems shall be of such a size and so installed as to provide a supply of gas sufficient to meet the maximum demand of all connected appliances, and supply gas to each appliance inlet at not less than the minimum supply pressure required by the appliance [54:5.4.1]

16.6.6.2 Gas Piping shall be sized in accordance with the following:
(1) Piping sizing Tables 16.6.12.1 through 16.6.12.4.
(2) Engineering methods
(3) Sizing tables included in a listed piping system manufacturer's installation instructions

16.6.7 Installation of Piping Systems

16.6.7.1 Piping in systems shall be run as directly as is practical from one point to another, with as few fittings as practical.

16.6.7.2 Where the piping system is designed to allow the removal of condensed LP-gas before it can enter the appliance, a valve and cap must be provided.

16.6.7.3 Piping systems, including the interconnection of permanently installed containers, shall compensate for expansion, contraction, jarring, vibration, and settling.

16.6.7.4 The use of nonmetallic pipe, tubing, or hose for permanently interconnecting containers shall be prohibited.

16.6.7.5 The piping system shall be designed, installed, supported, and secured to minimize the possibility of physical damage due to vibration, strains, or wear and to preclude any loosening while in transit.

16.6.7.6 Pipe or tubing shall not be run inside walls, floors, partitions, ceilings, or concealed construction space.

16.6.7.7 All piping shall be supported to ensure the integrity of the piping and be secured in place at intervals of not more than 4 ft (1.2m)

16.6.7.8 Fastening or other protection shall be installed to prevent damage due to vibration or abrasion.

16.6.7.9 No part of the LP gas piping system should extend beyond the perimeters of the vehicle

16.6.7.10 All welding and brazing of metallic piping shall be in accordance with ASME *Boiler and Pressure Vessel Code*, Section IX.

16.6.8 Flexibility of Piping Systems.

16.6.8.1 A flexible connector shall be installed between the regulator outlet and the fixed piping system to provide flexibility in the piping system.
16.6.8.2 Flexible connectors shall be installed in accordance with the manufacturer's instructions.
16.6.8.3 Flexible connectors shall not exceed 5 ft (1.5 m) in overall length.
16.6.8.4 Hose shall not be installed in the vehicle

16.6.9 Protection of Piping Systems
16.6.9.1 Piping shall be located to minimize physical damage by vehicles.
16.6.9.2 Pipe, tubing, and hoses shall be installed in a manner that protects them from damage due to accidental contact with stationary objects, impact from stones, mud, or ice, or a vehicular accident.
16.6.9.3 The portion of piping in contact with a support or a corrosion-causing substance shall be protected against corrosion.
16.6.9.4 Metallic piping shall be either of the following:
(1) of a corrosion-resistant material
(2) coated or protected to minimize corrosion where installed outdoors.
16.6.9.5 Piping installed outside or underneath a motorized vehicle shall be either:
(1) schedule 80 pipe
(2) tubing installed inside a protective conduit or a listed encasement system
16.6.9.6 At each point where piping passes through sheet metal or a structural member, a rubber grommet or equivalent protection shall be installed to prevent chafing.

16.6.10 Testing New or Modified Piping Systems. After initial installation or modification, the piping system~~,~~ including flexible connectors and accessories shall be pressure tested and proven free of leaks
16.6.10.1 The test shall be conducted at a test pressure not less than 1.5 times the maximum operating pressure, but not less than 3-PSI (20- kPa).
16.6.10.1.1 Appliances shall be either of the following
(1) disconnected from the piping and the piping fittings capped during the test
(2) the appliance shutoff valve be closed during the test.
16.6.10.2 Air, nitrogen or LP-Gas shall be permitted to be used as the test medium.
16.6.10.2.1 Oxygen shall not be used as the test medium.
16.6.10.3 The test duration shall not be less than 10 minutes.
16.6.10.4 Only pressure gauges shall be used to detect leaks.
16.6.10.4.1 The gauge shall have a 2-in (50-mm) minimum dial face diameter.
16.6.10.4.2 The gauge~~s~~ shall have a maximum pressure of 5 times the test pressure.
16.6.10.5 Prior to testing, the interior of the pipe shall be cleared of all foreign material.
16.6.10.6 Where a reduction in test pressure is indicated by the pressure gauge, the test fails.
16.6.10.7 The leak shall be located and the affected portion of the piping system shall be repaired or replaced and retested.

16.6.11 Pressure Regulator Requirements
16.6.11.1 Pressure regulators shall comply with UL 144.
16.6.11.2 A two-stage regulator system, an integral two-stage regulator, or a 2 psi regulator system shall be required for all systems with a total input of 100,000 Btu/hr. or more.

16.6.11.3 Systems with a total input of 100,000 Btu/hr. or less shall have either an external single stage regulator or a two-stage regulator.
16.6.11.4. Regulators shall be installed in accordance with 16.6.11.4.1 through 16.6.11.4.5.
16.6.11.4.1. Regulators shall be installed with the pressure relief vent opening pointing vertically downward to allow for drainage of moisture collected on the diaphragm of the regulator.
16.6.11.4.2 Regulators not installed in compartments shall be equipped with a durable cover designed to protect the regulator vent opening from sleet, snow, freezing rain, ice, mud, and wheel spray.
16.6.11.4.3 If regulators are installed at or below the floor level, they shall be installed in a compartment that provides protection against the weather and wheel spray.
16.6.11.4.4 Regulator compartments shall comply with the following:

(1) The compartment shall be of sufficient size to allow tool operation for connection to and replacement of the regulator(s).
(2) The compartment shall be vaportight to the interior of the vehicle.
(3) The compartment shall have a 1 in.^{2} (650 mm^2) minimum vent opening to the exterior located within 1 in. (25 mm) of the bottom of the compartment.
(4) The compartment shall not contain flame or spark-producing equipment.

16.6.11.4.5 A regulator vent outlet shall be at least 2 in. (51 mm) above the compartment vent opening.

16.6.12 Pipe Sizing Charts

Table 16.6.12.1. Propane pipe sizing, Schedule 40 Steel Pipe Between First or Single Stage Pressure Regulator and Appliance Shutoff Valve. , pressure = 11" w.c

	Pipe size (in.)					
Nominal Inside Diameter:	½	¾	1	1¼	1½	2
Actual Diameter:	0.622	0.824	1.049	1.380	1.610	2.067
Length (ft)	Capacity in Thousands of Btu per					
10	291	608	1,150	2,350	3,520	6,790
20	200	418	787	1,620	2,420	4,660
30	160	336	632	1,300	1,940	3,750
40	137	287	541	1,110	1,660	3,210
50	122	255	480	985	1,480	2,840

Table 16.6.12.2 Propane Pipe sizing, Schedule 80 Steel Pipe Between First or Single Stage Pressure Regulator and Appliance Shutoff Valve. , pressure = 11" w.c

	Pipe size (in.)					
Nominal Inside Diameter:	½	¾	1	1¼	1½	2
Actual Diameter:	0.546	0.742	0.957	1.278	1.5	1.939
Length (ft)	Capacity in Thousands of Btu per					
10	207	462	901	1924	2928	5941

20	142	318	619	1322	2012	3946
30	114	255	497	1062	1616	3169
40	98	218	426	909	1383	2712
50	87	193	377	805	1226	2404

Table 16.6.12.3 Propane copper tube Sizing Between Single- or Second-Stage (Low-Pressure) Regulator and Appliance Shutoff Valve, pressure = 11" w.c.

		Tube size (in.)						
Nominal:	K & L:	1/2	5/8	3/4	1	1 1/4	1 1/2	2
	ACR:	5/8	3/4	7/8	1 1/8	1 3/8	—	—
Outside:		0.625	0.750	0.875	1.125	1.375	1.625	2.125
Inside:*		0.527	0.652	0.745	0.995	1.245	1.481	1.959
Length (ft)		Capacity in Thousands of Btu per Hour						
10		188	329	467	997	1,800	2,830	5,890
20		129	226	321	685	1,230	1,950	4,050
30		104	182	258	550	991	1,560	3,250
40		89	155	220	471	848	1,340	2,780
50		79	138	195	417	752	1,180	2,470

Table 16.6.12.4 Propane CSST Sizing Between Single- or Second-Stage (Low-Pressure) Regulator and Appliance Shutoff Valve, pressure = 11" w.c

Nominal Size:	½ "	½"	¾"	¾"	1"	1"	1¼"	1¼"	1½"	1 ½ "
Flow Designation:	18	19	23	25	30	31	37	39	46	48
Length (ft)	**Capacity in Thousands of Btu per Hour**									
5	181	211	355	426	744	863	1,420	1,638	2,830	3,270
10	129	150	254	303	521	605	971	1,179	1,990	2,320
15	104	121	208	248	422	490	775	972	1,620	1,900
20	91	106	183	216	365	425	661	847	1,400	1,650
25	2	94	164	192	325	379	583	762	1,250	1,480
30	74	87	151	177	297	344	528	698	1,140	1,350
40	64	74	131	153	256	297	449	610	988	1,170
50	58	66	118	137	227	265	397	548	884	1,050

16.7 Appliances for Use in Mobile Food Facilities.

16.7.1 Cooking appliances shall be listed for commercial cooking and installed in accordance with the manufacturer's instructions.
16.7.2 Space and water heating appliances shall be listed for use in vehicles.
16.7.2 Any appliance originally manufactured for operation with a gaseous fuel other than LP-Gas shall not be used with LP-Gas unless it is converted for use with LP-Gas in accordance with the manufacturer's instructions.
16.7.3 Combustion air, flue outlets and cooking exhaust systems shall be provided as specified by the appliance manufacturer
16.7.4 Gas-fired appliances that are operated while the vehicle is in transit shall be equipped with automatic devices designed to shut off the flow of gas to the main burner and the pilot in the event the pilot flame is extinguished.
16.7.5 Catalytic heating appliances shall be equipped with an approved automatic device to shut off the flow of gas in the event of combustion failure.
16.7.6 Appliances shall be connected to the piping system using one of the following methods:

1. Metallic pipe or tubing and fittings
2. A listed connector in compliance with ANSI Z21.69/CSA 6.16 *Connectors for Moveable Gas Appliances*
3. A listed connector in compliance with ANSI Z21.24/CSA 6.19 *Connectors for Gas Appliances*
4. A listed connector in compliance with ANSI Z21.75/CSA 6.27 *Connectors for Outdoor Gas Appliances and Manufactured Homes*

16.7.6.1 The connector shall be used in accordance with the manufacturer's installation instructions

16.7.6.2 Only one connector shall be used per appliance

16.7.7 Appliances shall be located so that a fire at any appliance will not block egress of persons from the vehicle.
16.7.8 A permanent caution plate shall be in a location visible to operational personnel.
16.7.9 The caution plate shall be in accordance with Figure 16.7.9 and contain the following text:
CAUTION:
(1) Be sure all appliance valves are closed before opening container valve.
(2) Check connections at the appliances, regulators, and containers periodically for leaks with a noncorrosive leak detector fluid or other approved leak detector methods.
(3) Never use a match or flame to check for leaks.
(4) Close all container valves when equipment is not in use.

- Appliance valves closed before opening container valve.
- Check connections at the appliances, regulators, and containers periodically for leaks.
- Never use a match or flame to check for leaks.
- Close all container valves when equipment is not in use.

Commented [IA1]: Format for the personal injury CAUTION signal word panel - black letters on safety yellow (PANTONE 109C) background, black triangle/safety yellow (PANTONE 109C) exclamation mark, red (PANTONE 186 C) diamond around fire symbol.

16.7.10* Components and systems not addressed by this code shall comply with NFPA 96,
A.16.7.10 Components and systems that are addressed in NFPA 96 include but are not limited to the following:

1. Kitchen exhaust equipment
2. Grease capture systems
3. Clearances from cooking and heating appliances to combustible materials
4. Fire suppression systems and fire extinguisher placement
5. Electrical systems

16.8 Training

16.8.1 Prior to preforming cooking operations, one worker shall be provided with initial training in emergency response procedures including the following:

(1) Emergency response procedures

(2) Shutting off fuel sources

(3) LP-Gas container change-out.

(4) Understanding LP-gas properties

16.8.2 During the time of cooking operation at least one person in the vehicle shall have been trained to perform the functions listed in 16.8.1

16.8.3 Refresher training shall be provided annually.

16.8.4 Initial and refresher training shall be documented, and the documentation shall be held in the mobile unit and made available to the AHJ upon request.

16.9 Parking, Servicing, and Repair.

16.9.1 LP-Gas container shutoff valves shall be closed when not in use.

16.9.2 Where vehicles with LP-Gas fuel systems used for other than propulsion are parked, serviced, or repaired inside buildings, the requirements of 16.9.3 through 16.9.5 shall apply.

16.9.3 The fuel system shall be leak free, and the container (s) shall not be filled beyond the limits specified in Chapter 7

16.9.4 The container shutoff valve shall be closed, when fuel is required for testing or repair.

16.9.5 The vehicle shall not be parked near sources of heat, open flames, or similar sources of ignition.

16.10 Transportation and Storage of Containers. LP-Gas containers and LP-Gas cylinders not connected for use shall not be transported or stored inside the vehicle.

16.11 Portable Fire Extinguishers. A minimum of one 2A:10BC portable fire extinguisher shall be provided when a generator or other fuel fired appliances are used.

16.12 O**perational Testing**

16.12.1 The piping system, including flexible connectors and accessories, shall be tested and proven free of leaks using LP-Gas at a test pressure not less than the normal operating pressure.

16.12.2 All connections within the piping system shall be tested with non-corrosive leak detecting fluid or other approved leak detection methods.

16.12.2.1 Where leakage is indicated, the gas supply shall be shut off immediately and shall not be restored until the necessary repairs have been made and the piping system re-tested.

16.12.3 LP-Gas piping system leak testing shall be documented, and the documentation be held in the mobile food facility and made available to the AHJ upon request.

16.12.4 The testing described in 16.12.1 through 16.12.2 shall be performed annually.

16.12.5 Cylinder connections shall be tested for leakage with a non-corrosive leak detecting fluid or other approved leak detection method each time the cylinder(s) is replaced.

Substantiation:

A new chapter for mobile food facilities is added as they are increasing in popularity with an increase in incidents. The requirements for design, installation, and maintenance as their applications are not sufficiently covered under NFPA 58 currently and LP-Gas systems on mobile food facilities are under the scope of NFPA 58.

Public Input No. 163-NFPA 1-2021 [Global Input]

Remove the NFPA 96 extracts from Chapter 50 and keep only the NFPA 17A extracts and NFPA 1 specific code items.

Statement of Problem and Substantiation for Public Input

NFPA 96 has been reorganized to include mobile food trucks and such into the body of the code. This work involves 4 distinct chapters and many individual locations in other chapters. They all can be extracted into NFPA 1 or not. Chapter 50 of NFPA 1 is currently at about 14 pages of extract material. Adding in nominal changes and the food truck sections may add many more pages of extract to NFPA 1.
I request the technical committee to resolve this PI as a CI and have the TC review NFPA 96 upon publication to decide if extracts are continued or direct reference to NFPA 96 is warranted.

Submitter Information Verification

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Submittal Date: Thu Apr 01 15:42:57 EDT 2021
Committee: FCC-HAZ

Committee Statement

Resolution: CI-28-NFPA 1-2021
Statement: The technical committee is considering removing all of the NFPA 96 extracted text to instead reference NFPA 96 for commercial cooking operations. A task group has been created to review this committee input for consideration at second draft. (See CI 29 for additional information)

Public Input No. 78-NFPA 1-2021 [Global Input]

See attached Tentative Interim Amendment No. 21-6 (Log No. 1496) on various NFPA 96 extracts. This TIA was issued and approved for incorporation into the document.

Additional Proposed Changes

File Name	Description	Approved
TIA_1_21_6.pdf	NFPA 1 TIA No. 21-6 (Log No. 1496)	

Statement of Problem and Substantiation for Public Input

NOTE: This public input originates from Tentative Interim Amendment No. 21-3 (Log No. 1493) issued by the Standard Council on August 11, 2020 and per the NFPA Regs., needs to be reconsidered by the Technical Committee for the next edition of the document.

Substantiation: The current text of NFPA 1 contains extracts from the last published edition of NFPA 96 but not what is most currently available which is the 2021 Edition. This TIA updates the extracted language from NFPA 96 in NFPA 1 and makes other adjustments as necessary for the changes to the updated extract text.

Emergency Nature: The standard contains an error or an omission that was overlooked during the regular revision process. The second draft report was not available during the NFPA 1 2nd draft report. Therefore, to ensure accuracy in the extract updates, the updates were done after the second draft report for the source document was posted. By waiting to update the extracts the final product in NFPA 1 will be more closely aligned to what is in the source document and ensures the most up to date information is contained in NFPA 1.

Submitter Information Verification

Submitter Full Name: TC ON FCC_HAZ
Organization: NFPA
Street Address:
City:
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Submittal Date: Mon Feb 15 11:23:13 EST 2021
Committee: FCC-HAZ

Committee Statement

Resolution: The committee agrees with the changes in the TIA and does not feel the need to provide further revision.

Tentative Interim Amendment

NFPA® 1

Fire Code

2021 Edition

Reference: Various NFPA 96 Extracts
TIA 21-6
(SC 20-8-19 / TIA Log #1496)

Note: Text of the TIA was issued and approved for incorporation into the document prior to printing.

1. Revise the following paragraphs to read as follows:

2.3.18 UL Publications.
UL 1484, *Residential Gas Detectors*, 2016, revised 2017.

2.3.21 U.S. Government Publications.
Title 49, Code of Federal Regulations, Part 180.205, "General Requirements for Requalification of Specification Cylinders."

2.4 References for Extracts in Mandatory Sections.
NFPA 17A, *Standard for Wet Chemical Extinguishing Systems*, 2021 edition.

NFPA 96, Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations, ~~2017~~ 2021 edition.

10.15.1.2 Section 10.15 shall not apply to portable and vehicle-mounted generators used solely for mobile and temporary cooking operations. *(See Section 50.8.)*~~.~~

~~**10.15.1.2**~~**10.15.1.3** Section 10.15 shall not apply to stationary generators. *(See Section 11.7.)*

~~**50.2.1.9**~~ **50.1.3** Cooking equipment used in fixed, mobile, or temporary concessions, such as trucks, buses, trailers, pavilions, tents, or any form of roofed enclosure, shall comply with this standard. [**96:**1.1.3]

~~**A.50.2.1.9**~~ **A.50.1.3** ~~**1.1.3**~~ The ~~authority having jurisdiction~~AHJ can exempt temporary facilities, such as a tent, upon evaluation for compliance to the applicable portions of this standard. [**96:**A.1.1.3]
—Although it might not be practical to enforce all requirements of this standard in temporary facilities, the ~~authority having jurisdiction~~AHJ should determine that all necessary provisions that affect the personal safety of the occupants are considered. [96:A.1.1.3]

50.1.4~~3~~ This chapter shall not apply to cooking equipment located in a single dwelling unit. [**96:**1.1.4~~3~~]

50.1.5~~4~~ * This chapter shall not apply to facilities where all of the following are met:
(1) Only residential equipment is ~~being~~ used.
(2) Fire extinguishers are located in all kitchen areas in accordance with Section 13.6.
(3) The facility is not an assembly occupancy.
(4) The AHJ has approved the installation.

[**96:**1.1.54]

A.50.1.54 This judgment should take into account the type of cooking being performed, the items being cooked, and the frequency of cooking operations. Examples of operations that might not require compliance with Chapter 50 include the following:

(1) Day care centers warming bottles and lunches
(2) Therapy cooking facilities in health care occupancies
(3) Churches and meeting operations that are not cooking meals that produce grease-laden vapors
(4) Employee break rooms where food is warmed

[**96:**A.1.1.5]

In non-assembly occupancies where residential equipment is utilized, the AHJ may consider requiring protection of the cooking surface with a listed residential range top extinguishing unit as an alternative to no protection or requiring full protection in accordance with this standard.
[**96:**A.1.1.54]

50.2 General Requirements for Cooking Operations in Buildings and Mobile and Temporary Cooking Operations~~General Requirements~~.

50.2.1.1.1 * Cooking equipment that has been listed in accordance with UL 197 ~~, *Commercial Electric Cooking Appliances,*~~ or an equivalent standard for reduced emissions shall not be required to be provided with an exhaust system. [**96:**4.1.1.1]

50.2.1.1.2 The listing evaluation of cooking equipment covered by 50.2.1.1.1 shall demonstrate that the grease discharge at the exhaust duct of a test hood placed over the appliance shall not exceed 0.00018 oz/ft^3 (5 mg/m^3) when operated with a total airflow of 500 cfm (0.236 m^3/sec). [**96:**4.1.1.2]

50.2.1.3 The following equipment shall be kept in working condition:

(1) Cooking equipment
(2) Hoods
(3) Ducts ~~(if applicable)~~
(4) Fans
(5) Fire-extinguishing equipment
(6) Special effluent or energy control equipment

[**96:**4.1.3]

50.2.1.6 * All solid fuel cooking equipment shall comply with the requirements of Chapter ~~14~~ 15 of NFPA 96. [**96:**4.1.6]

A.50.2.1.6 When solid fuel is burned in cooking operations, increased quantities of carbon, creosote, and grease- laden vapors are produced that rapidly contaminate surfaces, produce airborne sparks and embers, and are subject to significant flare-ups. Also, solid fuel cooking requires fuel storage and handling and produces ash that requires disposal. For these reasons, solid fuel cooking operations are required to comply with Chapter ~~14~~ 15 of NFPA 96. [**96:**A.4.1.6]

50.2.1.7 Multi-tenant applications shall require the concerted cooperation of design, installation, operation, and maintenance responsibilities by tenants and by the building owner. [**96:**4.1.7]

50.2.2 *Clearance.

50.2.2.1* Where enclosures are not required, hoods, grease removal devices, exhaust fans, and ducts shall have a clearance of at least 18 in. (457 mm) to combustible material, 3 in. (76 mm) to limited-combustible material, and 0 in. (0 mm) to noncombustible material. [**96:**4.2.1]

50.2.2.2 Where a hood, duct, or grease removal device is listed for clearances less than those required in 50.2.2.1, the listing requirements shall be permitted. [**96:**4.2.2]

50.2.3 Drawings.

50.2.3.1 Where inspections are required, notice shall be given to the AHJ~~authority having jurisdiction~~ on completion of the installation, or as otherwise directed. [**96**:4.6.3]

~~**50.2.3 Drawings**~~ **50.2.3.2** ~~A~~For cooking operations in buildings, a drawing(s) of the exhaust system installation along with copies of operating instructions for subassemblies and components used in the exhaust system, including electrical schematics, shall be kept on the premises and made available on request to the AHJ and maintenance persons. [**96:**4.6.4]

50.4 Fire-Extinguishing Equipment for Cooking Operations in Buildings~~Fire-Extinguishing Equipment~~.

50.4.4.3* Automatic fire-extinguishing systems shall comply with UL 300~~, *Fire Testing of Fire Extinguishing Systems for Protection of Restaurant Cooking Areas,*~~ or other equivalent standards and shall be installed in accordance with the requirements of the listing. [**96:**10.2.3]

A.50.4.4.3 UL 300 primarily addresses the method of fire testing for self-contained chemical extinguishing systems commonly referred to as pre-engineered systems. UL 300 has been identified as a baseline for testing fire-extinguishing systems intended for the protection of commercial cooking–related hazards.
Additional equivalent testing standards ~~can and have been written~~ for other types of fire-extinguishing systems not considered pre-engineered that demonstrate equivalent fire testing severity to the UL 300 test standard include~~. Current examples include, but are not limited to,~~ UL 199, UL ~~Subject~~ 199B, UL ~~Subject~~ 199E, and UL 710B. [**96:**A.10.2.3]

A.50.4.4.3.1 A change from rendered animal fat to cooking oil likely will increase auto-ignition temperatures, and a change to insulated energy-efficient cooking equipment that does not allow ease of cooling likely will result in difficulties sustaining extinguishment with systems not complying with UL 300, UL 199, UL 199B, UL 199E, or UL 710B~~ or equivalent standards~~. [**96:**A.10.2.3.1]

50.4.4.4 Grease removal devices, hood exhaust plenums, exhaust ducts, and cooking equipment that are not addressed in UL 300 or other equivalent test standards shall be protected with an automatic fire- extinguishing system(s) in accordance with the applicable NFPA standard(s), all local building and fire codes, and the fire- extinguishing system's manufacturer's recommendations and shall be approved by the AHJ. [**96:**10.2.4]

50.4.4.5 Automatic fire-extinguishing equipment provided as part of listed recirculating systems shall comply with UL 710B~~, *Outline of Investigation for Recirculating Exhaust System*~~. [**96:**10.2.5]

50.4.4.8.5 Where a separate fire-extinguishing system is used for protection of cooking equipment only, a water- wash fire-extinguishing system listed for protection of the grease removal device(s), hood exhaust plenum(s), exhaust duct(s), or combination thereof shall be provided with instructions and appropriate means for electrical interface for simultaneous ~~activation~~actuation. [**96:**10.2.8.5]

50.4.4.8.6 A water-wash system approved to be used for protection of the grease removal device(s), hood exhaust plenum(s), exhaust duct(s), or combination thereof shall include instructions and appropriate electrical interface for simultaneous ~~activation~~ actuation of the water-wash system from an automatic fire- extinguishing system, where the automatic fire-extinguishing system is used for cooking equipment protection only. [**96:**10.2.8.6]

50.4.4.8.7 Where the automatic fire -extinguishing system in accordance with NFPA 17A provides protection for the hood and duct in a ~~fixed baffle~~ hood containing a water-wash system, the water-wash system shall be made inoperable or delayed for a minimum of 60 seconds upon operation of the automatic fire- extinguishing system. [**96:**10.2.8.7]

50.4.5.1.1 Hoods installed end to end, back to back, or both, or sharing a common ductwork, not exceeding 75 ft (22.9 m)~~ (75 ft)~~ in distance from the farthest hood, and having a grease-producing appliance(s) located under one or more of the hoods, shall be considered a single hazard area requiring simultaneous automatic fire protection in all hoods and ducts. [**96:**10.3.1.1]

50.4.5.1.1.1 In hoods that are installed end to end, back to back, or both, and that share a common ductwork, the ductwork beyond 75 ft (22.9 m)~~ (75 ft)~~ from the farthest hood shall be protected by an independent fire-extinguishing system with its own detection system or by a fire-extinguishing system that activates simultaneously with the fire-extinguishing system(s) protecting the hoods. [**96:**10.3.1.1.1]

50.4.6.1 Upon ~~activation~~ actuation of any fire-extinguishing system for a cooking operation, all sources of fuel and electric power that produce heat to all equipment ~~requiring protection~~protected by the~~at~~ system shall automatically shut off. [~~96~~**17A:**~~10.4.1~~4.4.4.1]

50.4.6.3 ~~Any g~~Gas appliances not requiring protection but located under the same ventilation~~ing~~ equipment where protected

appliances are located shall also be automatically shut off upon ~~activation~~ actuation of the extinguishing system. [~~96~~**17A:**~~10.4.3~~4.4.4.2]

50.4.6.4 Shutoff devices shall require manual resetting prior to fuel or power being restored. [**96:**10.4.4]

50.4.7 Manual ~~Activation~~Actuation.

50.4.7.1.1 At least one manual actuation device shall be located in a means of egress or at a location acceptable to the AHJ. [**96:**10.5.1.1]

50.4.7.1.2 The manual actuation device shall clearly identify the hazard protected and be provided with instructions for its use. [**96:**10.5.1.2]

50.4.7.1.3* Manual actuation devices installed in locations where accidental operation could occur shall be provided with a guard where required by the AHJ. [**96:**10.5.1.3]

A.50.4.7.1.3 Installing a guard should reduce the likelihood of an unwanted discharge of the fire-extinguishing system. [**96:**A.10.5.1.3]

~~**50.4.7.3** Instruction regarding the proper use of portable fire extinguishers and the manual activation of fire- extinguishing equipment shall be documented and shall be provided by the management to new employees on hiring and to all employees annually. [**96:**10.5.3]~~

50.4.8 System Annunciation.

50.4.8.1 Upon ~~activation~~ actuation of an automatic fire-extinguishing system, an audible alarm or visual indicator shall be provided to show that the system has ~~activated~~actuated. [**96:**10.6.1]

50.4.8.2 Where a fire alarm signaling system is serving the occupancy where the extinguishing system is located, the ~~activation~~ actuation of the automatic fire-extinguishing system shall ~~activate~~ actuate the fire alarm signaling system in accordance with the requirements of *NFPA 72*. [**96:**10.6.2]

50.4.9.2 A single listed detection device~~, listed with the extinguishing system,~~ shall be permitted for more than one appliance ~~where~~ when installed in accordance with ~~the terms of the~~ system's listing. [~~96~~**17A:**~~10.7.2~~5.6.1.5.4]

A.50.4.10.2 Although training and qualification might be available elsewhere, the manufacturer of the equipment being installed should be considered an appropriate source of training and qualification. [**96:**A.10.8~~9~~.2]

A.50.4.11.1 The system used to rate extinguishers for Class B fires (flammable liquids in depth) does not take into consideration the special nature of heated grease fires. Cooking-grease fires are a special hazard requiring agents that saponify (make a soap foam layer to seal the top surface of the grease) for this application. [**96:**A.10.9~~10~~.1]

50.4.11.4 Carbon dioxide~~-~~-type extinguishers shall not be permitted. [**96:**10.9.4]

50.5 Fire-Extinguishing Equipment for Mobile and Temporary Cooking Operations.

50.5.1 General Requirements.

50.5.1.1 Fire-extinguishing equipment for the protection of grease removal devices, hood exhaust plenums, and exhaust duct systems shall be provided. [**96:**11.1.1]

50.5.1.2* Cooking equipment that produces grease-laden vapors shall be protected by a fire-extinguishing system for the protection of grease removal devices, hood exhaust plenums, and exhaust duct systems. [**96:**11.1.2]

A.50.5.1.2 Examples of cooking equipment that produce grease-laden vapors include, but are not limited to, deep fat fryers, ranges, griddles, broilers, woks, tilting skillets, and braising pans. [**96:**A.11.1.2]

50.5.2 Types of Equipment.

50.5.2.1* A placard shall be conspicuously placed near each Class K extinguisher that states that the fire protection system shall be activated prior to using the fire extinguisher. [**96**:11.2.1]

A.50.5.2.1 NFPA 10, Annex A, provides recommendations for placards. [**96:**A.11.2.1]

50.5.2.1.1 The language and wording for the placard shall be approved by the AHJ. [**96:**11.2.1.1]

50.5.2.2* Automatic fire-extinguishing systems shall comply with UL 300 or other equivalent standards and shall be installed in accordance with the terms of their listing and NFPA 17A. [**96:**11.2.2]

A.50.5.2.2 UL 300 primarily addresses the method of fire testing for self-contained chemical extinguishing systems commonly referred to as pre-engineered systems. UL 300 has been identified as a baseline for testing fire-extinguishing systems intended for the protection of commercial cooking–related hazards.
Additional equivalent testing standards for other types of fire-extinguishing systems not considered pre-engineered that demonstrate equivalent fire testing severity to the UL 300 test standard include UL 199, UL 199B, UL 199E, and UL 710B. [**96**:A.11.2.2]

50.5.2.3 Modifications to Existing Hood Systems.

50.5.2.3.1 Any abandoned pipe or conduit from a previous installation shall be removed from within the hood, plenum, and exhaust duct. [**96**:11.2.3.1]

50.5.2.3.2 Penetrations and holes resulting from the removal of conduit or piping shall be sealed with listed or equivalent liquidtight sealing devices. [**96:**11.2.3.2]

50.5.2.3.3 The addition of obstructions to spray patterns from the cooking appliance nozzle(s) such as baffle plates, shelves, or any modification shall not be permitted. [**96:**11.2.3.3]

50.5.2.3.4 Changes or modifications to the hazard after installation of the fire-extinguishing systems shall result in re-evaluation of the system design by a properly trained, qualified, and certified person(s). [**96:**11.2.3.4]

50.5.3 Fuel and Electric Power Shutoff.

50.5.3.1 Upon actuation of any fire-extinguishing system for a cooking operation, all sources of fuel and electric power that produce heat to all equipment protected by the system shall automatically shut off. [**17A**:4.4.4.1]

50.5.3.2 Gas appliances not requiring protection but located under the same ventilation equipment where protected appliances are located shall also be automatically shut off upon actuation of the extinguishing system. [**17A:**4.4.4.2]

50.5.3.3 Shutoff devices shall require manual resetting prior to fuel or power being restored. [**96:**11.3.3]

50.5.3.3.1 Where an electrical gas valve is used for shutting off gas to appliances, a manually reset relay shall be used to restore electrical power to the gas valve. [**96:**11.3.3.1]

50.5.4 Manual Actuation.

50.5.4.1 All systems shall have both automatic and manual methods of actuation. [**96**:11.4.1]

50.5.4.1.1* At least one manual actuation device shall be located in a means of egress or at a location acceptable to the AHJ. [**96:**11.4.1.1]

A.50.5.4.1.1 Mounting location is recommended to be a minimum of 10 ft (3 m) and a maximum of 20 ft (6 m) from the protected hood. [**96:**A.11.4.1.1]

50.5.4.1.2 The manual actuation device shall clearly identify the hazard protected and be provided with instructions for its use. [**96:**11.4.1.2]

50.5.4.1.3* Manual actuation devices installed in locations where accidental operation could occur shall be provided with a guard where required by the AHJ. [**96:**11.4.1.3]

A.50.5.4.1.3 Installing a guard should reduce the likelihood of an unwanted discharge of the fire-extinguishing system. [**96:**A.11.4.1.3]

50.5.4.2 An automatic sprinkler system shall not require a method of manual actuation. [**96:**11.4.2]

50.5.5 System Annunciation.

50.5.5.1 Upon actuation of an automatic fire-extinguishing system, an audible alarm or visual indicator shall be provided to show that the system has actuated. [**96**:11.5.1]

50.5.5.2 At least one listed audible and visual notification appliance shall be installed on the exterior surface of the vehicle readily audible and visible to the public. [**96:**11.5.2]

50.5.6 Review and Certification.

50.5.6.1 Where required, complete drawings of the system installation, including the hood(s), exhaust duct(s), and appliances, along with the interface of the fire-extinguishing system detectors, piping, nozzles, fuel and electric power shutoff devices, agent storage container(s), and manual actuation device(s), shall be submitted to the AHJ and located within the mobile cooking operation. [**96**:11.6.1]

50.5.6.2* Installation Requirements.

A.50.5.6.2 Although training and qualification might be available elsewhere, the manufacturer of the equipment being installed should be considered an appropriate source of training and qualification. [**96**:11.6.2]

50.5.6.2.1 Installation of systems shall be performed only by persons properly trained and qualified to install the specific system being provided. [**96:**11.6.2.1]

50.5.6.2.2 The installer shall provide certification to the AHJ that the installation is in agreement with the terms of the listing and the manufacturer's instructions and/or approved design. [**96:**11.6.2.2]

~~**50.7.1.4**~~**50.5.7 Portable Fire Extinguishers.**

~~**50.7.1.4.1**~~ **50.5.7.1*** Portable fire extinguishers shall be selected and installed in kitchen cooking areas in accordance with Section 13.6 and shall be specifically listed for such use~~provided per NFPA 96 for cooking operations~~. [**96:**11.7.1]

A.50.5.7.1 The system used to rate extinguishers for Class B fires (flammable liquids in depth) does not take into consideration the special nature of heated grease fires. Cooking-grease fires are a special hazard requiring agents that saponify (i.e., make a soap foam layer to seal the top surface of the grease) for this application. [**96:**A.11.7.1]

50.5.7.2 Class K fire extinguishers shall be provided for cooking appliance hazards that involve combustible cooking media (vegetable oils and animal oils and fats). [**96:**11.7.2]

~~**50.7.1.4.3**~~ **50.5.7.3** ~~When wood or charcoal is used, a minimum of one 2A p~~Portable fire extinguishers ~~or an approved hose line~~ shall be provided for solid fuel cooking operations in accordance with Section 13.6. [**96:**11.7.3]

50.5.7.4 Portable fire extinguishers shall be provided for other hazards in kitchen areas and shall be selected and installed in accordance with Section 13.6. [**96:**11.7.4]

~~**50.7.1.4.2**~~**50.5.7.5** Where internal combustion engine power sources are provided, at least~~A minimum of~~ one portable fire extinguisher rated ~~2A:10BC~~ 20-B:C ~~portable fire extinguisher~~ shall be provided ~~when a generator or other fuel fired appliance is used~~. [**96:**11.7.5]

50.5.7.6 Carbon dioxide–type extinguishers shall not be permitted. [**96:**11.7.6]

50.5.7.7 Portable fire extinguishers shall be maintained in accordance with Section 13.6. [**96:**11.7.7]

~~50.5~~50.6 Procedures for the Use, Inspection, Testing, and Maintenance of Equipment.

~~50.5.1~~50.6.1 Operating Procedures.

~~50.5.1.1~~ 50.6.1.1 Exhaust systems shall be operated whenever cooking equipment is turned on. [**96:**1~~1~~2.1.1]

~~50.5.1.2~~50.6.1.2 Filter-equipped exhaust systems shall not be operated with filters removed. [**96:**1~~1~~2.1.2]

~~50.5.1.3~~50.6.1.3 Openings provided for replacing air exhausted through ventilating equipment shall not be restricted by covers, dampers, or any other means that would reduce the operating efficiency of the exhaust system. [**96:**1~~1~~2.1.3]

~~50.5.1.4~~50.6.1.4* Instructions shall be provided to new employees on hiring and to all employees ~~semi~~annually on the use of portable fire extinguishers and the manual actuation of the fire-extinguishing system. [**96:**1~~1~~2.1.4]

~~A.50.5.1.4~~A.50.6.1.4 It is important that all kitchen employees be instructed that the fire-extinguishing system is the primary protection and how to respond appropriately to a fire. If the fire cannot be extinguished by shutting off the fuel source to a pan of burning grease and covering the pan, then employees should perform the following:

(1) Operate the manual actuation device for the fire-extinguishing system to suppress the fire and automatically shut off fuel to the appliances.
(2) Call the fire department and report the fire.
(3) Evacuate personnel and guests, as needed.
(4) Stand by with a Class K fire extinguisher to be used if the fire is not fully extinguished by the fire-extinguishing system.

[**96:**A.1~~1~~2.1.4]

~~50.5.1.4.1~~50.6.1.4.1 Responsibility for compliance with 50.~~5~~6.1.4~~11.1.4~~ shall be that of management of the commercial cooking operation. [**96:**1~~1~~2.1.4.1]

~~50.5.1.4.2~~50.6.1.4.2 Records of compliance with ~~11.1.4~~50.~~5~~6.1.4 shall be maintained and shall be available to the AHJ~~authority having jurisdiction~~. [**96:**1~~1~~2.1.4.2]

~~50.5.1.4.3~~50.6.1.4.3 Instructions for manually operating the fire-extinguishing system shall be posted conspicuously in the kitchen and shall be reviewed with employees by the management. [**96:**1~~1~~2.1.4.3]

~~50.5.1.5~~50.6.1.5 Listed exhaust hoods shall be operated in accordance with the terms of their listings and the manufacturer's instructions. [**96:**1~~1~~2.1.5]

~~50.5.1.6~~50.6.1.6 Cooking equipment shall not be operated while its fire-extinguishing system or exhaust system is nonoperational or impaired. [**96:**1~~1~~2.1.6]

~~50.5.1.6.1~~50.6.1.6.1 Where the fire-extinguishing system or exhaust system is nonoperational or impaired, the system~~s~~ shall be tagged as noncompliant, ~~and~~ the system owner or the owner's representative shall be notified in writing of the impairment, and, where required, the AHJ shall be notified. [**96:**1~~1~~2.1.6.1]

~~50.5.1.7~~50.6.1.7 Secondary filtration and pollution control equipment shall be operated in accordance with the terms of its listing and the manufacturer's recommendations. [**96:**1~~1~~2.1.7]

50.6.1.7.1 The requirement of 50.6.1.7 shall not apply to mobile and temporary cooking operations. [**96:**12.1.7.1]

~~50.5.1.8~~50.6.1.8 Inspection and maintenance of "other equipment" as allowed in 9.3.1 of NFPA 96 shall be conducted by properly trained and qualified persons at a frequency determined by the manufacturer's instructions or the equipment listing. [**96:**1~~1~~2.1.8]

~~50.5.2~~50.6.2 Inspection, Testing, and Maintenance of Fire-Extinguishing Systems.

~~50.5.2.1~~50.6.2.1* Maintenance of the fire-extinguishing systems and listed exhaust hoods containing a constant or fire-activated water system that is listed to extinguish a fire in the grease removal devices, hood exhaust plenums, and exhaust ducts shall be made by properly trained, qualified, and certified person(s) acceptable to the AHJ at least every 6 months. [**96:**1~~1~~2.2.1]

~~A.50.5.2.1~~A.50.6.2.1 It is recommended that such training and qualification be performed by the manufacturer of the equipment being inspected and serviced. The various electrical, mechanical, and filtration components of the systems should be inspected and tested as required to ensure that they continue to function according to original design. [**96:**A.12~~1~~.2.1]

50.6.2.1.1 The requirement of 50.6.2.1 shall not apply to mobile and temporary cooking operations. [**96:**12.2.1.1]

~~50.5.2.2~~50.6.2.2* All actuation and control components, including remote manual pull stations, mechanical ~~or~~and electrical devices, detectors, and actuators, shall be tested for proper operation during the inspection in accordance with the manufacturer's procedures. [**96:**1~~1~~2.2.2]

~~A.50.5.2.2~~A.50.6.2.2 It is not intended that actual discharge of agent occur to test all components, but where pressure from the discharging agent or from compressed gas actuators is needed to ~~activate~~ actuate control components, an alternate means for testing those components should be provided and used. [**96:**A.1~~1~~2.2.2]

~~50.5.2.3~~50.6.2.3 The specific inspection and maintenance requirements of the extinguishing system standards as well as the applicable installation and maintenance manuals for the listed system and service bulletins shall be followed. [**96:**1~~1~~2.2.3]

~~50.5.2.4~~50.6.2.4* Fusible links of the metal alloy type and automatic sprinklers of the metal alloy type shall be replaced at least semiannually. [**96:**1~~1~~2.2.4]

~~A.50.5.2.4~~A.50.6.2.4 The date of manufacture marked on fusible metal alloy sensing elements does not limit when they can be used. These devices have unlimited shelf life. The intent of 50.6~~5~~.2.4 is to require semiannual replacement of fusible metal alloy sensing elements that have been installed in environments that subject them to contaminant loading, such as grease in restaurant hoods and ducts, that could adversely affect their proper operation. [**96:**A.1~~1~~2.2.4]

~~50.5.2.5~~50.6.2.5 The year of manufacture and the date of installation of the fusible links shall be marked on the system inspection tag. [**96:**1~~1~~2.2.5]

~~50.5.2.5.1~~50.6.2.5.1 The tag shall be signed or initialed by the installer. [**96:**1~~1~~2.2.5.1]

~~50.5.2.5.2~~50.6.2.5.2 The fusible links shall be destroyed when removed. [**96:**1~~1~~2.2.5.2]

~~50.5.2.6~~50.6.2.6 Detection devices that are bulb-type automatic sprinklers and fusible links other than the metal alloy type shall be examined and cleaned or replaced annually. [**96:**1~~1~~2.2.6]

~~50.5.2.7~~50.6.2.7 Fixed temperature-sensing elements other than the fusible metal alloy type shall be permitted to remain continuously in service, provided they are inspected and cleaned or replaced if necessary in accordance with the manufacturer's instructions, every 12 months or more frequently to ensure proper operation of the system. [**96:**1~~1~~2.2.7]

~~50.5.2.8~~50.6.2.8 Where required, certificates of inspection and maintenance shall be forwarded to the AHJ. [**96:**1~~1~~2.2.8]

~~50.5.2.8.1~~50.6.2.8.1 Records, including certificates of inspection and maintenance, shall be permitted to be forwarded to or shared with the AHJ~~authority having jurisdiction~~ either by hard copy or electronically. [**96:**1~~1~~2.2.8.1]

~~50.5.3~~50.6.3 **Inspection of Fire Dampers.**

50.6.3.1 The requirements in 50.6.3 shall not apply to mobile and temporary cooking operations. [**96:**12.3.1]

~~50.5.3.1~~50.6.3.2 Actuation components for fire dampers shall be inspected for proper operation in accordance with the manufacturer's listed procedures. [**96:**1~~1~~2.3.~~1~~2]

~~50.5.3.2~~50.6.3.3 **Replacement of Fusible Links.**

~~50.5.3.2.1~~50.6.3.3.1 Fusible links on fire damper assemblies shall be replaced at least semiannually or more frequently as necessary. [**96:**1~~1~~2.3.3~~2~~.1]

~~50.5.3.2.2~~50.6.3.3.2 Replacement shall be made by a certified person acceptable to the AHJ. [**96:**1~~1~~2.3.~~2~~3.2]

~~50.5.3.3~~50.6.3.4 ***Documentation Tag.**

~~A.50.5.3.3~~A.50.6.3.4 **See ~~A.50.5.2.4~~A.50.6.2.4. [96:A.1~~1~~2.3.~~4~~3]**

~~50.5.3.3.1~~50.6.3.4.1 The year of manufacture and the date of installation of the fusible links shall be documented. [**96:**1~~1~~2.3.~~4~~3.1]

~~50.5.3.3.2~~50.6.3.4.2 The tag shall be signed or initialed by the installer. [**96:**1~~1~~2.3.~~4~~3.2]

~~50.5.4~~50.6.4 ***Inspection for Grease Buildup.** The entire exhaust system shall be inspected for grease buildup by a properly trained, qualified, and certified person(s) acceptable to the AHJ and in accordance with Table ~~50.5.4~~50.6.4. [**96:**1~~1~~2.4]

~~1~~**Table ~~50.5.4~~50.6.4 Schedule of Inspection for Grease Buildup**

Type or Volume of Cooking	Inspection Frequency
Systems serving solid fuel cooking operations	Monthly
*Systems serving high-volume cooking operations	Quarterly
Systems serving moderate-volume cooking operations	Semiannually
†Systems serving low-volume cooking operations	Annually

*High-volume cooking operations include 24-hour cooking, charbroiling, and wok cooking.
†Low-volume cooking operations include churches, day camps, seasonal businesses, and senior centers.
[96: Table 1~~1~~2.4]

~~A.50.5.4~~A.50.6.4 The primary focus of an inspection for cleanliness is to establish whether the volume of grease buildup within the exhaust system warrants cleaning and to determine whether adequate access is available throughout the exhaust system to remove the grease buildup. [**96:**A.1~~1~~2.4]

ANSI/IKECA I10 provides guidance for inspection of the exhaust system. [**96:**A.12.4]

~~50.5.5~~50.6.5 **Inspection, Testing, and Maintenance of Listed Hoods Containing Mechanical, Water Spray, or Ultraviolet Devices.** Listed hoods containing mechanical or fire-actuated dampers, internal washing components, or other mechanically operated devices shall be inspected and tested by properly trained, qualified, and certified persons every 6 months or at frequencies recommended by the manufacturer in accordance with their listings. [**96:**1~~1~~2.5]

~~50.5.6~~50.6.6 **Cleaning of Exhaust Systems.**

~~50.5.6.1~~50.6.6.1~~*~~ If, upon inspection, the exhaust system is found to be contaminated with deposits from grease-laden vapors, the contaminated portions of the exhaust system shall be cleaned by a properly trained, qualified, and certified person(s) acceptable to the AHJ. [**96:**1~~1~~2.6.1]

~~50.5.6.1.1~~50.6.6.1.1 A measurement system of deposition shall be established to trigger a need to clean when the exhaust system is inspected at the frequencies in Table ~~50.5~~6.~~4~~50.6.4. [**96:**1~~1~~2.6.1.1]

~~50.5.6.1.1.1~~50.6.6.1.1.1 Hoods, grease removal devices, fans, ducts, and other appurtenances shall be cleaned to remove combustible contaminants to a minimum of 0.002 in. (50 µm~~ (0.002 in.~~). [**96:**1~~1~~2.6.1.1.1]

~~50.5.6.1.1.2~~50.6.6.1.1.2 A grease depth gauge comb, as shown in Figure ~~50.5.6.1.1.2~~50.6.6.1.1.2, shall be placed upon the surface to measure grease depth. [**96:**1~~1~~2.6.1.1.2]

Figure ~~50.5.6.1.1.2~~50.6.6.1.1.2 Depth Gauge Comb. [96:Figure 12.6.6.1.1.2]
****INSERT FIGURE****

~~50.5.6.1.1.3~~50.6.6.1.1.3 Where a measured depth of 0.078 in. (2000 µm)~~ (0.078 in.)~~ is observed, the surfaces shall be cleaned in accordance with ~~50.6~~5.6.~~1~~50.6.6.1. [**96:**1~~1~~2.6.1.1.3]

~~50.5.6.1.1.4~~50.6.6.1.1.4 Where a measured depth of 0.125 in. (3175 µm) ~~(0.125 in.)~~ is observed in a fan housing, the surfaces shall be cleaned in accordance with ~~50.56.6.1~~50.6.6.1. [**96:**1~~1~~2.6.1.1.4]

~~50.5.6.2~~50.6.6.2 Hoods, grease removal devices, fans, ducts, and other appurtenances shall be cleaned to remove combustible contaminants prior to surfaces becoming heavily contaminated with grease or oily sludge. [**96:**1~~1~~2.6.2]

~~50.5.6.3~~50.6.6.3 At the start of the cleaning process, electrical switches that could be activated accidentally shall be locked out. [**96:**1~~1~~2.6.3]

~~50.5.6.4~~50.6.6.4 Components of the fire suppression system shall not be rendered inoperable during the cleaning process. [**96:**1~~1~~2.6.4]

~~50.5.6.5~~50.6.6.5 Fire-extinguishing systems shall be permitted to be rendered inoperable during the cleaning process where serviced by properly trained and qualified persons. [**96:**1~~1~~2.6.5]

~~50.5.6.6~~50.6.6.6 Flammable solvents or other flammable cleaning aids shall not be used. [**96:**1~~1~~2.6.6]

~~50.5.6.7~~50.6.6.7 Cleaning chemicals shall not be applied on fusible links or other detection devices of the automatic extinguishing system. [**96:**1~~1~~2.6.7]

~~50.5.6.8~~50.6.6.8 After the exhaust system is cleaned, it shall not be coated with powder or other substance. [**96:**1~~1~~2.6.8]

~~50.5.6.9~~50.6.6.9 When cleaning procedures are completed, all access panels (doors) and cover plates shall be restored to their normal operational condition. [**96:**1~~1~~2.6.9]

~~50.5.6.10~~50.6.6.10 When an access panel is removed, a service company label or tag preprinted with the name of the company and giving the date of inspection or cleaning shall be affixed near the affected access panels. [**96:**1~~1~~2.6.10]

~~50.5.6.11~~50.6.6.11 Dampers and diffusers shall be positioned for proper airflow. [**96:**1~~1~~2.6.11]

~~50.5.6.12~~50.6.6.12 When cleaning procedures are completed, all electrical switches and system components shall be returned to an operable state. [**96:**1~~1~~2.6.12]

~~50.5.6.13~~50.6.6.13 When an exhaust system is inspected or cleaned, a certificate showing the name of the servicing company, the name of the person performing the work, and the date of inspection or cleaning shall be maintained on the premises. [**96:**1~~1~~2.6.13]

~~50.5.6.14~~50.6.6.14 After cleaning or inspection is completed, the exhaust cleaning company and the person performing the work at the location shall provide the owner of the system with a written report that also specifies areas that were inaccessible or not cleaned. [**96:**1~~1~~2.6.14]

~~50.5.6.15~~50.6.6.15 Where required, certificates of inspection and cleaning and reports of areas not cleaned shall be submitted to the AHJ. [**96:**1~~1~~2.6.15]

~~50.5.6.16~~50.6.6.16 Metal containers used to collect grease drippings shall be inspected or emptied at least weekly. [**96:**1~~1~~2.6.16]

~~50.5.7~~50.6.7 **Cooking Equipment Maintenance.**

~~50.5.7.1~~50.6.7.1 Inspection and servicing of the cooking equipment shall be made at least annually by properly trained and qualified persons. [**96:**1~~1~~2.7.1]

~~50.5.7.2~~50.6.7.2 Cooking equipment that collects grease below the surface, behind the equipment, or in cooking equipment flue gas exhaust, such as griddles, deep-fat fryers, or charbroilers, shall be inspected and, if found with grease accumulation, cleaned by a properly trained, qualified, and certified person(s) acceptable to the AHJ. [**96:**1~~1~~2.7.2]

~~50.6~~50.7 **Minimum Safety Requirements for Cooking Equipment.**

~~50.6.1~~50.7.1 Cooking Equipment.

~~**50.6.1.1**~~**50.7.1.1*** Cooking equipment shall be approved based on one of the following criteria:

(1) Listings by a testing laboratory
(2) Test data acceptable to the AHJ

[**96:**1~~2~~3.1.1]

~~**A.50.6.1.1**~~**A.50.7.1.1** Cooking appliances that are designed for permanent installation, including, but not limited to, ranges, ovens, stoves, broilers, grills, fryers, griddles, and barbecues, should be installed in accordance with the manufacturer's installation instructions.

(1) Commercial electric cooking appliances should be listed and labeled in accordance with UL 197.
(2) Microwave cooking appliances should be listed and labeled in accordance with UL 923.
(3) Oil-burning stoves should be listed and labeled in accordance with UL 896.
(4) Wood-fired cooking appliances should be listed and labeled in accordance with UL 737 or, UL ~~Subject~~ 2162, ~~or UL Subject 2728,~~ depending on exact appliance type.
(5) Gas-fired cooking appliances should be listed and labeled in accordance with ANSI Z83.11.
(6) Gas-wood-fired cooking appliances should be listed and labeled in accordance with ANSI Z83.11, UL 737, and/or UL ~~Subject~~ 2162, depending on exact appliance type.

[**96:** A.1~~2~~3.1.1]

~~**50.6.1.2**~~**50.7.1.2 Installation.**

~~**50.6.1.2.1**~~**50.7.1.2.1*** All listed appliances shall be installed in accordance with the terms of their listings and the manufacturer's instructions. [**96:**1~~2~~3.1.2.1]

~~**A.50.6.1.2.1**~~**A.50.7.1.2.1** Gas-fueled appliances should be installed to the requirements of NFPA 54 or NFPA 58. [**96:**A.1~~2~~3.1.2.1]

~~**50.6.1.2.1.1**~~**50.7.1.2.1.1** Solid fuel used for flavoring within a gas-operated appliance shall be in a solid fuel holder (smoker box) that is listed with the equipment. [**96:**1~~2~~3.1.2.1.1]

~~**50.6.1.2.2**~~**50.7.1.2.2*** Cooking appliances requiring protection shall not be moved, modified, or rearranged without prior re-evaluation of the fire-extinguishing system by the system installer or servicing agent, unless otherwise allowed by the design of the fire-extinguishing system. [**96:**1~~2~~3.1.2.2]

~~**A.50.6.1.2.2**~~**A.50.7.1.2.2** The effectiveness of an automatic extinguishing system is affected by the placement of the nozzles. For this reason, it is essential that cooking appliances be situated in the area in which they were when the extinguishing equipment was designed and installed. If an appliance is moved from under the equipment for cleaning or any other reason, it should be returned to its original position prior to initiation of a cooking operation. [**96:**A.1~~2~~3.1.2.2]

When appliances are on wheels or casters for ease of cleaning, it is important that the appliance be placed in its design position to ensure that the fire-extinguishing system will be effective. An approved method should ensure that the appliance is returned to its appropriate position before cooking takes place. Channels, markings, or other approved methods assist in ensuring proper placement. [**96:**A.1~~2~~3.1.2.2]

~~**50.6.1.2.2.1**~~**50.7.1.2.2.1** A solid fuel holder shall not be added to an existing appliance until the fire-extinguishing system has been evaluated by the fire-extinguishing system service provider. [**96:**1~~2~~3.1.2.2.1]

~~**50.6.1.2.3**~~ **50.7.1.2.3** The fire-extinguishing system shall not require re-evaluation where the cooking appliances are moved for the purposes of maintenance and cleaning, provided the appliances are returned to approved design location prior to cooking operations, and any disconnected fire-extinguishing system nozzles attached to the appliances are reconnected in accordance with the manufacturer's listed design manual. [**96:**1~~2~~3.1.2.3]

~~**50.6.1.2.3.1**~~**50.7.1.2.3.1*** An approved method shall be provided that will ensure that the appliance is returned to an approved design location. [**96:**1~~2~~3.1.2.3.1]

A.50.7.1.2.3.1 Wheel chocks that can be fastened to the floor should be installed to ensure that an appliance with casters is returned to its approved design location. [**96:**A.13.1.2.3.1]

~~50.6.1.2.4~~50.7.1.2.4 All deep-fat fryers shall be installed with at least a 16 in. (406 mm) space between the fryer and surface flames from adjacent cooking equipment. [**96:**1~~2~~3.1.2.4]

~~50.6.1.2.5~~50.7.1.2.5 Where a steel or tempered glass baffle plate is installed at a minimum 8 in. (203 mm) in height between the fryer and surface flames of the adjacent appliance, the requirement for a 16 in. (406 mm) space shall not apply. [**96:**1~~2~~3.1.2.5]

~~50.6.1.2.5.1~~50.7.1.2.5.1 If the fryer and the surface flames are at different horizontal planes, the minimum height of 8 in. (203 mm) shall be measured from the higher of the two. [**96:**1~~2~~3.1.2.5.1]

~~50.7~~50.8 **Mobile and Temporary Cooking Operations.**

~~**50.7.1**~~**50.8.1** **General.**

~~50.7.1.1~~50.8.1.1 Mobile and temporary cooking operations shall comply with the requirements of ~~50.7.1~~this section, NFPA 96 and the applicable section for the type of cooking performed.

~~50.7.1.2~~50.8.1.2 Where required by the AHJ, permits shall be required for the location, design, construction, and operation of mobile and temporary cooking operations.

50.8.1.3 Cooking equipment that is powered on during transit shall be listed as installed for such use. [**96:**17.1.2]

~~50.7.1.7~~50.8.1.4 **Fire Department Access.** Mobile or temporary cooking operations shall not block fire apparatus access roads, fire lanes, fire hydrants, or other fire protection devices and equipment.

~~50.7.1.8~~50.8.1.5 **Communications.**

~~50.7.1.8.1~~50.8.1.5.1 Where required by the AHJ, ~~An~~an approved method of communication to emergency personnel shall be accessible to all employees.

~~50.7.1.8.2~~50.8.1.5.2 The address of the current operational location shall be posted and accessible to all employees.

~~**50.7.1.11 Charcoal and Wood Burning.**~~

~~50.7.1.11.1 Mobile or temporary cooking operations that use wood or charcoal shall comply with Section 14.9 of NFPA 96.~~

~~50.7.1.12~~50.8.1.6 **Storage of Flammable and Combustible Liquids.** Flammable and combustible liquids shall not be stored inside mobile cooking vehicles or in temporary cooking areas unless stored in accordance with NFPA 30.

50.8.2 Location of Mobile and Temporary Cooking Operations.

~~50.7.1.5~~50.8.2.1 ~~**Separation**~~**Relative to Buildings.** Mobile or temporary cooking operations shall be separated from the entrances and other exits of buildings or structures, combustible materials, vehicles, and other cooking operations by a clear space distance ~~minimum~~ of 10 ft (3 m). [**96**:17.2.1]

A.50.8.2.1 The intent of this section is to also permit separation distances greater than 10 ft (3 m).

50.8.2.2 Relative to Other Mobile or Temporary Cooking. Mobile or temporary cooking operations shall be separated from other mobile or temporary cooking operations by a clear distance of 10 ft (3 m). [**96:**17.2.2]

A.50.8.2.2 The intent of this section is to also permit separation distances greater than 10 ft (3 m).

50.8.2.3 When the mobile unit is parked, the vehicle shall be stabilized so that it will not move, either by jacking the vehicle or placing wheel chocks around the wheels. [**96:**17.2.3]

~~50.7.1.6~~ 50.8.3 **Tents.**

~~50.7.1.6.1~~ 50.8.3.1 ~~Mobile or t~~Temporary cooking operations conducted in tents shall ~~not take place within tents occupied by the public~~ comply with NFPA 102 and Chapter 25. [**96:**17.3.1]~~.~~

~~**50.7.1.6.2 Tents shall comply with Chapter 25.** [96:17.3.1]~~

~~**50.7.1.6.3**~~ **50.8.3.2** Seating for the public shall not be located within any mobile or temporary cooking vehicle.

~~50.7.2.4.750.8.4~~ Cooking Appliance Installation on Vehicles.

~~**50.7.2.4.7.1**~~**50.8.4.1** Subsection ~~50.7.2.4.7~~50.8.4 shall apply to the installation of all appliances on vehicles. It shall not apply to engines. [**58**:6.26.7.1]

~~**50.7.2.4.7.2**~~**50.8.4.2** All appliances covered by ~~50.7.2.4.7~~ 50.8.4 installed on vehicles shall be approved. [**58:**6.26.7.2]

~~**50.7.2.4.7.3**~~ **50.8.4.3** Where the device or appliance, such as a cargo heater or cooler, is designed to be in operation while the vehicle is in transit, means, such as an excess-flow valve, to stop the flow of gas in the event of a line break shall be installed. [**58:**6.26.7.3]

~~**50.7.2.4.7.4**~~ **50.8.4.4** Gas-fired heating appliances shall be equipped with shutoffs in accordance with 5.23.7(A) of NFPA 58, except for portable heaters used with cylinders having a maximum water capacity of 2.7 lb (1.2 kg), portable torches, melting pots, and tar kettles. [**58:**6.26.7.4]

~~**50.7.2.4.7.5**~~ **50.8.4.5** Gas-fired heating appliances, other than ranges and illuminating appliances installed on vehicles intended for human occupancy, shall be designed or installed to provide for a complete separation of the combustion system from the atmosphere inside the vehicle. [**58:**6.26.7.5]

~~**50.7.2.4.7.6**~~**50.8.4.6*** Where unvented-type heaters that are designed to protect cargo are used on vehicles not intended for human occupancy, provisions shall be made to provide air from the outside for combustion and dispose of the products of combustion to the outside. [**58:**6.26.7.6]

~~**50.7.2.4.7.7**~~**50.8.4.7** Appliances installed in the cargo space of a vehicle shall be readily accessible whether the vehicle is loaded or empty. [**58:**6.26.7.7]

~~**50.7.2.4.7.8**~~ **50.8.4.8** Appliances shall be constructed or otherwise protected to minimize possible damage or impaired operation due to cargo shifting or handling. [**58:**6.26.7.8]

~~**50.7.2.4.7.9**~~ **50.8.4.9** Appliances shall be located so that a fire at any appliance will not block egress of persons from the vehicle. [**58:**6.26.7.9]

~~**50.7.2.4.7.10**~~ **50.8.4.10** A permanent caution plate shall be affixed to either the appliance or the vehicle outside of any enclosure. [**58:**6.26.7.10]

~~**50.7.2.4.7.10.1**~~ **50.8.4.10.1** The caution plate shall be adjacent to the container(s). [**58:**6.26.7.10.1]

~~**50.7.2.4.7.10.2**~~ **50.8.4.10.2** The caution plate shall include the following text:

CAUTION:

1. Be sure all appliance valves are closed before opening container valve.
2. Connections at the appliances, regulators, and containers shall be checked periodically for leaks with soapy water or its equivalent.
3. Never use a match or flame to check for leaks.
4. Container valves shall be closed when equipment is not in use.

[**58:**6.26.7.10.2]

~~**50.7.2.4.7.11**~~ **50.8.4.11** Gas-fired heating appliances and water heaters shall be equipped with automatic devices designed to shut off the flow of gas to the main burner and the pilot in the event the pilot flame is extinguished. [**58:**6.26.7.11]

~~**50.7.1.10**~~**50.8.5 Internal Combustion Engine Power Sources.**

~~**50.7.1.10.1**~~ **50.8.5.1** Electric generator and internal combustion power sources used for mobile or temporary cooking shall comply with 50.8.5~~with 10.15~~.

~~50.7.1.10.2~~ 50.8.5.2 Electrical appliances, fixtures, equipment, or wiring other than low-voltage and automotive vehicle circuits or extensions thereof, installed within or on vehicles, shall comply with *NFPA 70*.

50.8.5.3 An internal combustion engine shall be permitted to be used to operate an electric power generator. [**96:**17.5.1]

50.8.5.4 Generator units that are not vehicle-mounted while in use shall meet the requirements of 50.8.5.4.1 through 50.8.5.4.3. [**96:**17.5.2]

50.8.5.4.1 Internal combustion engine power sources shall be located at least 12 ft (4 m) from mobile or temporary cooking operations. [**96:**17.5.2.1]

50.8.5.4.2 Internal combustion engine power sources shall be isolated from physical contact by the installation of physical guards, fencing, or an enclosure. [**96:**17.5.2.2]

50.8.5.4.3 Internal combustion engine power sources shall be positioned so that the exhaust complies with the following:

(1) Located at least 12 ft (4 m) from openings, air intakes, and means of egress
(2) In a position pointed away from any building
(3) In a position pointed away from any mobile or temporary cooking operations [**96:**17.5.2.3]

50.8.6 Vehicle-Mounted Generators.

50.8.6.1 Vehicle-mounted generators shall meet the requirements of 50.8.6.2 through 50.8.6.5. [**96:**17.6.1]

50.8.6.2 Internal combustion engine-driven generator units (subject to the provisions of NFPA 1192) shall be listed and installed in accordance with the manufacturer's instructions and shall be vapor resistant to the interior of the vehicle. [**1192:**6.4.5.1]

50.8.6.3 Where a generator compartment is used to isolate the installed generator from the vehicle's interior, or a compartment is provided for the future installation of a generator and is intended to isolate the future generator from the vehicle interior, the generator compartment shall be lined with galvanized steel not less than 26 MSG thick. [**1192:**6.4.5.2]

50.8.6.3.1 Seams and joints shall be lapped, mechanically secured, and made vapor resistant to the interior of the vehicle. [**1192:**6.4.5.2.1]

50.8.6.3.2 Alternative materials and methods of construction shall be permitted in accordance with Section 1.4. [**1192:**6.4.5.2.2]

50.8.6.4 Liquid fuel lines and exhaust systems shall not penetrate into the area. [**1192:**6.4.5.2.3]

50.8.6.5 Holes into the living area shall be sealed. [**1192:**6.4.5.2.4]

~~50.7.2.250.8.7~~ LP-Gas Systems.

~~50.7.2.2.2~~ **50.8.7.1** LP-Gas systems ~~on~~ for mobile cooking ~~vehicles~~ operations shall comply with NFPA 58 and this section. [**96:**17.7.1]

~~50.7.2.2.1~~ **50.8.7.1.1** LP-Gas ~~C~~cylinders shall be secured in an upright position ~~to prevent tipping over~~. [**96:**17.7.1.1]

~~50.78.7.1.22.2.3~~ **50.8.7.1.2** Where a shutoff valve is provided, it shall be readily accessible and identified with a sign permanently affixed to the vehicle in reflective decal material with letters a minimum of 2 in. (50 mm) high.

~~50.7.2.4.6~~**50.8.7.2** **Equipment Installation.** Equipment shall be installed in accordance with Section 6.20 of NFPA 58, ~~50.7.2.4.6.1~~50.8.7.2.1, and ~~50.7.2.4.6.2~~50.8.7.2.2. [**58:**6.26.6]

~~50.7.2.4.6.1~~**50.8.7.2.1** Installation shall be made in accordance with the manufacturer's recommendations and, in the case of approved equipment, as provided in the approval. [**58:**6.26.6.1]

~~50.7.2.4.6.2~~**50.8.7.2.2** Equipment installed on vehicles shall be protected against vehicular damage as provided for container

appurtenances and connections in ~~50.7.2.4.3.4.5~~50.8.7.3.7.5. [**58:**6.26.6.2]

~~50.7.2.3~~50.8.7.3 ~~*~~ LP-Gas System Leak Detection.

~~A.50.7.2.3~~8.7.2 ~~The certification documentation might consist of the following:~~

~~(1) The name of the certification company~~

~~(2) The license number, certificate of fitness number or other applicable identifying number that demonstrates the certification company is approved to install, inspect, and maintain LP-Gas systems~~

~~(3) The corporate name of the mobile food service business~~

~~(4) The identifying name on the side of the mobile food vehicle~~

~~(5) Date of inspection~~

~~(6) Vehicle tag number and VIN 7~~

~~(7) A signed statement by the agent for the certification company that reads: The LP-Gas system has been inspected for compliance with the current edition of NFPA 58 and found to be in compliance with the provisions of the code. In addition, leak detection has been conducted on the LP-Gas system piping and the piping has been found to maintain integrity.~~

50.8.7.3.1 All mobile and temporary cooking operations equipped with a propane appliance and an electrical system shall be equipped with a propane detector listed and marked on the device as being suitable for use in the vehicles under the requirements of UL 1484, and installed according to the terms of its listing. [**96:**17.7.2.1]

~~**50.7.2.3.3**~~ **50.8.7.2.2** The LP-~~Where a g~~Gas leak detection system ~~has been installed, it~~ shall be tested ~~every~~ monthly. [**96:**17.7.2.2]

~~**50.7.2.3.1**~~ **50.8.7.2.3** LP-Gas systems shall be inspected prior to each use ~~by a worker trained in accordance with 50.7.1.8~~. [**96:**17.7.2.3]

50.8.7.2.4 LP-Gas leak detection testing shall be performed every time a new LP-Gas connection is made or an LP- Gas cylinder is changed out. [**96:**17.7.2.4]

~~**50.7.2.3.2**~~ **50.8.7.2.5 LP-**~~Gass~~Gas ~~L~~leak detection testing shall be documented and the documentation be held in the mobile or temporary unit and made available to the AHJ upon request ~~in accordance with 50.7.2.3.4~~. [**96:**17.7.2.5]

~~**50.7.2.3.4*** LP-Gas systems on mobile food service vehicles shall be certified for compliance with NFPA 58 by an approved company with expertise in the installation, inspection, and maintenance of LP-Gas systems.~~

~~**50.7.2.3.4.1** The certification shall be good for one year.~~

~~**50.7.2.3.4.2** Recertification shall occur every time an appliance is replaced or added and if a piping connection is modified in anyway.~~

~~**50.7.2.3.4.2.1** A change in cylinder shall not be considered a piping connection modification.~~

~~**50.7.2.3.4.3** Mobile food service vehicles equipped with an LP-Gas system, but without a current approved LP-Gas certification, shall not be permitted to be operated for mobile food service.~~

~~50.7.2.4~~50.8.7.3 LP-Gas Systems on Vehicles ~~(~~Other than Engine Fuel Systems~~)~~.

~~**50.7.2.4.1**~~**50.8.7.3.1*** **Application.** Section ~~50.7.2.4~~50.8.7.3 shall apply to the following:

1. Nonengine fuel systems on all vehicles
2. Installations served by exchangeable (removable) cylinder systems and by permanently mounted containers.

[**58:**6.26.1]

~~**50.7.2.4.2**~~**50.8.7.3.2 Nonapplication.** Section ~~50.7.2.4~~50.8.7.3 shall not apply to the following:

1. Systems installed on mobile homes
2. Systems installed on recreational vehicles
3. Cargo tank vehicles, including trailers and semitrailers, and similar units used to transport LP- Gas as cargo, which are covered by Chapter 9 of NFPA 58.
4. LP-Gas engine fuel systems on the vehicles, which are covered by Chapter 11 of NFPA 58.

[**58:**6.26.2]

~~**50.7.2.4.3**~~**50.8.7.3.3 LP-Gas Container Installation Requirements.**

~~**50.7.2.4.3.1** Containers shall comply with 50.7.2.4.3.1.1 through 50.7.2.4.3.1.5.~~

~~**50.7.2.4.3.1.1**~~ **50.8.7.3.3.1** Only ASME mobile LP-Gas containers ~~shall be~~ in ~~accordance~~ compliance with ~~one of~~ the following shall be used:

(1) A maximum allowable working pressure (MAWP) of 312 psi~~g~~ (2.2 MPag) or higher ~~where~~ for LP-Gas containers installed in the enclosed spaces of a vehicle~~s~~
(2) ~~A MAWP of 312 psig (2.2 MPag) or higher where installed on passenger vehicles~~
~~(3)~~ A maximum allowable working pressure (MAWP) of 250 psi~~g~~ (1.7 MPag) or higher for LP-Gas containers ~~where~~ installed on the exterior of ~~nonpassenger~~ a vehicle~~s~~

[**96:**17.7.3.1.1]

~~**50.7.2.4.3.1.2**~~ **50.8.7.3.3.2** LP-Gas ~~fuel~~ containers installed ~~used~~ on ~~passenger-carrying~~ vehicles shall not exceed 200 gal (0.8 m^3) aggregate water capacity. [**96:**17.7.3.1.2]

50.8.7.3.4 Disconnected LP-Gas containers and LP-Gas cylinders for purposes other than engine fuel systems shall not be transported or stored inside the vehicle. [**96:**17.7.3.2]

50.8.7.3.5 All other LP-Gas containers and LP-Gas cylinders in storage shall comply with Section 10.5 of NFPA 96 and Chapter 69. [**96:**17.7.3.3]

~~**50.7.2.4.3.1.3** The capacity of individual LP-Gas containers on highway nonpassenger vehicles shall 1000 gal (3.8 m^3) or in accordance with U.S. Department of Transportation regulations.~~
~~**50.7.2.4.3.1.4** The capacity of cargo tank motor vehicles shall not be limited by NFPA 58.~~
~~**50.7.2.4.3.1.5** Containers designed for stationary service only and not in compliance with the container appurtenance protection requirements of 5.2.6 of NFPA 58 shall not be used. [**58:**6.26.3.1(E)]~~
~~**50.7.2.4.3.2** ASME containers and cylinders utilized for the purposes covered by 50.7.2.4 shall not be installed, transported, or stored (even temporarily) inside any vehicle covered by 50.7.2.4, except for ASME containers installed in accordance with 50.7.2.4.3.4.9, Chapter 9 of NFPA 58, or DOT regulations. [**58:**6.26.3.2]~~

~~**50.7.2.4.3.3**~~**50.8.7.3.6** The LP-Gas supply system, including the containers, shall be installed either on the outside of the vehicle or in a recess or cabinet vaportight to the inside of the vehicle but accessible from and vented to the outside, with the vents located near the top and bottom of the enclosure and 3 ft (1 m) horizontally away from any opening into the vehicle below the level of the vents. [**58:**6.26.3.3]

~~**50.7.2.4.3.4**~~ **50.8.7.3.7** Containers shall be mounted securely on the vehicle or within the enclosing recess or cabinet. [**58:**6.26.3.4]

~~**50.7.2.4.3.4.1**~~ **50.8.7.3.7.1** Containers shall be installed with road clearance in accordance with 11.8.3 of NFPA 58. [**58:**6.26.3.4(A)]

~~**50.7.2.4.3.4.2**~~ **50.8.7.3.7.2** Fuel containers shall be mounted to prevent jarring loose and slipping or rotating, and the fastenings shall be designed and constructed to withstand, without permanent visible deformation, static loading in any direction equal to four times the weight of the container filled with fuel. [**58:**6.26.3.4(B)]

~~**50.7.2.4.3.4.3**~~ **50.8.7.3.7.3** Where containers are mounted within a vehicle housing, the securing of the housing to the vehicle shall comply with this provision. Any removable portions of the housing or cabinet shall be secured while in transit. [**58:**6.26.3.4(C)]

~~**50.7.2.4.3.4.4**~~ **50.8.7.3.7.4** Field welding on containers shall be limited to attachments to nonpressure parts such as saddle plates, wear plates, or brackets applied by the container manufacturer. [**58:**6.26.3.4(D)]

~~**50.7.2.4.3.4.5**~~ **50.8.7.3.7.5** All container valves, appurtenances, and connections shall be protected to prevent damage from accidental contact with stationary objects; from loose objects, stones, mud, or ice thrown up from the ground or floor; and from damage due to overturn or similar vehicular accident. [**58:**6.26.3.4(E)]

~~50.7.2.4.3.4.6~~ **50.8.7.3.7.6** Permanently mounted ASME containers shall be located on the vehicle to provide the protection specified in ~~50.7.2.4.3.4.5~~50.8.7.3.7.5. [**58:**6.26.3.4(F)]

~~50.7.2.4.3.4.7~~ **50.8.7.3.7.7** Cylinders shall have permanent protection for cylinder valves and connections. [**58:**6.26.3.4(G)]

~~50.7.2.4.3.4.8~~ **50.8.7.3.7.8** Where cylinders are located on the outside of a vehicle, weather protection shall be provided. [**58:**6.26.3.4(H)]

~~50.7.2.4.3.4.9~~ **50.8.7.3.7.9** Containers mounted on the interior of passenger-carrying vehicles shall be installed in compliance with Section 11.9 of NFPA 58. Pressure relief valve installations for such containers shall comply with 11.8.5 of NFPA 58. [**58:**6.26.3.4(I)]

50.8.7.3.8 Where equipment such as a cargo heater or cooler is designed to be in operation while the vehicle is in transit, means such as an excess-flow valve to stop the flow of gas in the event of a line break shall be installed. [**96:**17.7.3.6]

50.8.7.3.9 Cylinders shall be retested every 5 to 12 years in accordance with the manufacturer's recommendations and 49 CFR 180.205:

(1) No letter after the requalification date means the cylinder must be retested within 12 years.
(2) "S" means the cylinder must be retested within 7 years.
(3) "E" means the cylinder must be retested within 5 years.

[**96:**17.7.3.7]

~~50.7.2.4.4~~ 50.8.7.4 Installation of LP-Gas Container Appurtenances.

~~50.7.2.4.4.1~~ **50.8.7.4.1** Container appurtenances shall be installed in accordance with the following:

1. Pressure relief valve installation on ASME containers installed in the interior of vehicles complying with Section 11.9 of NFPA 58 shall comply with 11.8.5 of NFPA 58.
2. Pressure relief valve installations on ASME containers installed on the outside of vehicles shall comply with 11.8.5 of NFPA 58 and ~~50.7.2.4.3.3~~50.8.7.3.6.
3. Main shutoff valves on containers for liquid and vapor shall be readily accessible.
4. Cylinders shall be designed to be filled in either the vertical or horizontal position, or if they are the universal type, they are permitted to be filled in either position.
5. All container inlets, outlets, or valves installed in container inlets or outlets, except pressure relief devices and gauging devices, shall be labeled to designate whether they communicate with the vapor or liquid space.
6. Containers from which only vapor is to be withdrawn shall be installed and equipped with connections to minimize the possibility of the accidental withdrawal of liquid.

[**58:**6.26.4.1]

50.8.7.4.2 Propane containers shall be so located that the discharge from their pressure relief valves shall be not less than 3 ft (0.9 m) measured horizontally along the surface of the vehicle from any of the following located below the level of such discharge:

(1) Openings into the vehicle
(2) Propane-burning appliance intake and exhaust vents
(3) All combustion engine and hydronic heating appliance exhaust terminations [**96:**17.7.4.2]

~~50.7.2.4.4.2~~ **50.8.7.5** Regulators shall be installed in accordance with 6.10.2 of NFPA 58 and ~~50.7.2.4.4.2.1~~50.8.7.5.1 through ~~50.7.2.4.4.2.5~~50.8.7.5.5. [**58:**6.26.4.2]

~~50.7.2.4.4.2.1~~ **50.8.7.5.1** Regulators shall be installed with the pressure relief vent opening pointing vertically downward to allow for drainage of moisture collected on the diaphragm of the regulator. [**58:**6.26.4.2(A)]

~~50.7.2.4.4.2.2~~ **50.8.7.5.2** Regulators not installed in compartments shall be equipped with a durable cover designed to protect the regulator vent opening from sleet, snow, freezing rain, ice, mud, and wheel spray. [**58:**6.26.4.2(B)]

~~50.7.2.4.4.2.3~~**50.8.7.5.**3 If vehicle-mounted regulators are installed at or below the floor level, they shall be installed in a compartment that provides protection against the weather and wheel spray. [**58:**6.26.4.2(C)]

~~50.7.2.4.4.2.4~~ **50.8.7.5.4** Regulator compartments shall comply with the following:

1. The compartment shall be of sufficient size to allow tool operation for connection to and replacement of the regulator(s).
2. The compartment shall be vaportight to the interior of the vehicle.
3. The compartment shall have a 1 in.^{2} (650 mm^2) minimum vent opening to the exterior located within 1 in. (25 mm) of the bottom of the compartment.
4. The compartment shall not contain flame or spark-producing equipment. [**58:**6.26.4.2(D)]

~~50.7.2.4.4.2.5~~ **50.8.7.5.5** A regulator vent outlet shall be at least 2 in. (51 mm) above the compartment vent opening. [**58:**6.26.4.2(E)]

~~50.7.2.4.5~~50.8.7.6 Gas Piping.

~~50.7.2.4.5.1~~ **50.8.7.6.1** Piping shall be installed in accordance with 6.11.3 of NFPA 58 and ~~50.7.2.4.5.1.1~~50.8.7.6.1.1 through ~~50.7.2.4.5.1.13~~50.8.7.6.1.13. [**58:**6.26.5.1]

~~50.7.2.4.5.1.1~~**50.8.7.6.1.1** Steel tubing shall have a minimum wall thickness of 0.049 in. (1.2 mm). [58:6.26.5.1(A)]

~~50.7.2.4.5.1.2~~ **50.8.7.6.1.2** A flexible connector shall be installed between the regulator outlet and the fixed piping system to protect against expansion, contraction, jarring, and vibration strains. [**58:**6.26.5.1(B)]

~~50.7.2.4.5.1.3~~**50.8.7.6.1.3** Flexibility shall be provided in the piping between a cylinder and the gas piping system or regulator. [**58:**6.26.5.1(C)]

~~50.7.2.4.5.1.4~~**50.8.7.6.1.4** Flexible connectors shall be installed in accordance with 6.11.6 of NFPA 58. [**58:**6.26.5.1(D)]

~~50.7.2.4.5.1.5~~**50.8.7.6.1.5** Flexible connectors longer than the length allowed in NFPA 58, or fuel lines that incorporate hose, shall be used only where approved. [**58:**6.26.5.1(E)]

~~50.7.2.4.5.1.6~~ **50.8.7.6.1.6** The fixed piping system shall be designed, installed, supported, and secured to minimize the possibility of damage due to vibration, strains, or wear and to preclude any loosening while in transit. [**58:**6.26.5.1(F)]

~~50.7.2.4.5.1.7~~ **50.8.7.6.1.7** Piping shall be installed in a protected location. [**58:**6.26.5.1(G)]

~~50.7.2.4.5.1.8~~ **50.8.7.6.1.8** Where piping is installed outside the vehicle, it shall be installed as follows:

1. Piping shall be under the vehicle and below any insulation or false bottom.
2. Fastening or other protection shall be installed to prevent damage due to vibration or abrasion.
3. At each point where piping passes through sheet metal or a structural member, a rubber grommet or equivalent protection shall be installed to prevent chafing.

[**58:**6.26.5.1(H)]

~~50.7.2.4.5.1.9~~**50.8.7.6.1.9** Gas piping shall be installed to enter the vehicle through the floor directly beneath or adjacent to the appliance served. [**58:**6.26.5.1(I)]

~~50.7.2.4.5.1.10~~ **50.8.7.6.1.10** If a branch line is installed, the tee connection shall be located in the main gas line under the floor and outside the vehicle. [**58:**6.26.5.1(J)]

~~50.7.2.4.5.1.11~~ **50.8.7.6.1.11** Exposed parts of the fixed piping system either shall be of corrosion-resistant material or shall be coated or protected to minimize exterior corrosion. [**58:**6.26.5.1(K)]

~~50.7.2.4.5.1.12~~ **50.8.7.6.1.12** Hydrostatic relief valves shall be installed in isolated sections of liquid piping as provided in Section 6.15 of NFPA 58. [**58:**6.26.5.1(L)]

~~50.7.2.4.5.1.13~~ **50.8.7.6.1.13** Piping systems, including hose, shall be pressure tested and proven free of leaks in accordance with Section 6.16 of NFPA 58. [**58:**6.26.5.1(M)]

~~50.7.2.4.5.2~~ **50.8.7.6.2** There shall be no fuel connection between a tractor and trailer or other vehicle units. [**58:**6.26.5.2]

~~50.7.2.4.12~~50.8.7.6.3 After installation or modification, piping systems (including hose) shall be proven free of leaks at not less than the normal operating pressure. [**58:**6.16.1.1]

~~50.7.2.4.10~~50.8.7.6.4* Containers shall be designed, fabricated, tested, and marked (or stamped) in accordance with the regulations of the U.S. Department of Transportation (DOT 49 CFR); Federal Aviation Administration (FAA 14 CFR); the ASME *Boiler and Pressure Vessel Code*, Section VIII, "Rules for the Construction of Unfired Pressure Vessels"; or the API-ASME *Code for Unfired Pressure Vessels for Petroleum Liquids and Gases*, except for UG-125 through UG-136. [**58:**5.2.1.1]

~~A.50.7.2.4.10~~A.50.8.7.6.4 Prior to April 1, 1967, regulations of the U.S. Department of Transportation were promulgated by the Interstate Commerce Commission. In Canada, the regulations of the Canadian Transport Commission apply and are available from the Canadian Transport Commission, Union Station, Ottawa, Canada. [**58:**A.5.2.1.1]

Construction of containers to the API-ASME Code for Unfired Pressure Vessels for Petroleum Liquids and Gases has not been authorized after July 1, 1961. [58:A.5.2.1.1]

~~50.7.2.4.10.1~~ 50.8.7.6.4.1 Used containers constructed to specifications of the Association of American Railroads shall not be installed. [**58:**5.2.1.1(A)]

~~50.7.2.4.10.2~~50.8.7.6.4.2 Adherence to applicable ASME Code case interpretations and addenda that have been adopted and published by ASME 180 calendar days prior to the effective date of NFPA 58 shall be considered as compliant with the ASME Code. [**58:**5.2.1.1(B)]

~~50.7.2.4.10.3~~50.8.7.6.4.3 Where containers fabricated to earlier editions of regulations, rules, or codes listed in ~~50.7.2.4.10~~50.8.7.6.4, and of the Interstate Commerce Commission (ICC) *Rules for Construction of Unfired Pressure Vessels*, prior to April 1, 1967, are used, the requirements of Section 1.4 of NFPA 58 shall apply. [**58:**5.2.1.1(C)]

~~50.7.2.4.11~~50.8.7.6.5 Containers that have been involved in a fire and show no distortion shall be requalified for continued service before being used or reinstalled. [**58:**5.2.1.2]

~~50.7.2.4.11.1~~50.8.7.6.5.1 Cylinders shall be requalified by a manufacturer of that type of cylinder or by a repair facility approved by DOT. [**58:**5.2.1.2(A)]

~~50.7.2.4.11.2~~50.8.7.6.5.2 ASME or API-ASME containers shall be retested using the hydrostatic test procedure applicable at the time of the original fabrication. [**58:**5.2.1.2(B)]

~~50.7.2.4.11.3~~50.8.7.6.5.3 All container appurtenances shall be replaced. [**58:**5.2.1.2(C)]

~~50.7.2.4.11.4~~50.8.7.6.5.4 DOT 4E specification (aluminum) cylinders and composite cylinders involved in a fire shall be removed from service. [**58:**5.2.1.1(D)5.2.1.2(D)]

~~50.7.2.4.13~~50.8.7.6.6 **General Location of Cylinder Storage~~s~~.**

~~50.7.2.4.13.1~~50.8.7.6.6.1 Cylinders in storage shall be located to minimize exposure to excessive temperature rises, physical damage, or tampering. [**58:**8.2.1.1]

~~50.7.2.4.13.2~~50.8.7.6.6.2 Cylinders in storage having individual water capacity greater than 2.7 lb (1.1 kg) [nominal 1 lb (0.45 kg) LP-Gas capacity] shall be positioned so that the pressure relief valve is in direct communication with the vapor space of the cylinder. [**58:**8.2.1.2]

~~50.7.2.4.13.3~~50.8.7.6.6.3 Cylinders stored in buildings in accordance with Section 8.3 of NFPA 58 shall not be located near exits, near stairways, or in areas normally used, or intended to be used, for the safe egress of occupants. [**58:**8.2.1.3]

~~50.7.2.4.13.4~~50.8.7.6.6.4 If empty cylinders that have been in LP-Gas service are stored indoors, they shall be considered as full cylinders for the purposes of determining the maximum quantities of LP-Gas permitted by 8.3.1, 8.3.2.1, and 8.3.3.1 of NFPA 58. [**58:**8.2.1.4]

~~50.7.2.4.13.5~~50.8.7.6.6.5 Cylinders shall not be stored on roofs. [**58:**8.2.1.5]

~~50.7.2.4.14~~50.8.7.6.7 **Protection of Valves on LP-Gas Cylinders in Storage.**

~~50.7.2.4.14.1~~ 50.8.7.6.7.1 Cylinder valves shall be protected as required by 5.2.6.1 and 7.2.2.5 of NFPA 58. [**58:**8.2.2.1]

~~50.7.2.4.14.2~~ 50.8.7.6.7.2 Screw-on-type caps or collars shall be in place on all cylinders stored, regardless of whether they are full, partially full, or empty, and cylinder outlet valves shall be closed. [**58:**8.2.2.2]

~~50.7.2.4.14.3~~ 50.8.7.6.7.3 Valve outlets on cylinders less than 108 lb (49 kg) water capacity [nominal 45 lb (20 kg) propane capacity] shall be plugged, capped, or sealed in accordance with 7.2.2.5 of NFPA 58. [**58:**8.2.2.3]

~~50.7.2.4.15~~50.8.7.7 **Transportation of Cylinders.**

~~50.7.2.4.15.1~~50.8.7.7.1 Cylinders having an individual water capacity not exceeding 1000 lb (454 kg) [nominal 420 lb (191 kg) propane capacity], when filled with LP-Gas, shall be transported in accordance with the requirements of Section 9.3 of NFPA 58. [**58:**9.3.2.1]

~~50.7.2.4.15.2~~50.8.7.7.2 Cylinders shall be constructed as provided in Section 5.2 of NFPA 58 and equipped in accordance with Section 5.75.9 of NFPA 58 for transportation as cylinders. [**58:**9.3.2.2]

~~50.7.2.4.15.3~~50.8.7.7.3 The quantity of LP-Gas in cylinders shall be in accordance with Chapter 7 of NFPA 58. [**58:**9.3.2.3]

~~50.7.2.4.15.4~~50.8.7.7.4 Cylinder valves shall comply with the following:

1. Valves of cylinders shall be protected in accordance with 5.2.6.1 of NFPA 58.
2. Screw-on-type protecting caps or collars shall be secured in place.
3. The provisions of 7.2.2.5 of NFPA 58 shall apply. [**58:**9.3.2.4]

~~50.7.2.4.15.5~~ 50.8.7.7.5 The cargo space of the vehicle shall be isolated from the driver's compartment, the engine, and the engine's exhaust system. [**58:**9.3.2.5]

~~50.7.2.4.15.5.1~~50.8.7.7.5.1 Open-bodied vehicles shall be considered to be in compliance with this provision. [**58:**9.3.2.5(A)]

~~50.7.2.4.15.5.2~~50.8.7.7.5.2 Closed-bodied vehicles having separate cargo, driver, and engine compartments shall be considered to be in compliance with this provision. [**58:**9.3.2.5(B)]

~~50.7.2.4.15.5.3~~50.8.7.7.5.3 Closed-bodied vehicles, such as passenger cars, vans, and station wagons, shall not be used for transporting more than 215 lb (98 kg) water capacity [nominal 90 lb (41 kg) propane capacity], but not more than 108 lb (49 kg) water capacity [nominal 45 lb (20 kg) propane capacity] per cylinder, unless the driver and engine compartments are separated from the cargo space by a vaportight partition that contains no means of access to the cargo space. [**58:**9.3.2.5(C)]

~~50.7.2.4.15.6~~50.8.7.7.6 Cylinders and their appurtenances shall be determined to be leak-free before being loaded into vehicles. [**58:**9.3.2.6]

~~50.7.2.4.15.7~~50.8.7.7.7 Cylinders shall be loaded into vehicles with flat floors or equipped with racks for holding cylinders. [**58:**9.3.2.7]

~~50.7.2.4.15.8~~50.8.7.7.8 Cylinders shall be fastened in position to minimize the possibility of movement, tipping, and physical damage. [**58:**9.3.2.8]

~~50.7.2.4.15.9~~50.8.7.7.9 Cylinders being transported by vehicles shall be positioned in accordance with Table ~~50.7.2.4.15.9~~50.8.7.7.9. [**58:**9.3.2.9]

Table ~~50.7.2.4.15.9~~50.8.7.7.9 Orientation of Cylinders on Vehicles

Propane Capacity of Cylinder			
lb	**kg**	**Open Vehicles**	**Enclosed Spaces of Vehicles**
≤45	≤20	Any position	
>45	>20	Relief valve in communication with the vapor space	

≤4.2	≤1.9	Any position
>4.2	>1.9	Relief valve in communication with the vapor space

[**58:**Table 9.3.2.9]

~~50.7.2.4.15.10~~**50.8.7.7.10** Vehicles transporting cylinders where the total weight is more than 1000 lb (454 kg), including the weight of the LP-Gas and the cylinders, shall be placarded as required by DOT regulations or state law. [**58:**9.3.2.10]

50.8.8 Electrical Wiring.

50.8.8.1 Vehicle-mounted generators shall comply with the provisions of *NFPA 70*, Article 551, Part III. [**96:**17.8.1]

50.8.8.2 The manufacturer of an engine generator unit intended for installation in a recreational vehicle shall provide instructions for the safe and effective installation, operation, and servicing of the generator. [**96:**17.8.2]

50.8.8.3 Refueling of internal combustion engine power sources shall be permitted only when the electric generators and internal combustion power sources are not in use. [**96:**17.8.3]

50.8.8.3.1 Refueling of internal combustion engines shall not be allowed during mobile or temporary cooking operations. [**96:**17.8.3.1]

50.8.8.3.2 Refueling of internal combustion engine power sources from a container shall be permitted when the engine is shut down and the surface temperature of the engine and fuel tank is below the autoignition temperature of the fuel. [**96:**17.8.3.2]

50.8.9 Carbon Monoxide Detectors.

~~50.7.1.11.2~~ **50.8.9.1** If the heat source is nonelectric and open flames are used, at least ~~An approved~~ one listed carbon monoxide detector shall be installed ~~where mobile cooking operations are performed in an enclosed area~~. [**96:**17.9.1]

~~50.7.1.9~~**50.8.10** **Training.**

~~50.7.1.9.1~~**50.8.10.1*** Prior to performing ~~mobile or temporary~~ cooking operations, one worker~~s~~ shall be provided with initial training ~~ed~~ in emergency response procedures, including the following:

1. ~~Proper u~~Using~~e of~~ portable fire extinguishers and extinguishing systems
2. ~~Proper method of s~~Shutting off fuel sources
3. ~~Proper procedure for n~~Notifying the local fire department
4. ~~Proper r~~Refueling internal combustion engine power sources and LP-Gas container change-out
5. ~~How to p~~Performing leak detection of LP-Gas 6.

~~F~~Understanding fuel properties

[**96:**17.10.1]

~~A.50.7.1.9.1 An approved method of leak detection would include pressurizing the LP-Gas system with LP-Gas and utilizing a gas meter to detect the presence of LP-Gas around the tank, piping, and appliances.~~

50.8.10.2 During the time of cooking operation at least one person in the vehicle shall be trained to provide the functions listed in 50.8.10.1. [**96:**17.10.2]

50.8.10.3 The provision of training shall be the responsibility of the owner, and the training program and materials shall be acceptable to the AHJ. [**96:**17.10.3]

~~50.7.1.9.2~~ **50.8.10.4** Refresher training shall be provided ~~every year~~annually. [**96:**17.10.4]

~~50.7.1.9.3~~ **50.8.10.5** Initial and refresher training shall be documented, and the documentation shall be held in the mobile unit and made available to the AHJ upon request. [**96:**17.10.5]

50.8.10.6 The address of the current operational location shall be posted and accessible to all employees. [**96:**17.10.6]

~~50.7.2.4.9~~**50.8.11 Parking, Servicing, and Repair.**

~~50.7.2.4.9.1~~ **50.8.11.1** Where vehicles with LP-Gas fuel systems used for purposes other than propulsion are parked, serviced, or repaired inside buildings, the requirements of 50.8.11.2~~50.7.2.4.9.2~~ through 50.8.11.4~~50.7.2.4.9.4~~ shall apply. [**58:**6.26.8.1]

~~50.7.2.4.9.2~~ **50.8.11.2** The fuel system shall be leak-free, and the container(s) shall not be filled beyond the limits specified in Chapter 7 of NFPA 58. [**58:**6.26.8.2]

~~50.7.2.4.9.3~~ **50.8.11.3** The container shutoff valve shall be closed, except that the container shutoff valve shall not be required to be closed when fuel is required for test or repair. [**58:**6.26.8.3]

~~50.7.2.4.9.4~~**50.8.11.4** The vehicle shall not be parked near sources of heat, open flames, or similar sources of ignition, or near unventilated pits. [**58:**6.26.8.4]

~~50.7.2.4.9.5~~ **50.8.11.5** Vehicles having containers with water capacities larger than 300 gal (1.1 m^3) shall comply with the requirements of Section 9.7 of NFPA 58. [**58:**6.26.8.5]

~~50.7.1.3~~ **50.8.11.6** Wheel chocks shall be ~~used~~ provided to prevent mobile and temporary cooking units from moving. [**96:**17.11.5]

~~**50.7.2 Mobile Cooking.**~~

~~**50.7.2.1 General.** Mobile cooking operations and equipment shall comply with 50.7.1, 50.7.2, and NFPA 96.~~

~~50.7.2.4.8~~**50.8.12 General Precautions.**

~~50.7.2.4.8.1~~**50.8.12.1** All fat fryers shall have a lid over the oil vat that can be secured to prevent the spillage of cooking oil during transit. This lid shall be secured at all times when the vehicle is in motion.

~~**50.7.3 Temporary Cooking.**~~
~~**50.7.3.1** Temporary cooking operations and equipment shall comply with NFPA 96, Section 50.7.1 and Section 50.7.3.~~
~~**50.7.3.2** Temporary cooking equipment and installations shall comply with NFPA 58.~~
~~**50.7.3.3** Deep fat fryers, fry-o-lators, or other appliances having combustible liquids heated by LP Gas, solid fuels, or electricity shall be protected by an approved hood fire suppression system or other approved means of extinguishment in the event of fire.~~

F.3 References for Extracts in Informational Sections.
NFPA 96, *Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations*, ~~2017~~ 2021 edition

Issue Date: August 11, 2020

Effective Date: August 31, 2020

(Note: For further information on NFPA Codes and Standards, please see www.nfpa.org/docinfo**)**
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NATIONAL FIRE PROTECTION ASSOCIATION

Public Input No. 80-NFPA 1-2021 [Global Input]

See attached Tentative Interim Amendment No. 21-9 (Log No. 1499) on various NFPA 30 extracts. This TIA was issued and approved for incorporation into the document.

Additional Proposed Changes

File Name	Description	Approved
TIA_1_21_9.pdf	NFPA 1 TIA No. 21-9 (Log No. 1499)	

Statement of Problem and Substantiation for Public Input

NOTE: This public input originates from Tentative Interim Amendment No. 21-3 (Log No. 1493) issued by the Standard Council on August 11, 2020 and per the NFPA Regs., needs to be reconsidered by the Technical Committee for the next edition of the document.

Substantiation: The current text of NFPA 1 contains extracts from the last published edition of NFPA 30 but not what is most currently available which is the 2021 Edition. This TIA updates the extracted language from NFPA 30 in NFPA 1 and makes other adjustments as necessary for the changes to the updated extract text.

Emergency Nature: The standard contains an error or an omission that was overlooked during the regular revision process. The second draft report was not available during the NFPA 1 2nd draft report. Therefore, to ensure accuracy in the extract updates, the updates were done after the second draft report for the source document was posted. By waiting to update the extracts the final product in NFPA 1 will be more closely aligned to what is in the source document and ensures the most up to date information is contained in NFPA 1.

Submitter Information Verification

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Submittal Date: Mon Feb 15 11:43:46 EST 2021
Committee: FCC-HAZ

Committee Statement

Resolution: The committee agrees with the changes in the TIA and does not feel the need to provide further revision.

Tentative Interim Amendment

NFPA® 1

Fire Code

2021 Edition

Reference: Various NFPA 30 Extracts
TIA 21-9
(SC 20-8-22 / TIA Log #1499)

Note: Text of the TIA was issued and approved for incorporation into the document prior to printing.

1. Revise the following paragraphs to read as follows:

See attached.

Issue Date: August 11, 2020

Effective Date: August 31, 2020

(Note: For further information on NFPA Codes and Standards, please see www.nfpa.org/docinfo**)**
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NFPA 30, 2021 Edition, Extract Updates for NFPA 1, 2021 Edition

2.3.3 API Publications.

~~API Standard 2000, *Venting Atmospheric and Low-Pressure Storage Tanks*, 7th edition, 2014.~~

2.3.6 ASME Publications.

ANSI/ASME B31.1, *Power Piping*, 2018.
ANSI/ASME B31.4, *Pipeline Transportation Systems for Liquids and Slurries*, 2016.

2.3.7 ASTM Publications.

ASTM D86, *Standard Test Method for Distillation of Petroleum Products at Atmospheric Pressure*, 2018.

2.3.18 UL Publications.

~~UL 1746, External Corrosion Protection Systems for Steel Underground Storage Tanks, 2007.~~
UL 142A, *Safety for Special Purpose Aboveground Tanks for Specific Flammable or Combustible Liquids*, 2018.
UL 1369, *Above Ground Piping for Flammable and Combustible Liquids*, 2018.
UL 2258, *Aboveground Nonmetallic Tanks for Fuel Oil and Other Combustible Liquids*, 2018

2.4 References for Extracts in Mandatory Sections.

NFPA 30, *Flammable and Combustible Liquids Code*, ~~2018~~ 2021 edition.

3.3.14.3 *Fire Area.*

An area of a building separated from the remainder of the building by construction having a fire resistance of at least 1 hour and having all communicating openings properly protected by an assembly having a fire resistance rating of at least 1 hour. [**30,** 2021~~18~~]

3.3.14.6 *Inside Liquid Storage Area.*

A room or building used for the storage of liquids in containers or portable tanks, separated from other types of occupancies. [**30,** 2021~~18~~]

3.3.21 Barrel.

A unit of volume used in the petroleum industry that is equal to 42 gal (159 L). [**30,** 2021~~18~~]

3.3.27 *Boiling Point.

The temperature at which the vapor pressure of a liquid equals the surrounding atmospheric pressure. [**30,** 2021~~18~~]

A.3.3.27 Boiling Point (BP).

At the boiling point, the surrounding atmospheric pressure can no longer hold the liquid in the liquid state and the liquid boils. A low boiling point is indicative of a high vapor pressure and a high rate of

evaporation. [**30:**A.4.3~~, 2021~~18]

3.3.28 *Boil-Over.

An event in the burning of certain oils in an open-top tank when, after a long period of quiescent burning, there is a sudden increase in fire intensity associated with expulsion of burning oil from the tank. [**30,** 2021~~18~~]

A.3.3.28 Boil-Over.

Boil-over occurs when the residues from surface burning become more dense than the unburned oil and sink below the surface to form a hot layer, which progresses downward much faster than the regression of the liquid surface. When this hot layer, called a "heat wave," reaches water or water-in-oil emulsion in the bottom of the tank, the water is first superheated and then boils almost explosively, overflowing the tank. Oils subject to boil-over consist of components having a wide range of boiling points, including both light ends and viscous residues. These characteristics are present in most crude oils and can be produced in synthetic mixtures. [**30~~A~~**, 2021~~18~~]

A boil-over is an entirely different phenomenon from a slop-over or froth-over. Slop-over involves a minor frothing that occurs when water is sprayed onto the hot surface of a burning oil. Froth-over is not associated with a fire but results when water is present or enters a tank containing hot viscous oil. Upon mixing, the sudden conversion of water to steam causes a portion of the tank contents to overflow. [**30,** 2021~~18~~]

3.3.29.7 **Important Building.*

A building that is considered not expendable in an exposure fire. [**30,** 2021~~18~~]

A.3.3.29.7 Important Building.

Examples of important buildings include occupied buildings where egress within 2 minutes cannot be reasonably expected, and control buildings that require presence of personnel for orderly shutdown of important or hazardous processes. Important buildings can also include unprotected storage where products from fire can harm the community or the environment or buildings that contain high-value contents or critical equipment or supplies. [**30,** 2021~~18~~]

3.3.29.11 *Storage Tank Building.*

A three-dimensional space that is enclosed by a roof and walls that cover more than one-half of the possible area of the sides of the space, is of sufficient size to allow entry by personnel, will likely limit the dissipation of heat or dispersion of vapors, and restricts access for fire fighting. [**30,** 2021~~18~~]

3.3.47 Chemical Plant.

A large integrated plant or that portion of such a plant, other than a refinery or distillery, where liquids are produced by chemical reactions or used in chemical reactions. [**30,** 2021~~18~~]

3.3.54 Closed-Top Diking.

A dike with a cover intended to minimize the entrance of precipitation into the diked area. [**30,** 2021~~18~~]

3.3.72.4 **Container (Flammable or Combustible Liquid).*

A~~ny~~ vessel of 119 gal (450 L) or less capacity used for transporting or storing liquids, excluding intermediate bulk containers. [**30,** 2021~~18~~]

A.3.3.72.4 Container (Flammable or Combustible Liquid).

The U.S. DOT defines *non-bulk packaging* as having up to 119 gal (450 L) capacity in 49 CFR 171.8. [**30,** 2021~~18~~]

3.3.72.~~2~~ 4.1 *Closed Container.*

A container as herein defined, so sealed by means of a lid or other device that neither liquid nor vapor will escape from it at ordinary temperatures. [**30,** 2021~~18~~]

3.3.72.6 *Intermediate Bulk Container.*

Any closed vessel having a liquid capacity not exceeding 3000 L (793 gal) and intended for storing and transporting liquids, as defined in Title 49, Code of Federal Regulations, Parts 100 through 199 or in Part 6 of the United Nations' *Recommendations on the Transport of Dangerous Goods*. [**30,** 2021~~18~~]

3.3.79 Crude Petroleum.

Hydrocarbon mixtures that have a flash point below 150°F (65.6°C) and that have not been processed in a refinery. [**30,** 2021~~18~~]

3.3.85 Damage-Limiting Construction.

For the purposes of this code, any set of construction elements, used individually or in combination, which will act to limit damage from an explosion, including open structures, pressure relieving construction, or pressure resistant construction. [**30,** 2021~~18~~]

3.3.93 Distillery.

A plant or that portion of a plant where liquids produced by fermentation are concentrated and where the concentrated products are also mixed, stored, or packaged. [**30,** 2021~~18~~]

3.3.101 Emergency Relief Vent.

An opening, construction method, or device that will automatically relieve excessive internal pressure due to an exposure fire. [**30,** 2021~~18~~]

3.3.133 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 D92, *Standard Test Method for Flash and Fire Points by Cleveland Open Cup Tester.* [**30,** 2021~~18~~]

3.3.140 *Flash Point (FP).

The minimum temperature of a liquid at which sufficient vapor is given off to form an ignitible mixture with the air, near the surface of the liquid or within the vessel used, as determined by the appropriate test procedure and apparatus specified in Section 4.4 of NFPA 30. [**30,** 2021~~18~~]

~~A.3.3.140 Flash Point.~~

~~Flash point is a direct measure of a liquid's ability to emit flammable vapors. The lower the flash point, the greater the risk of fire. Flash point is determined using one of several different test procedures and apparatus that are specified in Section 4.4 of NFPA 30. [**30,** 2018]~~

~~A liquid that has a flash point at or below ambient temperature is easy to ignite and will burn quickly. On ignition, the spread of flame over the surface of such a liquid will be rapid, because it is not necessary for the fire to expend energy heating the liquid to generate more vapor. Gasoline is a familiar example. A liquid with a flash point above ambient temperature presents less risk because it must be heated to generate enough vapor to become ignitible; it is more difficult to ignite and presents less potential for the generation and spread of vapor. A common example is home heating oil (Fuel Oil No. 2). Home heating oil must be atomized to a fine mist in order for it to be easily ignited. [**30,** 2018]~~

~~Certain solutions of liquids in water exhibit a flash point using the standard closed-cup test procedures but will not burn and could even extinguish a fire. To assist identifying such solutions, the following standards are helpful:~~

~~(1) ASTM D4207, *Standard Test Method for Sustained Burning of Low Viscosity Liquid Mixtures by the Wick Test*~~

~~(2) ASTM D4206, *Standard Test Method for Sustained Burning of Liquid Mixtures Using the Small Scale Open-Cup Apparatus*~~

~~[**30,** 2018]~~

~~Liquid mixtures that do not sustain combustion for a specified time at a specified temperature are considered to be noncombustible. The tests described in the references listed in A.3.3.140(1) and A.3.3.140(2) provide additional data for determining proper storage and handling of such mixtures. In a confined space, such mixtures could still create an ignitible vapor–air mixture, depending on the amount of flammable liquid in the mixture and the quantity of the spill. [**30,** 2018]~~

~~Related to the flash point is the fire point. The fire point of a liquid is the temperature at which ignition of vapors will result in continued burning. As the term *flash point* suggests, the vapors generated at that temperature will flash but will not necessarily continue to burn. The difference between flash point and fire point has some significance when conducting flash point tests *[see 9.1.4(5) and 9.1.4(6) ofNFPA 30]*. However, a closed-cup flash point is used to classify the liquid and characterize its hazard. [**30,**2018]~~

~~For more information, see ASTM E502, *Standard Test Method for Selection and Use of ASTM Standards for the Determination of Flash Point of Chemicals by Closed Cup Methods*, and the ASTM *Manual on Flash Point Standards and Their Use*. [**30,** 2018]~~

3.3.143 *Fugitive Emissions.

Releases of flammable vapor that continuously or intermittently occur from process equipment during normal operations. [**30,** 2021~~18~~]

A.3.3.143 Fugitive Emissions.

These include leaks from pump seals, valve packing, flange gaskets, compressor seals, process drains, and so forth. [**30,** 2021~~18~~]

3.3.146.7 *Liquefied Gas.*

A gas, other than in solution, that in a packaging under the charged pressure exists both as a liquid and a gas at a temperature of 68°F (20°C). [**30,** 2021~~18~~]

3.3.158 Hazardous Materials Storage Locker.

A movable prefabricated structure, manufactured primarily at a site other than the final location of the structure and transported completely assembled or in a ready-to-assemble package to the final location, and intended to meet local, state, and federal requirements for outside storage of hazardous materials. [**30,** 2021~~18~~]

3.3.159 *Hazardous Reaction or Hazardous Chemical Reaction.

Reactions that result in dangers beyond the fire problems relating to flash point and boiling point of either the reactants or of the products. [**30,** 2021~~18~~]

A.3.3.159 Hazardous Reaction or Hazardous Chemical Reaction.

These dangers might include, but are not limited to, toxic effects, reaction speed (including detonation), exothermic reaction, or production of unstable or reactive materials. [**30,** 2021~~18~~]

3.3.160 Heat Transfer Fluid (HTF).

A liquid that is used as a medium to transfer heat energy from a heater or vaporizer to a remote heat consumer (e.g., injection molding machine, oven, or dryer, or jacketed chemical reactor). [**30,** 2021~~18~~]

3.3.169 Incidental Liquid Use or Storage.

Use or storage as a subordinate activity to that which establishes the occupancy or area classification. [**30,** 2021~~18~~]

3.3.178.1 *Combustible Liquid.*

An ignitible liquid that is classified as a Class II or Class III liquid. *(See 4.2.2 and 4.2.3 of NFPA 30.)*~~Any liquid that has a closed-cup flash point at or above 100°F (37.8°C), as determined by the test procedures and apparatus set forth in Section 4.4 of NFPA 30. Combustible liquids are classified according to Section 4.3 of NFPA 30.~~ [**30,** 2021~~18~~]

3.3.178.2 ~~*~~*Flammable Liquid.*

An ignitible liquid that is classified as a Class I liquid. *(See 4.2.1 of NFPA 30.)*~~Any liquid that has a closed-cup flash point below 100°F (37.8°C), as determined by the test procedures and apparatus set forth in~~

~~Section 4.4 of NFPA 30 and a Reid vapor pressure that does not exceed an absolute pressure of 40 psi (276 kPa) at 100°F (37.8°C), as determined by ASTM D323, *Standard Test Method for Vapor Pressure of Petroleum Products (Reid Method).* Flammable liquids are classified according to Section 4.3 of NFPA 30~~. [**30,** 2021~~18~~]

~~A.3.3.178.2 Flammable Liquid.~~

~~For the purposes of this *Code*, a material with a Reid vapor pressure greater than an absolute pressure of 40 psi (276 kPa) is considered to be a gas and is, therefore, not within the scope of NFPA 30. See NFPA 58. [**30,** 2021~~18~~]~~

3.3.34.4 Liquid Class.

A uniform system of classifying ignitible liquids. *(See 66.4 and Chapter 4 of NFPA 30.)*

3.3.178.4* *Ignitible Liquid.*

Any liquid or liquid mixture that has a measurable fire point. [**30,** 2021]

A.3.3.178.4 *Ignitible Liquid.*

Unless otherwise specified, the term liquid means an ignitible liquid. [**30,** 2021]

The term ignitible liquid refers to any liquid that will burn. Class I liquids [FP < 100°F (37.8°C)], Class II and Class III liquids [FP ≥ 100°F (37.8°C)], and inflammable liquids are all ignitible liquids. [**30,** 2021]

3.3.178.~~4~~5 *Stable Liquid.*

Any liquid not defined as unstable. [**30,** 2021~~18~~]

3.3.203 *Operating Unit (Vessel) or Process Unit (Vessel).

The equipment in which a unit operation or unit process is conducted. *(See also 3.3.289, Unit Operation or Unit Process.)* [**30,** 2021~~18~~]

A.3.3.203 Operating Unit (Vessel) or Process Unit (Vessel).

Unit operations include, but are not limited to, distillation, oxidation, cracking, and polymerization. [**30,** 2021~~18~~]

3.3.204 Operations.

A general term that includes, but is not limited to, the use, transfer, storage, and processing of liquids. [**30,** 2021~~18~~]

3.3.224 *Process or Processing.

An integrated sequence of operations. [**30,** 2021~~18~~]

A.3.3.224 Process or Processing.

The sequence can include both physical and chemical operations, unless the term is modified to restrict it to one or the other. The sequence can involve, but is not limited to, preparation, separation, purification, or change in state, energy content, or composition. [**30,** 2021~~18~~]

3.3.227 Protection for Exposures.

Fire protection for structures on property adjacent to liquid storage that is provided by (1) a public fire department or (2) a private fire brigade maintained on the property adjacent to the liquid storage, either of which is capable of providing cooling water streams to protect the property adjacent to the liquid storage. [**30,** 2021~~18~~]

3.3.236 Refinery.

A plant in which flammable or combustible (ignitible) liquids are produced on a commercial scale from crude petroleum, natural gasoline, or other hydrocarbon sources. [**30,** 2021~~18~~]

3.3.244 *Safety Can.

A listed container of not more than 5.3 gal (20 L) capacity having a screen or strainer in each fill and pour opening~~,~~ and having a spring-closing lid and spout cover~~,~~ designed to safely relieve internal pressure when exposed to fire. [**30,** 2021~~18~~]

A.3.3.244 Safety Can.

Safety cans listed to UL 30, *Metal Safety Cans,* are limited to 5 U.S. gal (19 L). UL 1313, *Nonmetallic Safety Cans for Petroleum Products,* allows for capacities up to 5 Imperial gal (23 L). [**30,** 2021~~18~~]

3.3.278.15 **Vapor Processing System.*

A system designed to capture and process vapors displaced during transfer or filling operations by use of mechanical or chemical means. [**30,** 2021~~18~~]

A.3.3.278.15 Vapor Processing System.

Examples are systems using blower-assist for capturing vapors and refrigeration, absorption, and combustion systems for processing vapors. [**30,** 2021~~18~~]

3.3.278.16 **Vapor Recovery System.*

A system designed to capture and retain, without processing, vapors displaced during transfer or filling operations. [**30,** 2021~~18~~]

A.3.3.278.16 Vapor Recovery System.

Examples are balanced-pressure vapor displacement systems and vacuum-assist systems without vapor processing. [**30,** 2021~~18~~]

3.3.279.2 *Aboveground Tank.*

A storage tank that is installed above grade, at grade, or below grade without backfill. [**30,** 2021~~18~~]

3.3.279.2.1 Protected Aboveground Tank.

An atmospheric aboveground storage tank with integral secondary containment and thermal insulation that has been evaluated for resistance to physical damage and for limiting the heat transferred to the primary tank when exposed to a hydrocarbon pool fire and is listed in accordance with UL 2085, *Protected Aboveground Tanks for Flammable and Combustible Liquids,* or an equivalent test procedure. [**30:**22.2.3]

3.3.279.4 **Portable Tank.*

Any vessel having a liquid capacity over 60 gal (230 L) intended for storing liquids and not intended for fixed installation. [**30,** 2021~~18~~]

A.3.3.279.4 Portable Tank.

A portable tank does not include any cylinder having less than 1000 lb (453.5 kg) water capacity, cargo tank, tank car tank, or trailers carrying cylinders of over 1000 lb (453.5 kg) water capacity. [**55,**2020]

3.3.279.5 *Secondary Containment Tank.*

A tank that has an inner and outer wall with an interstitial space (annulus) between the walls and that has a means for monitoring the interstitial space for a leak. [**30,** 2021~~18~~]

3.3.279.7 *Storage Tank.*

Any vessel having a liquid capacity that exceeds 60 gal (230 L), is intended for fixed installation, and is not used for processing. [**30,** 2021~~18~~]

3.3.289 Unit Operation or Unit Process.

A segment of a physical or chemical process that might or might not be integrated with other segments to constitute the manufacturing sequence. [**30,** 2021~~18~~]

3.3.296 ~~*~~Vapor Pressure.

The pressure, measured in pounds per square inch, absolute (psia), exerted by a liquid, as determined by ASTM D323, *Standard Test Method for Vapor Pressure of Petroleum Products (Reid Method).* [**30,** 2021~~18~~]

~~A.3.3.296 Vapor Pressure.~~

~~Vapor pressure is a measure of the pressure that the liquid exerts against the atmosphere above it. Just as the atmosphere exerts pressure on the surface of the liquid, the liquid pushes back. Vapor pressure is normally less than atmospheric pressure and is a measure of the liquid's tendency to evaporate (i.e., to move from the liquid to the gaseous state). This tendency is also referred to as volatility, thus the use of the term *volatile* to describe liquids that evaporate very easily. The higher the vapor pressure, the greater the rate of evaporation and the lower the boiling point. Simply put, this means more vapors and increased fire risk. [**30:**A.4.2.6]~~

3.3.300.1 *General-Purpose Warehouse.*

A separate, detached building or portion of a building used only for warehousing-type operations and classified as a "storage — low hazard" or "storage — ordinary hazard" occupancy by the building code and by NFPA *101*. [**30,** 2021~~18~~]

3.3.300.2 *Liquid Warehouse.*

A separate, detached building or an attached building that is used for warehousing-type operations for liquids and whose exterior wall comprises at least 25 percent of the building perimeter. [**30,** 2021~~18~~]

42.3.3.2.4 Storage Tank Selection and Arrangement.

42.3.3.2.6.1

Vaults that contain tanks storing Class I liquids [FP < 100°F (37.8°C)] shall be ventilated at a rate of not less than 1 cfm/ft^2 of floor area (0.3 m^3/min/m^2), but not less than 150 cfm (4 m^3/min). [**30:**25.10.1]

42.3.3.2.7 Detection and Alarm Systems for Storage Tank Vaults~~Vapor and Liquid Detection Systems~~.

42.3.3.2.7.6

Activation of either the vapor detection system or the liquid detection system shall cause a signal to be sounded at an approved, constantly attended location within the facility serving the tanks or at an approved location. [**30:**25.15.6]

42.3.3.2.8 Location of Storage Tank Vaults.

In lieu of the separation distance requirements given in 66.22.4, separation distances between the vault and any of the following shall be permitted to be reduced to 0 ft (0 m), as measured from the outer perimeter of the vault wall:

(1) Any property line that is or can be built upon
(2) The near and far sides of a public way
(3) The nearest important building on the same property

[**30:**25.4]

42.3.3.2.9 Inspection and Maintenance of Storage Tank Vaults and Equipment.

Vaults and their required equipment shall be maintained in accordance with the requirements of ~~42.3.3.2~~Chapter 25 of NFPA 30. [**30:**25.16]

42.3.3.4 Additional Requirements for Protected Aboveground Storage Tanks.

42.3.3.4.1 ~~Protected Tanks.~~

Protected aboveground tanks shall be tested and listed in accordance with UL 2085, *Protected Aboveground Tanks for Flammable and Combustible Liquids.* [**30:**22.10.1]

42.3.3.4.2~~1~~

Protected aboveground tanks shall also meet both of the following requirements:

(1) The construction that provides the required fire-resistive protection shall reduce the heat transferred to the primary tank in order to limit the temperature of the primary tank to an average maximum rise of 260°F (144°C) and a single point maximum rise of 400°F (204°C) and to prevent release of ignitible (flammable or combustible) liquid, failure of the primary tank, failure of the supporting structure, and impairment of venting for a period of not less than 2 hours when tested using the fire exposure specified in UL 2085, *Protected Aboveground Tanks for Flammable and Combustible Liquids*.

(2) Reduction in sizing of the emergency vents in accordance with 22.7.3.5 of NFPA 30 shall not be permitted.

[**30:**22.10.2]

42.10.3.1.3.10.2

Joints ~~[and flanges]~~ shall be designed and installed so that the mechanical strength of the joint will not be impaired if exposed to a fire. [**30:**27.5.1.2]

43.1.6.2 ~~Storage in Process Areas~~General Occupancy Limits.

The maximum allowable quantities (MAQs) of ignitible (flammable or~~and~~ combustible) liquids allowed in each control area shall not exceed the amounts specified in Table 43.1.6.2. [**30:**9.6.1]~~, with additional quantities allowed in accordance with the requirements established in 43.1.6.3. [**33:**8.2]~~

~~1~~Table 43.1.6.2 MAQ of Ignitible (Flammable ~~and~~ or Combustible) Liquids per Control Area

Liquid Classes[#]	Quantity		~~Notes~~
	gal	L	Notes~~gal~~
IA	~~115~~30	115~~30~~	1, 2
IB and~~&~~ IC	120~~460~~	460~~120~~	1, 2
IA, IB, IC combined	120~~460~~	460~~120~~	1, 2, 3
II	120~~460~~	460~~120~~	1, 2
IIIA	330~~1,265~~	1,265~~330~~	1, 2
IIIB	13,200	50,600	1, 2, 4

[#] See 66.4.1 for details on the classification scheme.

Notes:

(1) Quantities are permitted to be increased 100 percent where ~~all liquids are~~ stored in approved ~~flammable~~ liquid~~s~~ storage cabinets or in safety cans in accordance with the fire code. Where Note 2 also applies, the increase for both notes is permitted to be applied accumulatively.

(2) Quantities are permitted to be increased 100 percent in buildings equipped throughout with an automatic sprinkler system installed in accordance with NFPA 13. Where Note 1 also applies, the increase for both notes is permitted to be applied accumulatively.

(3) Containing not more than the maximum allowable quantity per control area of Class IA, Class IB, or Class IC [FP < 100°F (37.8°C)]~~flammable~~ liquids, individually.~~[~~

(4) Quantities are not limited in a building equipped throughout with an automatic sprinkler system installed in accordance with NFPA 13 and designed in accordance with the protection criteria contained in 66.16.
Exception: As modified by 9.6.2 and Chapters 10 through 14 of NFPA 30.
[**30:**Table 9.6.1]

43.1.8.8.1.1

Paragraph 43.1.8.8 shall apply to solvent distillation units having distillation chambers or still pots that do not exceed 60 gal (227~~30~~ L) nominal capacity and are used to recycle Class I, Class II, ~~and~~ or Class IIIA liquids [FP < 200°F (93°C)]. [**30:**19.6.1.1]

43.1.8.8.5 Liquid Storage.

Distilled liquids and liquids awaiting distillation shall be stored in accordance with ~~Chapter 6 of~~ NFPA 30. [~~**33**~~**30**:~~10.8.5~~19.6.5]

63.3.1.18 Installation of Underground Piping.

63.3.1.18.6

In paved areas where a minimum 4 in. (100 mm) of reinforced concrete is used, backfill between the pipe and the ~~concrete~~ asphalt shall be permitted to be reduced to 4 in. (100 mm) minimum. [**30:**27.6.5.4]

63.3.1.18.9

Piping within the same trench shall be separated horizontally by at least two pipe diameters. Separation ~~shall~~ need not ~~need to~~ exceed 9 in. (230 mm). [**30:**27.6.5.7]

66.1.3

This chapter shall not apply to the following:

(1) * Any liquid that has a melting point of 100°F (37.8°C) or greater
(2) * Any liquid that does not meet the criteria for fluidity given in the definition of *liquid* in 3.3.30 of NFPA 30 and in the provisions of Chapter 4 of NFPA 30
(3) Any cryogenic fluid or liquefied gas, as defined in 3.3.146.7
(4) * Any liquid that does not have a flash point, but which is capable of burning under certain conditions
(5) * Any aerosol product
(6) Any mist, spray, or foam
(7) * Transportation of ignitible (flammable or~~and~~ combustible) liquids as governed by the U.S. Department of Transportation
(8) * Storage, handling, and use of fuel oil tanks and containers connected with oil-burning equipment
(9) * Use and installation of alcohol-based-hand-rub (ABHR) dispensers *(See 60.5.2.)*
(10)Liquids in the fuel tanks of motor vehicles, aircraft, boats, or portable or stationary engines

(11)Liquids that have no fire point when tested in accordance with ASTM D92, *Flash and Fire Points by Cleveland Open Cup Tester*, up to the boiling point of the liquid or up to a temperature at which the liquid shows an obvious physical change

~~(9)~~(12) Liquids with a flash point greater than 95°F (35°C) in a water-miscible solution or water-miscible dispersion with a water and noncombustible solids content of more than 80 percent by weight, and which does not sustain combustion when tested in accordance with "Method of Testing for Sustained Combustibility," in accordance with 49 CFR 173, Appendix H, or the UN publication, *Recommendations on the Transport of Dangerous Goods*

[**30:**1.1.2]

A.66.1.3(1)

Liquids that are solid at 100°F (37.8°C) or above, but are handled, used, or stored at temperatures above their ~~flash points~~FP, should be reviewed against pertinent sections of this *Code*. [**30:**A.1.1.2(1)]

A.66.1.3(4)

Certain mixtures of flammable or combustible (ignitible) liquids and halogenated hydrocarbons either do not exhibit a ~~flash point~~FP using the standard closed-cup test methods or will exhibit elevated ~~flash points~~FP. However, if the halogenated hydrocarbon is the more volatile component, preferential evaporation of this component can result in a liquid that does have a ~~flash point~~FP or has a FP~~flash point~~ that is lower than the original mixture. In order to evaluate the fire hazard of such mixtures, FP~~flash point~~ tests should be conducted after fractional evaporation of 10, 20, 40, 60, or even 90 percent of the original sample or other fractions representative of the conditions of use. For systems such as open process tanks or spills in open air, an open-cup test method might be more appropriate for estimating the fire hazard. [**30:**A.1.1.2(4)]

A.66.1.3(7)

Requirements for transportation of flammable and combustible (ignitible) liquids can be found in NFPA 385 and in the U.S. Department of Transportation's Hazardous Materials Regulations, Title 49, Code of Federal Regulations, Parts 100–199. [**30:**A.1.1.2(7)]

66.1.4

Installations made in accordance with the applicable requirements of the following standards shall be deemed to be in compliance with this *Code*:

(1) NFPA 20~~, *Standard for the Installation of Stationary Pumps for Fire Protection*~~
(2) NFPA 30A~~, *Code for Motor Fuel Dispensing Facilities and Repair Garages*~~
(3) NFPA 31~~, *Standard for the Installation of Oil-Burning Equipment*~~
(4) NFPA 32~~, *Standard for Drycleaning Plants*~~
(5) NFPA 33~~, *Standard for Spray Application Using Flammable or Combustible Materials*~~
(6) NFPA 34~~, *Standard for Dipping, Coating, and Printing Processes Using Flammable or Combustible Liquids*~~
(7) NFPA 35~~, *Standard for the Manufacture of Organic Coatings*~~
(8) NFPA 36~~, *Standard for Solvent Extraction Plants*~~
(9) NFPA 37~~, *Standard for the Installation and Use of Stationary Combustion Engines and Gas Turbines*~~

(10)NFPA 45~~, *Standard on Fire Protection for Laboratories Using Chemicals*~~
(11)NFPA 99~~, *Health Care Facilities Code*~~
(12)NFPA *101*~~, *Life Safety Code*~~
[**30:**1.5.3]

66.3.3.10 Container.

A~~ny~~ vessel of 119 gal (450 L) or less capacity used for transporting or storing liquids, excluding intermediate bulk containers. [**30,** 2021~~18~~]

66.3.3.11 Control Area.

For ~~the purposes of~~ this chapter, a building or portion of a building within which ~~flammable and combustible~~ liquids are allowed to be stored, dispensed, and used or handled in quantities that do not exceed the maximum allowable quantity (MAQ). [**30,** 2021~~18~~]

66.3.3.19 *Hazardous Material or Hazardous Chemical.

Material presenting dangers beyond the fire problems relating to flash point and boiling point. [**30,** 2021~~18~~]

A.66.3.3.19 Hazardous Material or Hazardous Chemical.

These dangers can arise from, but are not limited to, toxicity, reactivity, instability, or corrosivity. [**30,** 2021~~18~~]

66.3.3.23 High-~~-~~Hazard Level 2 Contents.

Contents that present a deflagration hazard or a hazard from accelerated burning, which, for this chapter ~~*Code*~~, includes~~. For the purposes of this chapter, this includes~~ Class I, Class II, or Class IIIA liquids [FP < 200°F (93°C)] that are used or stored in normally open containers or systems, or in closed containers or systems at gauge pressures 15 psi (103 kPa) or greater. [**30,** 2021~~18~~]

66.3.3.24 High-~~-~~Hazard Level 3 Contents.

Contents that readily support combustion or that present a physical hazard, which, for this ~~*Code*~~chapter, ~~. For the purposes of this chapter, this~~ includes Class I, Class II, or Class IIIA liquids [FP < 200°F(93°C)] that are used or stored in normally closed containers or in closed systems at gauge pressures of less than 15 psi (103 kPa). [**30,** 2021~~18~~]

66.3.3.33.2 Low-Pressure Tank.

For the purposes of this *chapter*, a storage tank designed to withstand an internal pressure above a gauge pressure of 1.0 psi~~g~~ (6.9 kPa) but not more than a gauge pressure of 15 psi (103 kPa) measured at the top of the tank. [**30,** 2021~~18~~]

66.3.3.33.3.1 *Nonmetallic Portable Tank.

A portable tank, as herein defined, constructed of plastic, fiber, or a material other than metal. [**30,**

2021~~18~~]

A.66.3.3.33.3.1 Nonmetallic Portable Tank.

Permissible nonmetallic portable tanks for shipping Class I, Class II, or Class IIIA liquids [FP < 200°F (93°C) and any BP] are governed by hazardous materials transportation regulations promulgated by the United Nations (UN) and the U.S. Department of Transportation (DOT). Small tanks for Class IIIB liquids [FP ≥ 200°F (93°C)] are not governed by either UN or DOT hazardous materials regulations. Fiber portable tanks for Class IIIB liquids [FP ≥ 200°F (93°C)] include composite designs consisting of a multi-ply corrugated box with a rigid or flexible inner plastic bladder. [**30,** 2021~~18~~]

66.3.3.36 Vapor Processing Equipment.

Those components of a vapor processing system designed to process vapors or liquids captured during transfer or filling operations. [**30,** 2021~~18~~]

66.3.3.40 *Warehouse.

A.66.3.3.40

Warehouse.

Warehousing operations referred to in these definitions are those operations not accessible to the public and include general-purpose, merchandise, distribution, and industrial warehouse–type operations. [**30,** 2021~~18~~]

66.4 ~~Definition and~~ Classification of Liquids.

~~66.4.1 Definitions Specific to Liquids.~~

~~For the purposes of this chapter, the terms in this subsection shall have the definitions given. [**30:**4.2]~~

~~66.4.1.1* Boiling Point.~~

~~See 3.3.27.~~

~~A.66.4.1.1~~

~~See A.3.3.27.~~

~~66.4.1.2 Combustible Liquid.~~

~~See 3.3.178.1.~~

~~66.4.1.3 Flammable Liquid.~~

~~See 3.3.178.2.~~

~~66.4.1.4* Flash Point.~~

~~See 3.3.140.~~

~~**A.66.4.1.4**~~

~~See A.3.3.140~~

~~**66.4.1.5 Liquid.**~~

~~See 3.3.172.~~

~~**66.4.1.6* Vapor Pressure.**~~

~~See 3.3.296.~~

~~**A.66.4.1.6**~~

~~See A.3.3.296~~

66.4.~~2~~ 1 *Classification ~~of Liquids~~Scheme.

66.4.1.1 Class I Liquids.

66.4.1.1.1

A liquid with a closed-cup flash point below 100°F (37.8°C) shall be designated as a Class I liquid (i.e., flammable liquid), as determined by the test procedures and apparatus set forth in Section 4.4 and a Reid vapor pressure that does not exceed an absolute pressure of 40 psi (276 kPa) at 100°F (37.8°C), as determined by ASTM D323, Vapor Pressure of Petroleum Products (Reid Method). [**30**:4.2.1.1]

66.4.1.1.2

Class I liquids shall be further subclassified in accordance with the following:

(1) Class IA Liquid. A liquid that has a flash point below 73°F (22.8°C) and a boiling point below 100°F (37.8°C).

(2) Class IB Liquid. A liquid that has a flash point below 73°F (22.8°C) and a boiling point at or above 100°F (37.8°C).

(3) Class IC Liquid. A liquid that has a flash point at or above 73°F (22.8°C), but below 100°F (37.8°C).

[**30**:4.2.1.2]

66.4.1.2 Class II Liquids.

A liquid with a closed-cup flash point at or above 100°F (37.8°C) but below 140°F (60°C) shall be designated as a Class II liquid (i.e., combustible liquid), as determined by the test procedures and apparatus set forth in 66.4.3. [**30**:4.2.2]

66.4.1.3 Class III Liquids.

66.4.1.3.1

A liquid with a closed-cup flash point at or above 140°F (60°C) shall be designated as a Class III liquid (i.e., combustible liquid), as determined by the test procedures and apparatus set forth in 66.4.3. [30:4.2.3.1]

66.4.1.3.2

Class III liquids shall be further subclassified in accordance with the following:

(1) *Class IIIA Liquid.* A liquid that has a flash point at or above 140°F (60°C), but below 200°F (93°C).

(2) *Class IIIB Liquid.* A liquid that has a flash point at or above 200°F (93°C).

[**30**:4.2.3.2]

~~Any liquid within the scope of this chapter and subject to the requirements of this chapter shall be classified in accordance with this subsection. [**30:**4.3]~~

~~A.66.4.2~~

~~The classification of liquids is based on flash points that have been corrected to sea level, in accordance with the relevant ASTM test procedures. At high altitudes, the actual flash points will be significantly lower than those either observed at sea level or corrected to atmospheric pressure at sea level. Allowances could be necessary for this difference in order to appropriately assess the risk. [**30:**A.4.3]~~

~~Table A.66.4.2 presents a comparison of the definitions and classification of flammable and combustible liquids, as set forth in Chapter 66 of this *Code*, with similar definitions and classification systems used by other regulatory bodies. [**30:**A.4.3]~~

~~The Hazardous Materials Regulations of the U.S. Department of Transportation (DOT), as set forth in the 49 CFR 173.120(b)(2) and 173.150(f), provide an exception whereby a flammable liquid that has a flash point between 37.8°C (100°F) and 60.5°C (141°F) and does not also meet the definition of any other DOT hazard class can be reclassified as a combustible liquid [i.e., one having a flash point above 60.5°C (141°F)] for shipment by road or rail within the United States. [**30:**A.4.3]~~

2~~**Table A.66.4.2 Comparative Classification of Liquids**~~

~~**Agency**~~	~~**Agency Classification**~~	~~**Agency Flash Point**~~		~~**NFPA Definition**~~	~~**NFPA Classification**~~	~~**NFPA Flash Point**~~	
				~~**°F**~~	~~**°C**~~	~~**°F**~~	~~**°C**~~
~~ANSI Z129.1~~	~~Flammable~~	~~<141~~	~~<60.5~~	~~Flammable~~	~~Class I~~	~~<100~~	~~<37.8~~
				~~Combustible~~	~~Class II~~	~~≥100 to <140~~	~~≥37.8 to <60~~
					~~Class IIIA~~	~~≥140 to <200~~	~~≥60 to <93~~

	~~Combustible~~	~~≥141 to <200~~	~~≥60.5 to <93~~	~~Combustible~~	~~Class IIIA~~	~~≥140 to <200~~	~~≥60 to <93~~
~~DOT~~	~~Flammable~~	~~<141~~	~~<60.5~~	~~Flammable~~	~~Class I~~	~~<100~~	~~<37.8~~
				~~Combustible~~	~~Class II~~	~~≥100 to <140~~	~~≥37.8 to <60~~
					~~Class IIIA~~	~~≥140 to <200~~	~~≥60 to <93~~
	~~Combustible~~	~~≥141 to <200~~	~~≥60.5 to <93~~	~~Combustible~~	~~Class IIIA~~	~~≥140 to <200~~	~~≥60 to <93~~
~~DOTHM-181 Domestic Exemption*~~	~~Flammable~~	~~<100~~	~~<37.8~~	~~Flammable~~	~~Class I~~	~~<100~~	~~<37.8~~
	~~Combustible~~	~~≥100 to <200~~	~~≥37.8 to <93~~	~~Combustible~~	~~Class II~~	~~≥100 to <140~~	~~≥37.8 to <60~~
					~~Class IIIA~~	~~≥140 to <200~~	~~≥60 to <93~~
~~UN~~	~~Flammable~~	~~<141~~	~~<60.5~~	~~Flammable~~	~~Class I~~	~~<100~~	~~<37.8~~
				~~Combustible~~	~~Class II~~	~~≥100 to <140~~	~~≥37.8 to <60~~
					~~Class IIIA~~	~~≥140 to <200~~	~~≥60 to <93~~
	~~Combustible~~	~~≥141 to <200~~	~~≥60.5 to <93~~	~~Combustible~~	~~Class II~~	~~≥100 to <140~~	~~≥37.8 to <60~~
					~~Class IIIA~~	~~≥140 to <200~~	~~≥60 to <93~~
~~OSHA~~	~~Flammable~~	~~<100~~	~~<37.8~~	~~Flammable~~	~~Class I~~	~~<100~~	~~<37.8~~
	~~Combustible†~~	~~≥100~~	~~≥37.8~~	~~Combustible~~	~~Class II~~	~~≥100 to <140~~	~~≥37.8 to <60~~
					~~Class IIIA~~	~~≥140 to <200~~	~~≥60 to <93~~
					~~Class IIIB†~~	~~≥200~~	~~≥93~~

~~*See A.66.4.3.~~

~~†See 29 CFR 1910.106 for Class IIIB liquid exemptions. [**30:** Table A.4.3]~~

~~**66.4.2.1**~~

~~Flammable liquids, as defined in 3.3.178.2 and 66.4.1.3, shall be classified as Class I liquids and shall be further subclassified in accordance with the following:~~

~~(1) Class IA Liquid — Any liquid that has a flash point below 73°F (22.8°C) and a boiling point below 100°F (37.8°C)~~

~~(2) Class IB Liquid — Any liquid that has a flash point below 73°F (22.8°C) and a boiling point at or above 100°F (37.8°C)~~

~~(3) Class IC Liquid — Any liquid that has a flash point at or above 73°F (22.8°C), but below 100°F (37.8°C)~~

~~[**30:**4.3.1]~~

~~**66.4.2.2**~~

~~Combustible liquids, as defined in 3.3.178.1 and 66.4.1.2, shall be classified in accordance with the following:~~

~~(1) Class II Liquid — Any liquid that has a flash point at or above 100°F (37.8°C) and below 140°F (60°C)~~

~~(2) Class III Liquid — Any liquid that has a flash point at or above 140°F (60°C)~~

~~(a) Class IIIA Liquid — Any liquid that has a flash point at or above 140°F (60°C), but below 200°F (93°C)~~

~~(b) Class IIIB Liquid — Any liquid that has a flash point at or above 200°F (93°C)~~

~~[**30:**4.3.2]~~

66.4.2 Determination of Boiling Point (BP).

66.4.2.1

For defining the boiling point, atmospheric pressure shall be considered to be an absolute pressure of 14.7 psi (101.4 kPa). [**30**:4.3.1]

66.4.2.2

For mixtures that do not have a constant boiling point, the 20 percent evaporated point of a distillation performed in accordance with ASTM D86, Distillation of Petroleum Products at Atmospheric Pressure, shall be considered to be the boiling point. [**30**:4.3.2]

66.4.3 Determination of Flash Point (FP).

The flash point of a liquid shall be determined according to the methods specified in 66.4.3.1 through 66.4.3.4. [**30:**4.4]

66.4.3.1.1

Cut-back asphalts, liquids that tend to form a surface film, and liquids that contain suspended solids shall not be tested in accordance with ASTM D56, *Standard Test Method for Flash Point by Tag Closed Cup Tester,* even if they otherwise meet the viscosity criteria. [**30:**4.4.1.1]

66.4.3.1.2

Such liquids as stated in 66.4.3.1.1 shall be tested in accordance with 66.4.3.2.-[**30:**4.4.1.2~~1~~]

66.4.3.3

As an alternative, ASTM D3278, *Standard Test Methods for Flash Point of Liquids by Small Scale Closed-Cup Apparatus*, shall be permitted to be used for paints, enamels, lacquers, varnishes, and related products and their components that have flash points between 32°F (0°C) and 230°F (110°C) and viscosities below 150 centiStokes at 77°F (25°C). [**30:**4.4.3]

66.6.1 *Scope.

This subsection shall apply to the hazards associated with storage, processing, handling, and use of ignitible (flammable or combustible) liquids. This subsection shall also apply when specifically referenced by another section. [**30:**6.1]

66.6.3 *Management of Fire and Explosion Hazards.

This subsection shall apply to the management methodology used to identify, evaluate, and control the hazards involved in the processing and handling of ignitible (flammable or~~and~~ combustible) liquids. These hazards include, but are not limited to, preparation, separation, purification, and change of state, energy content, or composition. [**30:**6.3]

A.66.6.3

The evaluation for management of fire hazards should consider probability of an ignitible mixture, the presence of a credible ignition source, and consequences of an ignition. Where the risk is unacceptable to the AHJ, explosion protection in accordance with NFPA 69, or deflagration venting in accordance with NFPA 68, or a combination of the two should be provided. See also *Guidelines for Chemical Process Quantitative Risk Analysis*, 2nd edition, from the Center for Chemical Process Safety/American Institute of Chemical Engineers. [**30:**A.6.3]

66.6.4 Hazards Analysis.

66.6.4.1 General.

Operations involving ignitible (flammable ~~and~~or combustible) liquids shall be reviewed to ensure that fire and explosion hazards are addressed by fire prevention, fire control, and emergency action plans, except as provided in 66.6.4.1.1. [**30:**6.4.1]

66.6.4.1.1

~~Exception No. 1:~~

~~(1)~~ Operations where liquids are used solely for on-site consumption as fuels.

(1)

~~Exception No. 2:~~

(2) Operations where Class II or Class III liquids are stored in atmospheric tanks or transferred at temperatures below their flash points.

(3)

~~Exception No. 3:~~ Mercantile occupancies, crude petroleum exploration, drillings, and well servicing operations, and normally unoccupied facilities in remote locations. [**30:**6.4.1.1]

66.6.4.1.2 Engineering Evaluation.

66.6.4.1.2.1*

The extent of fire prevention and control that is provided shall be determined in consultation with the authority having jurisdiction or by means of an engineering evaluation of the operation and application of sound fire protection and process engineering principles. [**30:**6.4.1.2.1]

~~A.66.6.4.1.1~~A.66.6.4.1.2.1

The wide range in size, design, and location of liquid-processing facilities precludes the inclusion of detailed fire and hazard prevention and control systems and methods applicable to all such facilities. The user should seek further guidance from documents such as NFPA 551 and the SFPE's *Engineering Guide to Fire Risk Assessment*. [**30:**A.6.4.1.2.1~~6.4.1.1~~]

~~66.6.4.1.1~~66.6.4.1.2.2 *

~~The extent of fire prevention and control that is provided shall be determined in consultation with the AHJ or by means of an engineering evaluation of the operation and application of sound fire protection and process engineering principles. This~~An engineering evaluation shall include, but not be limited to, the following:

(1) Analysis of the fire and explosion hazards of the operation
(2) Analysis of emergency relief from process vessels, taking into consideration the properties of the materials used and the fire protection and control measures taken
(3) Analysis of applicable facility design requirements in Chapters 17, 18, 19, 28, and 29 of NFPA 30
(4) Analysis of applicable requirements for liquid handling, transfer, and use, as covered in Chapters 17, 18, 19, 28, and 29 of NFPA 30
(5) Analysis of local conditions, such as exposure to and from adjacent properties and exposure to floods, earthquakes, and windstorms
(6) Analysis of the emergency response capabilities of the local emergency services

[**30:**6.4.1.~~1~~2.2]

66.6.4.1.2 *

Storage, processing, handling, and use of Class II and Class III liquids [FP ≥ 100°F (37.8°C)] heated at or above their flash point shall follow the requirements for Class I liquids [FP < 100°F (37.8°C)], unless an engineering evaluation conducted in accordance with Section 66.6 justifies following the requirements for some other liquid class. [**30:**6.4.1.3~~2~~]

A.66.6.4.1.2

Storage, processing, handling, and use of Class II and Class III liquids [FP≥ 100°F (37.8°C)] at temperatures above the ~~flash point~~FP can produce ignitible vapors if the liquid is released or vessels are

vented. Class I liquid [FP < 100°F (37.8°C)] requirements address such events to minimize the likelihood of ignition and the consequences if ignition occurs, thus becoming a benchmark for design features when Class II and Class III liquids [FP ≥ 100°F (37.8°C)] are handled above the FP~~flash point~~. However, their characteristics differ from those of Class I liquids [FP < 100°F (37.8°C)]. For example, the extent of travel of the Class II and III vapors is limited by the quick condensation of released vapors as they cool to lower temperatures. This might justify a more limited electrical area classification, different ventilation, elimination of explosion venting, and so forth. In addition, the process handling these Class II and Class III heated liquids ~~may~~ could incorporate safety design features that accomplish the intent of NFPA 30, that is to address the hazards of released vapors. Further, the more restrictive building construction requirements in Table 17.6.1 of NFPA 30 might not be necessary for a particular process involving Class II~~,~~ and Class III liquids [FP≥ 100°F (37.8°C)] heated above the ~~flash point~~FP. The option of conducting an engineering evaluation in accordance with Section 66.6 was included to allow the use of alternative designs to address the level of hazards identified. The SFPE's *Engineering Guide to Performance-Based Fire Protection* provides a methodology on how to perform an alternative design. [**30:**A.6.4.1.3~~2~~]

A.66.6.5.1(8)

With respect to frictional heat or sparks, it is recognized that there is a need to control sources of ignition, including mechanical sparks from hand tools, that have sufficient energy to ignite flammable vapors. Studies, anecdotes, codes, ~~and~~ referenced standards, and other historical documents (e.g., API 2214, *Spark Ignition Properties of Hand Tools*) show that there is a potential for hand tool sparks to ignite flammable vapors from a limited number of chemicals and under certain unique conditions. These include Class I liquids [FP < 100°F (37.8°C)]~~flammable liquids~~ with low minimum ignition energies, operations in which flammable or combustible (ignitible) liquids are heated, and atypical spark generation that can occur between specific types of hand tools and struck surfaces (i.e., thermite reactions or impact of steel tools on quartzitic materials). Even spark-resistant tools might not provide suitable protection against ignition. For example, hard metal particles can become imbedded in the relatively soft metal of spark-resistant tools, and these particles can cause sparks when the tools are used. [**30:**A.6.5.1(8)]

NFPA 30 requires analyses, such as job safety analyses or activity hazard analyses, of the hazards and risks of a given task and the application of appropriate protective measures to prevent or mitigate the hazards and risks. This includes identification and mitigation of ignition risk from multiple sources, including hand tools. Due to the complexity of the numerous operations involving Class I liquids~~flammable liquids~~ [FP < 100°F (37.8°C)], NFPA 30 cannot address all conditions in which spark-resistant tools should be made mandatory, might be advisable, or are unnecessary to help control the ignition risk of any given operation. [**30:**A.6.5.1(8)]

It is recognized that the adoption of the new Globally Harmonized System for labeling by the U.S. Occupational Safety and Health Administration (29 CFR 1910.1200, Appendix C) creates a generalized mandate for the use of spark-resistant tools. However, based on available technical information, this mandate goes beyond what is considered necessary for fire safety, given the fact that it applies to liquids that present little risk of ignition unless heated to or above their flash points. *(See A.66.6.4.1.2.)* [**30:**A.6.5.1(8)]

66.6.5.3.1

Welding, cutting, and similar spark-producing operations shall not be permitted in areas containing Class I ~~flammable~~ liquids [FP < 100°F (37.8°C)] until a written permit authorizing such work has been issued. [**30:**6.5.3.1]

66.6.5.4.5

All nonmetallic equipment and piping where the potential exists for an ignit~~i~~able mixture to be present shall be designed and operated to prevent electrostatic ignition. [**30:**6.5.4.5]

66.6.6.2

Those areas, including buildings, where a potential exists for a Class I~~flammable~~ liquid [flash point < 100°F (37.8°C)] ~~liquid~~ spill shall be monitored as appropriate. The following methods shall be permitted to be used:

(1) Personnel observation or patrol
(2) Process-monitoring equipment that would indicate a spill or leak could have occurred
(3) Provision of gas detectors to continuously monitor the area where facilities are unattended

[**30:**6.6.2]

66.6.7.1 *

This section identifies recognized fire protection and fire suppression systems and methods used to prevent or minimize the loss from fire or explosion in ignitible (flammable or combustible) liquid-processing facilities. The application of one or a combination of these systems and methods as well as the use of fire-resistive materials shall be determined in accordance with Sections 66.6.3 and 66.6.4. [**30:**6.7.1]

66.6.7.5

Where the need is indicated by the hazards of ignitible (flammable or combustible) liquid processing, storage, or exposure as determined by 66.6.4, fixed protection shall be provided. [**30:**6.7.5]

66.6.9.2

Maintenance and operating practices shall be established and implemented to prevent and control leakage and spillage of ignitible (flammable or~~and~~ combustible) liquids. [**30:**6.9.2]

66.6.10.1.1

This section shall apply to the management methodology used to identify, evaluate, and control the security hazards involved in the processing, storage, and handling of ignitible (flammable ~~and~~or combustible) liquids. [**30:**6.10.1.1]

66.6.10.3.1

Operations involving ignitible (flammable ~~and~~or combustible) liquids shall be reviewed to ensure that security vulnerabilities identified during the security vulnerability ~~analysis~~ assessment (SVA) are

addressed in a facility security program, with corresponding fire prevention and emergency action plans and drills. [**30:**6.10.3.1]

66.7.1 Scope.

This section shall apply to areas where Class I liquids [FP < 100°F (37.8°C)] are stored, ~~or~~ handled, or used and to areas where Class II or Class III liquids [FP ≥ 100°F (37.8°C)] are stored, ~~or~~ handled, or used at or above their flash points. [**30:**7.1]

66.7.3.3 *

Table 66.7.3.3 shall be used to delineate and classify areas for ~~the purpose of~~ installation of electrical utilization equipment and wiring under normal operating conditions. [**30:**7.3.3]

Table 66.7.3.3 Electrical Area Classifications

Location	*NEC* Class I		Extent of Classified Area
		Division	Zone
Indoor equipment installed in accordance with 66.7.3 where flammable vapor–air mixtures can exist under normal operation	1	0	The entire area associated with such equipment where flammable gases or vapors are present continuously or for long periods of time
	1	1	Area within 5 ft of any edge of such equipment, extending in all directions
	2	2	Area between 5 ft and 8 ft of any edge of such equipment, extending in all directions; also, space up to 3 ft above floor or grade level within 5 ft to 25 ft horizontally from any edge of such equipment*~~1~~
Outdoor equipment of the type covered in 66.7.3 where flammable vapor–air mixtures can exist under normal operation	1	0	The entire area associated with such equipment where flammable gases or vapors are present continuously or for long periods of time
	1	1	Area within 3 ft of any edge of such equipment, extending in all directions
	2	2	Area between 3 ft and 8 ft of any edge of such equipment, extending in all directions; also, space up to 3 ft above floor or grade level within 3 ft to 10 ft horizontally from any edge of such equipment
Tank storage installations inside buildings	1	1	All equipment located below grade level
	2	2	Any equipment located at or above grade level
Tank — aboveground, fixed roof	1	0	Inside fixed-roof tank
	1	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	2	Within 10 ft from shell, ends, or roof of tank; also, area inside dike up to top of dike wall
	1	0	Area inside of vent piping or vent opening
	1	1	Within 5 ft of open end of vent, extending in all directions
	2	2	Area between 5 ft and 10 ft from open end of vent, extending in all directions
Tank — aboveground, floating roof			
With fixed outer roof	1	0	Area between the floating and fixed-roof sections and within the shell
With no fixed outer roof	1	1	Area above the floating roof and within the shell
Tank vault — interior	1	1	Entire interior volume, if Class I liquids [FP< 100°F (37.8°C)] are stored within
Underground tank fill opening	1	1	Any pit, box, or space below grade level, if any part is within a Division 1 or 2 or Zone 1 or 2 classified location
	2	2	Up to 18 in. above grade level within a horizontal radius of 10 ft from a loose fill connection and within a horizontal radius of 5 ft from a tight fill connection
Vent — discharging upward	1	0	Area inside of vent piping or opening
	1	1	Within 3 ft of open end of vent, extending in all directions
	2	2	Area between 3 ft and 5 ft of open end of vent, extending in all directions
Drum and container filling — outdoors or indoors	1	0	Area inside the drum or container
	1	1	Within 3 ft of vent and fill openings, extending in all directions
	2	2	Area between 3 ft and 5 ft from vent or fill opening, extending in all directions; also, up to 18 in. above floor or grade level within a horizontal radius of 10 ft from vent or fill opening
Pumps, bleeders, withdrawal fittings			
Indoor	2	2	Within 5 ft of any edge of such devices, extending in all directions; also, up to 3 ft above floor or grade level within 25 ft horizontally from any edge of such devices
Outdoor	2	2	Within 3 ft of any edge of such devices, extending in all directions; also, up to 18 in. above grade level within 10 ft horizontally from any edge of such devices

Pits and sumps			
Without mechanical ventilation	1	1	Entire area within a pit or sump if any part is within a Division 1 or 2 or Zone 1 or 2 classified location
With adequate mechanical ventilation	2	2	Entire area within a pit or sump if any part is within a Division 1 or 2 or Zone 1 or 2 classified location
Containing valves, fittings, or piping, and not within a Division 1 or 2 or Zone 1 or 2 classified location	2	2	Entire pit or sump
Drainage ditches, separators, impounding basins			
Outdoor	2	2	Area up to 18 in. above ditch, separator, or basin; also, area up to 18 in. above grade within 15 ft horizontally from any edge
Indoor			Same as pits and sumps
Tank vehicle and tank car[2†]			
Loading through open dome	1	0	Area inside of the tank
	1	1	Within 3 ft of edge of dome, extending in all directions
	2	2	Area between 3 ft and 15 ft from edge of dome, extending in all directions
Loading through bottom connections with atmospheric venting	1	0	Area inside of the tank
	1	1	Within 3 ft of point of venting to atmosphere, extending in all directions
	2	2	Area between 3 ft and 15 ft from point of venting to atmosphere, extending in all directions; also, up to 18 in. above grade within a horizontal radius of 10 ft from point of loading connection
Loading through closed dome with atmospheric venting	1	1	Within 3 ft of open end of vent, extending in all directions
	2	2	Area between 3 ft and 15 ft from open end of vent, extending in all directions; also, within 3 ft of edge of dome, extending in all directions
Loading through closed dome with vapor control	2	2	Within 3 ft of point of connection of both fill and vapor lines, extending in all directions
Bottom loading with vapor control or any bottom unloading	2	2	Within 3 ft of point of connections, extending in all directions; also, up to 18 in. above grade within a horizontal radius of 10 ft from point of connections
Storage and repair garage for tank vehicles	1	1	All pits or spaces below floor level

	2	2	Area up to 18 in. above floor or grade level for entire storage or repair garage
Garages for other than tank vehicles	Ordinary		If there is any opening to these rooms within the extent of an outdoor classified location, the entire room shall be classified the same as the area classification at the point of the opening
Outdoor drum storage	Ordinary		
Inside rooms or storage lockers used for the storage of Class I liquids [FP < 100°F (37.8°C)]	2	2	Entire room or locker
Indoor warehousing where there is no ~~flammable~~ Class I liquid [FP < 100°F (37.8°C)] transfer	Ordinary		If there is any opening to these rooms within the extent of an indoor classified location, the classified location shall extend through the opening to the same extent as if the wall, curb, or partition did not exist
Office and rest rooms	Ordinary		If there is any 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
Piers and wharves			See Figure 29.3.22 of NFPA 30.

For SI units, 1 in. = 25 mm; 1 ft = 0.3 m.

~~1The~~ *The release of Class I liquids [FP < 100°F (37.8°C)] can generate vapors to the extent that the entire building, and possibly an area surrounding it, should be considered a Class I, Division 2, or Zone 2 location.

~~1~~2When classifying extent of area, consideration should 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 should be used. [**30:**~~-~~Table 7.3.3]

66.7.3.6

The area classifications listed in Table 66.7.3.3 are based on the premise that all applicable requirements of this *Code* have been met;~~.~~ ~~I~~if this is not the case, the AHJ shall have the authority to classify the extent of the area. [**30:**7.3.6]

66.8 Application of Area Classification.

Area classification ~~is~~ shall be used to assure that fixed electrical utilization equipment, electrical fixtures, and wiring are ~~properly~~ installed within Class I, Division 1; ~~Class I,~~ Zone 1; Class I, Division 2; or ~~Class I,~~ Zone 2 designated areas, as defined by Article 500 of *NFPA 70*. [**30:**7.4~~.1~~]

66.9 Storage of Ignitible (Flammable or Combustible) Liquids in Containers — General Requirements.

66.9.1.1

This section shall apply to the storage of ignitible (flammable ~~and~~or combustible) liquids in:

(1) Drums or other containers that do not exceed 119 gal (450 L) individual capacity

(2) Portable tanks that do not exceed 660 gal (2500 L) individual capacity
(3) Intermediate bulk containers that do not exceed 793 gal (3000 L)

[**30:**9.1.1]

66.9.1.2

This section shall also apply to limited transfer of ignitible (flammable or combustible) liquids incidental thereto. [**30:**9.1.2]

66.9.1.4

This section shall not apply to the following:

(1) Containers, intermediate bulk containers, and portable tanks that are used in operations areas, as covered by Section 66.17
(2) Liquids in the fuel tanks of motor vehicles, aircraft, boats, or portable or stationary engines
~~(3) Beverages where packaged in individual containers that do not exceed 1.3 gal (5 L) capacity~~
~~(4)~~(3) Beverages, ~~M~~medicines, foodstuffs, cosmetics, and other products that contain more than 20 percent by volume of water-miscible ignitible (flammable or combustible) liquids, with the remainder of the product consisting of components that do not burn
~~(5)~~(4) Liquids that have no fire point when tested in accordance with ASTM D92, *Standard Test Method for Flash and Fire Points by Cleveland Open Cup Tester*, up to the BP of the liquid or up to a temperature at which the liquid shows an obvious physical change
~~(6)~~(5) Liquids with a FP greater than 95°F (35°C) in a water-miscible solution or water-miscible dispersion with a water and noncombustible solids content of more than 80 percent by weight, and which does not sustain combustion when tested in accordance with "Method of Testing for Sustained Combustibility," in accordance with 49 CFR 173, Appendix H, or the UN publication, *Recommendations on the Transport of Dangerous Goods*
~~(7)~~(6) Distilled spirits and wines in wooden barrels or casks

[**30:**9.1.4]

66.9.2 General Requirements.

66.9.2.1

The general requirements of this section shall be applicable to the storage of ignitible (flammable or combustible) liquids in liquid storage areas as covered in Chapters 10 through 14 of NFPA 30, regardless of the quantities being stored.

Exception: Where more stringent requirements are set forth in Chapters 10 through 14 of NFPA 30, those requirements shall take precedence. [**30:**9.3.1]

66.9.2.2

For the purposes of Sections 66.9 through 66.16, unstable liquids shall be treated as Class IA liquids [FP < 73°F (22.8°C) and BP < 100°F (37.8°C)]. [**30:**9.3.2]

66.9.2.5

Class I liquids [FP < 100°F (37.8°C)] shall not be permitted to be stored in basements as defined in 3.3.22. [**30:**9.3.5]

66.9.2.6

Class II and Class IIIA liquids [100°F (37.8°C) ≤ FP < 200°F (93°C)] shall be permitted to be stored in basements as defined in 3.3.22, provided the basement is protected in accordance with Section 66.16. [**30:**9.3.6]

66.9.2.7

Class IIIB liquids [FP ≥ 200°F (93°C)] shall be permitted to be stored in basements as defined in 3.3.22. [**30:**9.3.7]

66.9.2.8.3 *

Power-operated industrial trucks used to move Class I liquids [FP < 100°F (37.8°C)] shall be selected, operated, and maintained in accordance with NFPA 505. [**30:**9.3.8.3]

A.66.9.2.8.3

Section 5.1 of NFPA 505 states, "In locations used for the storage of Class I ~~flammable~~ liquids [FP < 100°F (37.8°C)] in sealed containers or liquefied or compressed flammable gases in containers, approved power-operated industrial trucks designated as Types CNS, DS, ES, GS, LPS, GS/CNS, or GS/LPS shall be permitted to be used where approved by the AHJ." Compared to the above types, industrial trucks that are designated DY and EE have significantly less potential for igniting flammable vapors (such as might result from a spill of Class I liquid [FP < 100°F (37.8°C)]) and should be used in inside liquid storage areas where conditions warrant. [**30:**A.9.3.8.3]

66.9.2.11

Storage, handling, and use of Class II and Class III liquids [FP ≥ 100°F (37.8°C)] heated at or above their ~~flash point~~FP ~~-~~shall follow the requirements for Class I liquids [FP < 100°F (37.8°C)], unless an engineering evaluation conducted in accordance with Section 66.6 justifies following the requirements for some other liquid class. *(See 66.6.4.1.2~~9.3.1.2~~ and A.66.6.4.1.2.)* [**30:**9.3.11]

66.9.3 Acceptable Containers.

66.9.3.1 *

Only the following approved containers, intermediate bulk containers, and portable tanks shall be used for Class I, Class II, and Class IIIA liquids [FP < 200°F (93°C)]:

(1) Metal containers, metal intermediate bulk containers, and metal portable tanks meeting the requirements of, and containing products authorized by, the U.S. Department of Transportation Hazardous Materials Regulations in 49 CFR 100–199, or by Part 6 of the UN *Recommendations on the Transport of Dangerous Goods*

(2) Plastic or metal consumer-use containers meeting the requirements of, and used within the scope of~~,~~ ASTM F852, *Standard Specification for Portable Gasoline, Kerosene and Diesel Containers for Consumer Use*~~one or more of the following specifications:~~

(3) Nonmetallic or metallic commercial/industrial safety cans meeting the requirements of, and used within the scope of, one or more of the following specifications:
    (a) UL 30, *Metal Safety Cans*
    (b) UL 1313, *Nonmetallic Safety Cans for Petroleum Products*
    (c) FM Global *Approval Standard for Safety Containers and Filling, Supply, and Disposal Containers* — Class Number 6051 and 6052
(4) Plastic containers that meet requirements set by, and contain products authorized by, the following:
    (a) The U.-S. Department of Transportation Hazardous Materials Regulations in 49 CFR 100–199, or by Part 6 of the UN publication, *Recommendations on the Transport of Dangerous Goods*
    (b) Items 256 or 258 of the *National Motor Freight Classification* (NMFC) for liquids that are not classified as hazardous by the U.S. Department of Transportation Hazardous Materials Regulations in 49 CFR 100–199, or by Part 6 of the UN publication *Recommendations on the Transport of Dangerous Goods*
(5) Fiber drums that meet the following:
    (a) Requirements of Items 294 and 296 of the *National Motor Freight Classification* (NMFC)~~,~~ or of Rule 51 of the *Uniform Freight Classification* (UFC), for Types 2A, 3A, 3B-H, 3B-L, or 4A
    (b) Requirements of, and containing liquid products authorized by, either the U.S. Department of Transportation Hazardous Materials Regulations in 49 CFR Chapter I, or by the U.S. Department of Transportation exemption
(6) * Rigid nonmetallic intermediate bulk containers that meet requirements set by, and contain products authorized by, the following:
    (a) The U.S. Department of Transportation Hazardous Materials Regulations in 49 CFR 100–199, or by Part 6 of the UN publication, *Recommendations on the Transport of Dangerous Goods,* for Classes 31H1, 31H2, and 31HZ1
    (b) The *National Motor Freight Classification* (NMFC), or the International Safe Transit Association for liquids that are not classified as hazardous by the U.S. Department of Transportation Hazardous Materials Regulations in 49 CFR 100–199, or by Part 6 of the UN publication *Recommendations on the Transport of Dangerous Goods*
(7) Glass containers up to the capacity limits stated in Table 66.9.3.3 and in accordance with U.S. Department of Transportation Hazardous Materials Regulations in 49 CFR 100–199
(8) Other nonmetallic intermediate bulk containers that comply with 66.9.3.1.1

[**30:**9.4.1]

A.66.9.3.1

It is not the intent of 66.9.3 to regulate containers and packaging systems for Class IIIB liquids [FP ≥ 200°F (93°C)], except as required for protected storage in accordance with Section 66.16 ~~Chapter 16 of NFPA 30~~. [**30:**A.9.4.1]

A.66.9.3.1(6)

The term *rigid nonmetallic intermediate bulk container* is used to describe intermediate bulk containers that have a plastic vessel that serves as the primary liquid-holding component. This vessel can be

enclosed in or encased by an outer structure consisting of a steel cage, a single-wall metal or plastic enclosure, a double wall of foamed or solid plastic, or a paperboard enclosure. These are often called *composite IBCs*, which is the term used by the U.S. Department of Transportation (DOT) to describe them. The term *rigid nonmetallic intermediate bulk container* also denotes an all-plastic single-wall IBC that might or might not have a separate plastic base and for which the containment vessel also serves as the support structure. IBCs and portable tanks ~~that have~~with a~~n~~ nonmetallic inner liner that have an outer ~~liquidtight~~ metal enclosure that is sufficient, in and of itself, to be compliant with the appropriate~~structure are considered to be metal IBCs or metal portable tanks by~~ DOT/UN designation for a metal IBC or metal portable tank are considered metal IBCs or metal portable tanks ~~and are defined in~~ as designated under 66.9.3.1(1). [**30:**A.9.4.1(6)]

66.9.3.1.1

For protected storage, nonmetallic intermediate bulk containers shall comply with Table 66.9.3.3 and shall be listed and labeled in accordance with UL 236~~889~~, *Fire Exposure Testing of Intermediate Bulk Containers for Flammable and Combustible Liquids*; FM ~~Class~~ 6020, *Approval Standard for Composite Intermediate Bulk Containers*; or an equivalent test procedure. [**30:**9.4.1.1]

66.9.3.2.2

At least one pressure-actuated vent having a minimum capacity of 6000 ft^3 (170 m^3) of free air per hour at an absolute pressure of 14.7 psi (101 kPa) and 60°F (15.6°C) shall be used. The vent~~It~~ shall be set to open at not less than a gauge pressure of 5 psi (35 kPa). [**30:**9.4.2.2]

66.9.3.3

The maximum allowable size of a container, intermediate bulk container, or metal portable tank for Class I, Class II, and Class IIIA liquids [FP < 200°F (93°C)] shall not exceed that specified in Table 66.9.3.3.

Exception: As provided for in 66.9.1, 66.9.3.3.1, 66.9.3.3.3, and 66.9.3.3.4. [**30:**9.4.3]

~~4~~Table 66.9.3.3 Maximum Allowable Size — Containers, Intermediate Bulk Containers (IBCs), and Portable Tanks

		~~Flammable Liquids~~				~~Combustible Liquids~~	
Container Type		**Class IA#**	**Class IB#**	**Class IC#**		**Class II#**	**Class IIIA#**
Glass		1 pt (0.5 L)	1 qt (1 L)	1.3 gal (5 L)		1.3 gal (5 L)	5.3 gal (20 L)
Metal (other than drums) or approved plastic		1.3 gal (5 L)	5.3 gal (20 L)	5.3 gal (20 L)		5.3 gal (20 L)	5.3 gal (20 L)
Safety cans		2.6 gal (10 L)	5.3 gal (20 L)	5.3 gal (20 L)		5.3 gal (20 L)	5.3 gal (20 L)
Metal drum (e.g., UN 1A1/1A2)		119 gal (450 L)	119 gal (450 L)	119 gal (450 L)		119 gal (450 L)	119 gal (450 L)
Approved metal portable tanks and IBCs		793 gal (3000 L)	793 gal (3000 L)	793 gal (3000 L)		793 gal (3000 L)	793 gal (3000 L)

Rigid plastic IBCs (UN 31H1 or 31H2) and composite IBCs with rigid inner receptacle (UN31HZ1)†		NP	NP	NP		793 gal (3000 L)	793 gal (3000 L)
Composite IBCs with flexible inner receptacle (UN31HZ2) DOT/UN-approved flexible IBCs, and NMFC/ISTA-compliant IBCs†		NP	NP	NP		331 gal (1300 L)	331 gal (1300 L)
Non-bulk ~~B~~bag-in-box		NP	NP	NP		NP	NP
Polyethylene UN1H1 and UN1H2, or as authorized by DOT exemption		1.3 gal (5 L)	5.3 gal (20 L)*	5.3 gal (20 L)*		119 gal (450 L)	119 gal (450 L)
Fiber drum NMFC or UFC Type 2A; Types 3A, 3B-H, or 3B-L; or Type 4A		NP	NP	NP		119 gal (450 L)	119 gal (450 L)

NP: Not permitted for the container categories so classified unless a fire protection system is provided that is developed in accordance with 66.16.3.6 and is approved for the specific container and protection against static electricity is provided.
*See 66.9.3~~4~~.3.1.
†See 66.9.~~4~~3.3.2
#See 66.4.1 for details on the classification scheme.
[**30:**-Table 9.4.3]

66.9.3.3.1

Class IB and Class IC [FP < 100°F (37.8°C) and BP ≥ 100°F (37.8°C)] water-miscible liquids shall be permitted to be stored in plastic containers up to 60 gal (230 L) in size, if stored and protected in accordance with Table 66.16.5.2.7. [**30:**9.4.3.1]

66.9.3.3.2

Nonmetallic intermediate bulk containers, as permitted by Table 66.9.3.3, shall be listed and labeled in accordance with UL 2368, *Fire Exposure Testing of Intermediate Bulk Containers for Flammable and Combustible Liquids*; FM ~~Class~~ 6020, *Approval Standard for Composite Intermediate Bulk Containers*; or an equivalent test procedure. [**30:**9.4.3.2]

66.9.3.3.3

Class IA and Class IB [FP < 73°F (22.8°C)] liquids shall be permitted to be stored in glass containers of not more than 1.3 gal (5 L) capacity if the required liquid purity (such as American Chemical Society analytical reagent grade or higher) would be affected by storage in metal containers or if the liquid can cause excessive corrosion of a metal container. [**30:**9.4.3.3]

66.9.3.3.4.1

To be considered protected storage as defined in ~~66.~~9.2.1 of NFPA 30 and in accordance with Section 66.16, an overpack container shall be constructed of the same material as the leaking or damaged container. [**30:**9.4.3.4.1]

66.9.4 *~~Flammable~~ Liquid~~s~~ Storage Cabinets.

A.66.9.4

The requirements in 66.9.4 are based on hazards associated with fixed Class I~~flammable~~ liquids [FP < 100°F (37.8°C)] storage cabinets. They do not address potential hazards associated with mobile storage cabinets (i.e., cabinets with integral wheels) such as the following:

(1) Increased risk of spills
(2) Potential for tipover or blockage of egress
(3) Maintenance of vent and grounding integrity
(4) Variable condition of exposed floor surfaces under the cabinet

[**30:**A.9.5]

66.9.4.1

The volume of Class I, Class II, and Class IIIA liquids [FP < 200°F (93°C)] stored in an individual storage cabinet shall not exceed 120 gal (460 L). [**30:**9.5.1]

66.9.4.2

The total aggregate volume of Class I, Class II, and Class IIIA liquids [FP < 200°F (93°C)] in a group of storage cabinets shall not exceed the maximum allowable quantity of ~~flammable and combustible~~ liquids per control area based on the occupancy where the cabinets are located. [**30:**9.5.2]

66.9.4.3

Storage cabinets that meet at least one of the following sets of requirements shall be acceptable for storage of ignitible (flammable or combustible) liquids:

(1) Storage cabinets designed and constructed to limit the internal temperature at the center of the cabinet and 1 in. (25 mm) from the top of the cabinet to not more than 325°F (163°C), when subjected to a 10-minute fire test that simulates the fire exposure of the standard time–temperature curve specified in ASTM E119, *Fire Tests of Building Construction and Materials*,~~NFPA 251~~ shall be acceptable. All joints and seams shall remain tight and the door shall remain securely closed during the test.
(2) Metal storage cabinets constructed in the following manner shall be acceptable:
    (a) The bottom, top, door, and sides of the cabinet shall be at least No. 18 gauge sheet steel and shall be double-walled, with $1^1/_2$ in. (38 mm) air space.
    (b) Joints shall be riveted, welded, or made tight by some equally effective means.
    (c) The door shall be provided with a three-point latch arrangement, and the door sill shall be raised at least 2 in. (50 mm) above the bottom of the cabinet to retain spilled liquid within the cabinet.
    ~~(c)~~(d) New cabinets shall have self-closing doors.
(3) Wooden cabinets constructed in the following manner shall be acceptable:
    (a) The bottom, sides, and top shall be constructed of exterior-grade plywood that is at least 1 in. (25 mm) thick and of a type that will not break down or delaminate under fire conditions.
    (b) All joints shall be rabbetted and shall be fastened in two directions with wood screws.

(c) Where more than one door is used, there shall be a rabbetted overlap of not less than 1 in. (25 mm).

(d) Doors shall be equipped with a means of latching, and hinges shall be constructed and mounted in such a manner as to not lose their holding capacity when subjected to fire exposure.

(e) A raised sill or pan capable of containing a 2 in. (50 mm) depth of liquid shall be provided at the bottom of the cabinet to retain spilled liquid within the cabinet.

~~(e)~~(f) New cabinets shall have self-closing doors.

(4) Listed storage cabinets that have been constructed and tested in accordance with UL 1275, *Flammable Liquid Storage Cabinets*; FM ~~Class Number~~ 6050, *Approval Standard for Storage Cabinets for Ignitable (Flammable ~~and Combustible~~ Liquids)*; or equivalent shall be acceptable.

[**30:**9.5.3]

66.9.4.5 *

Storage cabinets shall include the following marking: ~~[**30:**9.5.5]~~

FLAMMABLE
KEEP FIRE AWAY
[**30:**9.5.5]

66.9.5.1 General Occupancy Limits.

The maximum allowable quantities (MAQs) of ignitible (flammable or combustible)~~MAQs of~~ liquids allowed in each control area shall not exceed the amounts specified in Table 66.9.5.1. [**30:**9.6.1]

~~5~~Table 66.9.5.1 MAQ of Ignitible (Flammable or Combustible) ~~Flammable and Combustible~~ Liquids per Control Area

Liquid Class(es)[#]	Quantity		
	gal	L	Notes
IA	30	115	1, 2
IB and IC	120	460	1, 2
IA, IB, IC combined	120	460	1, 2, 3
II	120	460	1, 2
IIIA	330	1,265	1, 2
IIIB	13,200	50,600	1, 2, 4

[#] See 66.4.1 for details on the classification scheme.

Notes:

(1) Quantities are permitted to be increased 100 percent where stored in approved ~~flammable~~ liquid~~s~~ storage cabinets or in safety cans in accordance with this *Code*. Where Note 2 also applies, the increase for both notes is permitted to be applied accumulatively.

(2) Quantities are permitted to be increased 100 percent in buildings equipped throughout with an automatic sprinkler system installed in accordance with NFPA 13. Where Note 1 also applies, the increase for both notes is permitted to be applied accumulatively.

(3) Containing not more than the maximum allowable quantity per control area of Class IA, Class IB, or Class IC [FP < 100°F (37.8°C)] ~~flammable~~ liquids, individually.
(4) Quantities are not limited in a building equipped throughout with an automatic sprinkler system installed in accordance with NFPA 13 and designed in accordance with the protection criteria contained in Section 66.16 of this *Code*. [**30:**~~-~~Table 9.6.1]

Exception: As modified by 66.9.5.2 and Chapters 10 through 14 of NFPA 30. [**30:**9.6.1]

66.9.5.2.1

For the following occupancies, the MAQs per control area shall not exceed the amounts specified in Table 66.9.5.2.1:

(1) Assembly
(2) Ambulatory health care
(3) Business
(4) Day care
(5) Detention and correctional
(6) Educational
(7) Health care
(8) Residential

[**30:**9.6.2.1]

~~6~~Table 66.9.5.2.1 MAQs — Special Occupancy Limits

	Quantity	
Liquid Class(es)[#]	**gal**	**L**
I and II	10	38
IIIA	60	227
IIIB	120	454

[#] See 66.4.1 for details on the classification scheme.

[**30:**~~-~~Table 9.6.2.1]

66.9.5.2.2

For the occupancies specified in 66.9.5.2.1, storage in excess of 10 gal (38 L) of Class I and Class II liquids [FP < 140°F (60°C)] combined or in excess of 60 gal (227 L) of Class IIIA liquids [140°F (60°C) ≤ FP < 200°F (93°C)] shall be permitted where stored in ignitible (flammable or combustible)~~flammable~~ liquid~~s~~ storage cabinets and where the total aggregate quantity does not exceed 180 gal (680 L). [**30:**9.6.2.2]

66.9.5.2.4

For ambulatory health care, day care, educational, and health care occupancies, the MAQ for Class IIIB liquids [FP ≥ 200°F (93°C)] shall be permitted to be increased 100 percent if the building is protected throughout with an automatic sprinkler system in~~-~~stalled in accordance with Section 13.3 and NFPA 13. [**30:**9.6.2.4]

66.9.6.1

For the purpose of this *Code*, a control area shall be a space within a building where quantities of

ignitible (flammable or combustible) liquids that do not exceed the maximum quantities allowed by Table 66.9.5.1 or Table 66.9.5.2.1 are stored. [**30:**9.7.1]

66.9.6.3

Control areas located below grade that are considered basements, as defined in 3.3.22, shall not be utilized for the storage of Class I liquids [FP < 100°F (37.8°C)]. [**30:**9.7.3]

66.9.7 Classification of Occupancies That Exceed the Maximum Allowable Quantities ~~AQs~~ of Ignitible (Flammable or Combustible) Liquids per Control Area.

A.66.9.7.1

The Protection Level classifications are taken from *NFPA 5000*. Protection Levels 1, 4, and 5 do not apply to the storage of flammable and combustible (ignitible) liquids and are, therefore, not extracted here. [**30:**A.9.8.1]

66.9.7.1.1 Protection Level 2.

Buildings and portions thereof storing quantities of ignitible (flammable or combustible) liquids that are considered as High-Hazard Level 2 liquids and that exceed the maximum allowable quantities per control area shall be classified as Protection Level 2 occupancies. [**30:**9.8.1.1]

66.9.7.1.2 Protection Level 3.

Buildings and portions thereof storing quantities of ignitible (flammable or combustible) liquids that are considered as High-Hazard Level 3 liquids and that exceed the maximum allowable quantities per control area shall be classified as Protection Level 3 occupancies. [**30:**9.8.1.2]

66.9.7.2 *Requirements for Specific Occupancies.

Ignitible (flammable or combustible) ~~L~~liquids stored in Protection Level 2 or Protection Level 3 occupancies shall meet the applicable requirements for storage in a Liquid Storage Room or Liquid Warehouse as defined in this *Code* and in *NFPA 5000*. [**30:**9.8.2]

66.9.8.1

Fire resistance ratings for ignitible (flammable or combustible) liquid storage areas shall comply with ~~Storage areas shall be constructed to meet the fire resistance ratings specified in~~ Table 66.9.8.1. ~~Construction assemblies shall comply with the test specifications given in ASTM E119.~~ [**30:**9.9.1]

~~7~~Table 66.9.8.1 Fire Resistance Ratings for Ignitible (Flammable or Combustible) Liquid Storage Areas

	Fire Resistance Rating (hr)		
Type of Storage Area	**Interior Walls[a], Ceilings, Intermediate Floors[a]**	**Roofs**	**Exterior Walls**
Liquid storage room			
Floor area ≤ 150 ft^2	1	NR~~—~~	~~—~~NR
Floor area > 150 ft^2, but ≤ 500 ft^2	2	NR~~—~~	NR~~—~~

Liquid warehouse[b,c,g]	4[bd]	NR—	2[e], 4[cf]

For SI units, 1 ft^2 = 0.09 m^2.

[a]Between liquid storage areas and any adjacent areas not dedicated to liquid storage.

[b]A 4-hour firewall, in accordance with NFPA 221 is required except as follows:Fire resistance ratings for liquid warehouses storing only Class IIIB liquids, which are not heated above their flash point, are permitted to be reduced to 2 hours.

1) Where storage of liquids in a liquid warehouse is limited to Class IIIB liquids [FP ≥ 200°F (93°C)] that are not heated above their FP, 2-hour fire resistance rated assemblies are permitted.
2) Where a liquid warehouse is protected in accordance with Section 66.16, 2-hour fire resistance rated assemblies are permitted.
1)3)Where a liquid warehouse is protected in accordance with Section 66.16, accessory use areas, such as offices and restrooms, having a combined area is less than 10 percent of the area of the liquid warehouse do not require a fire resistance rating for the interior walls and ceilings.

[c]The fire resistance rating for walls that are located more than 10 ft (3 m) but less than 50 ft (15 m) from an important building or line of adjoining property that can be built upon is permitted to be 2 hours. Walls located 50 ft (15 m) or more from an important building or line of adjoining property that can be built upon do not require a fire resistance rating. Fire resistance ratings for liquid warehouses protected in accordance with Section 66.16 are permitted to be reduced to 2 hours.

dThis shall be a fire wall as defined in NFPA 221, *Standard for High Challenge Fire Walls, Fire Walls, and Fire Barrier Walls*.

[e]For exposing walls that are located more than 10 ft (3 m) but less than 50 ft (15 m) from an important building or line of adjoining property that can be built upon.

[f]For exposing walls that are located 10 ft (3 m) or less from an important building or line of adjoining property that can be built upon.

[g]For accessory use areas in protected liquid warehouses, such as offices and restrooms, whose combined area is less than 10 percent of the area of the warehouse, no fire resistance rating shall be required for the interior walls and ceilings.

[**30:**-Table 9.9.1]

66.9.8.2

Acceptable methods for determining fire resistance shall be in accordance with this *Code* and the building code. [**30:**9.9.2]

66.9.8.266.9.8.3

Openings in interior walls to adjacent rooms or buildings and openings in exterior walls with fire resistance ratings shall be provided with normally closed, listed fire doors with fire protection ratings that correspond to the fire resistance rating of the wall as specified in Table 66.9.8.2. [**30:**9.9.32]

8**Table 66.9.8.2 Protection Ratings for Fire Doors**

Fire Resistance Rating of Wall as Required by Table 66.9.~~8~~9.1 (hr)	Fire Protection Rating of Door (hr)
1	$^3/_4$
2	$1^1/_2$
4	3*

*One fire door required on each side of interior openings for attached liquid warehouses. [**30:**Table 9.9.~~2~~3]

~~66.9.8.2.1~~66.9.8.3.1

Such doors shall be permitted to be arranged to stay open during material-handling operations if the doors are designed to close automatically in a fire emergency by provision of listed closure devices. [**30:**9.9.3~~2~~.1]

~~66.9.8.2.2~~66.9.8.3.2

Fire doors shall be installed in accordance with NFPA 80. [**30:**9.9.3~~2~~.2]

~~66.9.8.3~~66.9.8.4

Exterior walls shall be constructed to provide ready access for fire-fighting operations by means of access openings, windows, or lightweight, noncombustible wall panels.

Exception: This requirement does not apply to liquid storage rooms totally enclosed within a building. [**30:**9.9.4~~3~~]

66.9.11.2

For liquid storage rooms that are totally enclosed within the building, electrical wiring and utilization equipment for Class I liquid [FP < 100°F (37.8°C)] storage shall be Class I, Division 2 (Zone 2), and electrical wiring and utilization equipment in ~~inside rooms used for the~~liquid storage rooms used for the storage of~~of~~ Class II and Class III liquids [FP ≥ 100°F (37.8°C)] shall be suitable for ordinary purpose.

Exception: Class I, Division 2 (Zone 2) requirements ~~shall~~ apply to Class II and Class III liquids [FP ≥ 100°F (37.8°C)] when stored at temperatures above their FP~~flash points~~. [**30:**9.12.2]

66.9.12 *Containment, Drainage, and Spill Control.

A.66.9.12

Spill containment can be accomplished by any of the following:

(1) Listed liquid drainage floor assemblies — FM Approval Standard 6090, *Approval Standard for Ignitable Liquid Drainage Floor Assemblies*, is one example of a listing standard.

~~(1)~~(2) Noncombustible, liquidtight raised sills, curbs, or ramps of suitable height at exterior openings.

~~(2)~~(3) Noncombustible, liquidtight raised sills, curbs, or ramps of suitable height, or other flow-diverting structures at interior openings.

~~(3)~~(4) Sloped floors.

~~(4)~~(5) Open-grate trenches or floor drains that are connected to a properly designed drainage system.

~~(5)~~(6) Wall scuppers that discharge to a safe location or to a properly designed drainage system.

~~(6)~~(7) Other means that are acceptable to the AHJ.

[**30:**A.9.13]

Where sills, curbs, or ramps are used, the appropriate height will depend on a number of factors, including the maximum expected spill volume, the floor area, and the existence of any drainage systems. Historically, curbs and sills have been 4 in. (100 mm) high. [**30:**A.9.13]

A variety of curb, sill, and ramp heights can be used to obtain the desired containment volume. As a guide, 1 ft^2 of water at a depth of 1 in. equals 0.6 gal (1 m^2 of water @ 25 mm = 25 L). Once the total quantity of liquid containment has been established, the necessary curb, sill, or ramp height can then be calculated. [**30:**A.9.13]

Where open-grate trenches are used, the volume of the trench should be able to contain the maximum expected spill volume or otherwise be connected to a properly designed drainage system. [**30:**A.9.13]

It should be noted that these containment and drainage provisions address only fire protection concerns. Consult the appropriate environmental regulations for other restrictions that could apply. [**30:**A.9.13]

66.9.12.1

Storage areas shall be designed and operated to prevent the discharge of ignitible (flammable or combustible) liquids to public waterways, public sewers, or adjoining property, unless such discharge has been specifically approved. [**30:**9.13.1]

66.9.12.4

Where only Class IIIB liquids [FP ≥ 200°F (93°C)] are stored, spill control, containment, and drainage shall not be required. [**30:**9.13.4]

66.9.12.5

Where only unsaturated polyester resins (UPRs) containing not more than 50 percent by weight of Class IC, Class II, or Class IIIA liquid [73°F (22.8°C) ≤ FP < 200°F (93°C)] constituents are stored and are protected in accordance with 66.16.5.2.11, spill control, containment, and drainage shall not be required. [**30:**9.13.5]

66.9.15.1 *

Where Class IA liquids [FP < 73°F (22.8°C) and BP < 100°F (37.8°C)] are stored in containers larger than 1 gal (4 L), areas shall be provided with a means of explosion control that meets the requirements of NFPA 69. An approved engineered damage limiting construction design shall also be permitted.

Exception: This ~~shall~~ does not apply to a liquid storage room totally enclosed within a building. [**30:**9.16.1]

A.66.9.15.1

Release of a Class IA liquid [FP < 73°F (22.8°C) and BP < 100°F (37.8°C)] into a room or enclosure can result in the evolution of large quantities of flammable vapor. The ignition of this flammable mixture can result in a significant pressure rise, the production of hot combustion gases, and flame. Failure to adequately design a room or building for this type of event can result in the failure of the room or building walls and/or roof and the uncontrolled release of the hot combustion gases, flames, and pressure. An acceptable method of protection against this type of event is the use of damage-limiting construction consisting of a combination of pressure-relieving construction and pressure-resistant construction as described in NFPA 68. [**30:**A.9.16.1]

66.9.16.1

Except as provided for in 66.9.16.3, ignitible (flammable or combustible) liquids shall be separated from incompatible materials where the stored materials are in containers having a capacity of more than 5 lb (2.268 kg) or $^{1}/_{2}$ gal (1.89 L). [**30:**9.17.1]

66.9.16.1.1

Separation shall be accomplished by one of the following methods:

(1) Segregating incompatible materials storage by a distance of not less than 20 ft (6.1 m)
(2) Isolating incompatible materials storage by a noncombustible partition extending not less than 18 in. (460 mm) above and to the sides of the stored materials
(3) Storing liquid materials in Class I liquids [FP < 100°F (37.8°C)]~~flammable liquids~~ storage cabinets in accordance with 66.9.4

[**30:**9.17.1.1]

66.9.16.2

Ignitible (flammable or combustible) liquids ~~Liquids~~ shall be separated from Level 2 and Level 3 aerosols in accordance with Chapter 61 and NFPA 30B. [**30:**9.17.2]

66.9.16.3

~~Flammable and combustible l~~Liquids shall be separated from oxidizers by at least 25 ft (7.6 m). [**30:**9.17.3]

66.9.16.4

Materials that are water-reactive, as described in NFPA 704, shall not be stored in the same control area with ignitible (flammable or combustible) liquids. [**30:**9.17.4]

66.9.17 Dispensing, Handling, and Use of Ignitible (Flammable or Combustible) Liquids in Storage Areas.

66.9.17.1

Dispensing, handling, and use of ignitible (flammable or combustible) liquids shall meet all applicable requirements of Section 66.18. [**30:**9.18.1]

66.9.17.2

Dispensing of Class I liquids [FP < 100°F (37.8°C)] or Class II and Class III liquids [FP ≥ 100°F (37.8°C)] at temperatures at or above their ~~flash points~~FP shall not be permitted in storage areas that exceed 1000 ft^2 (93 m^2) in floor area unless the dispensing area is separated from the storage areas in accordance with Table 66.9.8.1 and meets all other requirements of 66.9.8. [**30:**9.18.2]

66.9.18 Outdoor Storage of Ignitible (Flammable or Combustible) Liquids.

Storage of ignitible (flammable or combustible) liquids outside of buildings shall meet the requirements of Section 66.14 or 66.15, whichever is applicable. [**30:**9.19]

66.14.1 *Scope.

This section shall apply to the storage of ignitible (flammable or combustible) liquids in movable, modular, prefabricated storage lockers, also known as hazardous materials storage lockers (hereinafter referred to as lockers), specifically designed and manufactured for storage of hazardous materials, in the following:

(1) Containers that do not exceed 119 gal (450 L) individual capacity
(2) Portable tanks that do not exceed 660 gal (2500 L) individual capacity
(3) Intermediate bulk containers that do not exceed 793 gal (3000 L) individual capacity

[**30:**14.1]

A.66.14.1

Environmental concerns have dictated special handling of hazardous materials, chemicals, and wastes. Some of these have flammable and combustible (ignitible) liquid characteristics, in addition to their environmental and health problems, thus causing some questions as to how they should be stored and handled. [**30:**A.14.1]

Several manufacturers have met this problem by designing and manufacturing movable, modular prefabricated storage lockers, working diligently with various building officials and AHJs. This results in a product that is intended to meet government standards and regulations for hazardous materials storage. Several municipalities have passed model ordinances covering the design, construction, and location of hazardous materials storage lockers. Design features can include, but are not limited to, the following:

(1) Secondary spill containment sumps
(2) Deflagration venting
(3) Ventilation requirements, including mechanical ventilation where dispensing operations are expected
(4) Electrical equipment for hazardous locations in accordance with *NFPA 70*
(5) Static electricity control
(6) Fire suppression systems (dry chemical or sprinklers)
(7) Heavy structural design for the following:

(a) Security provisions
(b) Doors that lock and permit pallet loading
(c) Wind load, snow load, and storage load conditions
(d) Anchorage provisions
(e) Skid design, permitting relocation using lift trucks

(8) Fire-related exterior walls, if required
(9) Interior partitions to segregate incompatible materials
(10) Size limits to limit quantities that can be stored within preassembled or ready-to-assemble designs
(11) Nonsparking floors
(12) Shelving, if required
(13) Heating or cooling units, if needed
(14) Corrosion protection as required
(15) Employee safety provisions (eye/face wash)
(16) NFPA 704 hazard symbols

[**30:**A.14.1]

Features provided are determined by specific storage requirements and needs of the owner, keeping in mind applicable regulations and ordinances that apply and the approval requirements of the AHJ. [**30:**A.14.1]

Several testing laboratories have developed internal procedures for the examination, testing, and listing or labeling of hazardous materials storage lockers submitted by manufacturers. [**30:**A.14.1]

66.14.3.1

Lockers that are used as liquid storage rooms shall meet the requirements of Chapters 9 and 12 of NFPA 30, ~~Section~~66.14.4 and 66.14.6 ~~66.9~~. [**30:**14.3.1]

66.14.4.5

Where electrical wiring and electrical utilization equipment are required, they shall comply with Section 66.7 and 66.9.11. [**30:**14.4.5]

66.14.4.8

Lockers shall include a spill containment system to prevent the flow of ignitible (flammable or combustible) liquids from the locker under emergency conditions. [**30:**14.4.8]

66.14.6.1

Containers of ignitible (flammable or combustible) liquid in their original shipping packages shall be permitted to be stored either palletized or solid piled within the locker. [**30:**14.6.1]

66.14.6.3

Containers over 30 gal (114 L) capacity storing Class I or Class II liquids [FP < 140°F (60°C)] shall not be

stored more than two containers high. [**30:**14.6.3]

66.15.1 Scope.

This section shall apply to the storage of ignitible (flammable or combustible) liquids outdoors in the following:

(1) Drums or other containers that do not exceed 119 gal (450 L) individual capacity
(2) Portable tanks that do not exceed 660 gal (2500 L) individual capacity
(3) Intermediate bulk containers that do not exceed 793 gal (3000 L) individual capacity

[**30:**15.1]

66.15.3 General Requirements.

Outdoor storage of ignitible (flammable or combustible) liquids in containers, intermediate bulk containers, and portable tanks shall comply with Table 66.15.3 and with all applicable requirements of this section. [**30:**15.3]

1**Table 66.15.3 Storage Limitations for Outside Storage**

Liquid Class[#]	Containers			Portable Tanks and Metal IBCs			Rigid Plastic and Composite IBCs			Minimum Separation Distance (ft)		
	Maximum Quantity per Pile (gal)[a,b,c]	Maximum Storage Height (ft)		Maximum Quantity per Pile (gal)	Maximum Storage Height (ft)		Maximum Quantity per Pile (gal)[a,c]	Maximum Storage Height (ft)		Between Piles or Rack Sections	To Property Line That Is or Can Be Built Upon[b,d]	To Street, Alley, or Public Way[b]
IA	1,100	10		2,200	7		NP	NP		5	50	10
IB	2,200	12		4,400	14		NP	NP		5	50	10
IC	4,400	12		8,800	14		NP	NP		5	50	10
II	8,800	12		17,600	14		8,800	14		5	25	5
III	22,000	18		44,000	14		22,000	18		5	10	5

For SI units, 1 ft = 0.3 m; 1 gal = 3.8 L.
NP: Not permitted.
[#]See 66.4.1 for details on the classification scheme.

[a]See 66.15.3.1 regarding mixed-class storage.
[b]See 66.15.3.4 for smaller pile sizes.
[c]For storage in racks, the quantity limits per pile do not apply, but the rack arrangements should be limited to a maximum of 50 ft (15 m) in length and two rows or 9 ft (2.7 m) in depth.
[d]See 66.15.3.3 regarding protection for exposures. [**30:**-Table 15.3]

66.15.3.5.1

Where curbs are used, provisions shall be made to drain accumulations of groundwater or rainwater or

spills of ignitible (flammable or combustible) liquids. Drains shall terminate at a safe location and shall flow freely under fire conditions. [**30:**15.3.5.1]

66.15.4.1

A maximum of 1100 gal (4160 L) of ignitible (flammable or combustible) liquids in containers, intermediate bulk containers, or portable tanks shall be permitted to be stored adjacent to a building under the same management, provided the following conditions apply:

(1) The adjacent building wall has an exterior fire resistance rating of 2 hours.
(2) The adjacent building wall has no openings at grade or above grade that are within 10 ft (3 m) horizontally of the storage.
(3) The adjacent building wall has no openings directly above the storage.
(4) The adjacent building wall has no openings below grade within 50 ft (15 m) horizontally of the storage.

[**30:**15.4.1]

66.15.4.2

The provisions of 66.15.4.1(1) through (4) shall be permitted to be waived, subject to the approval of the AHJ, if the building in question is one story, is of fire-resistive or noncombustible construction, and is devoted principally to the storage of ignitible (flammable or combustible) liquids. [**30:**15.4.2]

66.15.4.3

The quantity of ignitible (flammable or combustible) liquid stored adjacent to a building that meets the conditions of 66.15.4.1(1) through (4) shall be permitted to exceed that permitted in 66.15.4.1, provided the maximum quantity per pile does not exceed 1100 gal (4160 L) and each pile is separated by a 10 ft (3 m) minimum clear space along the common wall. [**30:**15.4.3]

66.15.4.4

The quantity of ignitible (flammable or combustible) liquid stored shall be permitted to exceed the 1100 gal (4160 L) quantity specified by 66.15.4.1 where a minimum distance equal to that specified by Table 66.15.3 for distance to property line shall be maintained between buildings and the nearest container or portable tank. [**30:**15.4.4]

66.16.1.1 *

This section shall apply to automatic fire protection systems for all inside storage of ignitible (flammable or combustible)~~flammable and combustible~~ liquids in containers, intermediate bulk containers, and portable tanks as specified in 66.9.3. [**30:**16.1.1]

A.66.16.1.1

See Annex E of NFPA 30 for limitations of the protection criteria of Table 16.5.2.1 through Table 16.5.2.12 of NFPA 30, particularly for intermediate bulk containers and portable tanks having capacities greater than 60 gal (230 L). [**30:**A.16.1.1]

Protected storage allowed under previous editions of NFPA 30 can be continued if the class of liquids

stored, the quantity of liquids stored, fire protection, and building configuration remain unchanged. Table A.66.16.1.1(a) and Table A.66.16.1.1(b), reprinted here from the 1993 edition of NFPA 30, can be used as a reference for storage arrangements in previously approved, protected, inside liquid storage areas. [**30:**A.16.1.1]

For certain liquids such as ketones, esters, and alcohols, the minimum required densities established in the listing criteria for foam discharge devices are often higher than the general densities specified for protection of flammable and combustible (i.e., ignitible) liquids. When determining the design criteria for extinguishing systems using foam, it is important to ensure that the listing criteria, which are typically based on empirical data from fire tests, are not overlooked. Otherwise, the fire protection system design can be inadequate for proper protection. [**30:**A.16.1.1]

Early suppression fast-response (ESFR) sprinklers have been tested for protection of liquids only to the extent reflected in the tables in Section 16.5 of NFPA 30. Any other use of ESFR sprinklers for protection of liquids should be based on an engineering analysis that evaluates the potential failure of the sprinkler system based on a rapid-growth fire or a large pool fire that would operate more sprinklers than are accommodated by the design area. The use of ESFR protection, particularly without provisions for the control of spread of liquid, presents the possibility of a liquid pool fire that could exceed the limited design operating area of an ESFR system. [**30:**A.16.1.1]

The information in Table 16.5.2.1 through Table 16.5.2.12 of NFPA 30 was developed from full-scale fire tests. Where only one K-factor sprinkler is allowed, this was the only size proven to provide fire control. Where a choice of K-factors is allowed by the tables, each was able to provide fire control; however, the larger K-factor sprinklers sometimes demonstrated better fire control and further limited fire damage. Where only one ~~response-type~~type of response ~~of~~ sprinkler is allowed, this is the only type of sprinkler proven to provide fire control. Where a choice of response characteristics (SR or QR) is allowed by the tables, each was able to provide fire control; however, the QR sprinklers sometimes demonstrated better fire control and further limited fire damage. [**30:**A.16.1.1]

In the testing involving metal containers, only steel containers were tested. Other metal containers, such as aluminum, have not been tested. [**30:**A.16.1.1]

Table A.66.16.1.1(a) Storage Arrangements for Protected Palletized or Solid Pile Storage of Liquids in Containers and Portable Tanks

		Maximum Storage Height (ft)			Maximum Quantity per Pile (gal)			Maximum Quantity* (gal)	
Liquid Class	**Storage Level**	**Containers**	**Portable Tanks**		**Containers**	**Portable Tanks**		**Containers**	**Portable Tanks**
IA	Ground floor	5	—		3,000	—		12,000	—
	Upper floors	5	—		2,000	—		8,000	—
	Basement	NP	NP		—	—		—	—
IB	Ground floor	6 1/2	7		5,000	20,000		15,000	40,000
	Upper floors	6 1/2	7		3,000	10,000		12,000	20,000
	Basement	NP	NP		—	—		—	—
IC	Ground floor	6 1/2 †	7		5,000	20,000		15,000	40,000
	Upper floors	6 1/2 †	7		3,000	10,000		12,000	20,000
	Basement	NP	NP		—	—		—	—
II	Ground floor	10	14		10,000	40,000		25,000	80,000
	Upper floors	10	14		10,000	40,000		25,000	80,000
	Basement	5	7		7,500	20,000		7,500	20,000
III	Ground floor	20	14		15,000	60,000		55,000	100,000
	Upper floors	20	14		15,000	60,000		55,000	100,000
	Basement	10	7		10,000	20,000		25,000	40,000

For SI units, 1 ft = 0.3 m; 1 gal = 3.8 L.

NP: Not permitted.

*Applies only to cut-off rooms and attached buildings.

†These height limitations can be increased to 10 ft for containers of 5 gal capacity or less. [**30:** Table A.16.1.1(a)]

Table A.66.16.1.1(b) Storage Arrangements for Protected Rack Storage of Liquids in Containers and Portable Tanks

Liquid Class	Type Rack	Storage Level	Maximum Storage Height of Containers (ft)	Maximum Quantity of Containers (gal)*†
IA	Double row	Ground floor	25	7,500
	or	Upper floors	15	4,500
	single row	Basement	NP	—
IB	Double row	Ground floor	25	15,000
IC	or	Upper floors	15	9,000
	single row	Basement	NP	—
II	Double row	Ground floor	25	24,000
	or	Upper floors	25	24,000
	single row	Basement	15	9,000
III	Multirow,	Ground floor	40	55,000
	double row,	Upper floors	20	55,000
	or single row	Basement	20	25,000

For SI units, 1 ft = 0.3 m; 1 gal = 3.8 L.
NP: Not permitted.
*Maximum quantity allowed on racks in cut-off rooms and attached buildings.
†Maximum quantity allowed per rack section in liquid warehouses. [**30:** Table A.16.1.1(b)]

66.16.1.2 *

This section shall not apply to Class IA ~~flammable~~ liquids [FP < 73°F 22.8°C) and BP < 100°F (37.8°C)] or to unstable ~~flammable or combustible~~ liquids. [**30:**16.1.2]

A.66.16.1.2

To date, there has been no full-scale testing to determine appropriate fire protection design criteria for Class IA liquids [FP < 73°F (22.8°C) and BP < 100°F (37.8°C)] or unstable liquids. [**30:**A.16.1.2]

66.16.1.3

Storage of ignitible (flammable or combustible) liquids that is protected in accordance with the applicable requirements of this section shall be considered protected, as defined in 66.16.2.1~~3~~. All other storage shall be considered unprotected unless an alternate means of protection has been approved by the AHJ. [**30:**16.1.3]

66.16.2 Definitions Specific to Section 66.16.

For the purpose of this section, the ~~following~~ terms in this section shall have the definitions given.

[**30:**16.2]

66.16.2.1 *Protected.

For the purposes of 66.16, this term shall apply to the storage of containers that meet the appropriate provisions of 66.16 or alternate provisions that have been approved by the AHJ~~authority having jurisdiction~~ *(see 66.16.3.5 and –66.16.9)*. [**30:**16.2.2]

A.66.16.2.3

Table A.66.16.2.3 provides examples of commonly used metal containers that are considered either relieving style or nonrelieving style for use in developing protected storage arrangements in accordance with Table 16.5.2.1 through Table 16.5.2.12 of NFPA 30. [**30:**A.16.2.4]

2**Table A.66.16.2.3 Common Relieving- and Nonrelieving-Style Metal Containers**

Container Type	Relieving Style	Nonrelieving Style
≤1 qt[a]	All	N/A
>1 qt and ≤6 gal[a]	Metal containers with plastic cap, or flexible or rigid plastic spout with plastic cap	Metal containers with steel spout and steel screw cap
≤1 gal, friction lid	Metal containers with metal friction-fit covers (e.g., paint can lid)	N/A
1 gal and ≤6 gal (lug cover)	Metal containers with metal covers held in place with a mechanical friction-fit (e.g., lug-type) closure mechanism	N/A
>6 gal and ≤60 gal[b,c] (drums)	Metal containers, tight or open-head (drums) having at least one 2 in. plastic plug (Note: Cap seals, if used, need to be plastic and nonmetallic)	Open head metal containers with steel covers having no steel flange openings; or open head and tight head metal containers with steel flange openings where only steel plugs and/or cap seals are used
>60 gal and ≤793 gal	Metal portable tanks or metal intermediate bulk containers with at least one relief device conforming to the design, construction, and capacity of the container's section	N/A

For SI units, 1 gal = 3.8 L, 1 qt = 1 L.

N/A: Not applicable.

[a]All containers ≤1 qt are considered relieving style because their failure is inconsequential.

[b]In full-scale fire tests, where containers were provided with both $^3/_4$ in. (19 mm) and 2 in. (50 mm) relieving vent openings and, in some cases, both vents were obstructed by pallet slats, rupture of containers did not occur. Because it is not possible to determine if all conceivable obstruction scenarios were represented, where drums are stacked more than one high, provide an additional $^3/_4$ in. (19 mm) or 2 in. (50 mm) pressure-relieving mechanism.

[c]The use of plastic plugs instead of steel plugs (bungs) in a steel drum in order to achieve a relieving-style container should contemplate the following issues in order to assure the safe storage of liquids:
(1) The compatibility of the plastic plug materials and gaskets with the liquids being stored.
(2) The stability and shelf life of the liquids being stored as the plastic plugs can admit water vapor, oxygen, and light.
(3) The difference in expansion coefficients for plastic plugs and steel drums for those drums subject to temperature variations and hot or cold conditions.
(4) The tooling issues involved with the use of plastic plugs as the torque levels are different from those levels used for steel plugs.
(5) The training of fill line operators in order to avoid cross-threading and/or the stripping of threads.
(6) The voiding of the United Nations (UN) rating on the steel drum by installing plastic plugs. If the user needs to install a plug other than the one originally provided by the container manufacturer, then the user should contact the manufacturer to ensure that the UN rating will still be valid. [**30:**-Table A.16.2.4]

66.16.2.4 *Unsaturated Polyester Resin (UPR).

A resin that contains up to 50 percent by weight of Class IC, Class II, or Class III [FP > 73°F (22.8°C)] liquid, but no Class IA or Class IB [FP < 73°F (22.8°C)] liquid. [**30:**16.2.5]

66.16.2.5 Viscous Liquid.

A liquid that gels, thickens, or solidifies when heated or whose viscosity at room temperature versus weight percent content of Class I, Class II, or Class III liquid (any FP or BP) is in the shaded portion of Figure 66.16.2.5. [**30:**16.2.6]

Figure 66.16.2.5 Viscous Liquid: Viscosity Versus Weight Percent Flammable or Combustible (Ignitible) Component. [30:-Figure 16.2.6]
****INSERT FIGURE****

66.16.3.1

Where different classes of liquids, container types, and storage configurations are stored in the same protected area, protection shall meet either of the following:

(1) Requirements of this section for the most severe storage fire hazard present
(2) Where areas are not physically separated by a barrier or partition capable of delaying heat from a fire in one hazard area from fusing sprinklers in an adjacent hazard area, the required protection for the more demanding hazard shall:
    (a) Extend 20 ft (6 m) beyond its perimeter, but not less than the required minimum sprinkler design area
    (b) Be provided with means to prevent the flow of burning ignitible (flammable or combustible) liquid under emergency conditions into adjacent hazard areas
    (c) Provide containment and drainage as required by 66.16.8

[**30:**16.3.1]

66.16.3.4

Viscous liquids, as defined in 66.16.2.5, shall be permitted to be protected using ~~either~~ one of the following~~, as applicable~~:

(1) For metal containers, the criteria for ~~a~~ Class IIIB liquids [FP ≥ 200°F (93°C)], ~~in accordance with~~as determined by Figure 66.16.4.1(a)
(2) For nonmetallic containers, the criteria for Class IIIB liquids~~,~~ [FP ≥ 200°F (93°C)], as determined by ~~as determined by~~ Figure 66.16.4.1(b)
(3) For nonmetallic containers, the criteria for cartoned unexpanded Group A plastics in accordance with NFPA 13, as indicated in Figure 66.16.4.1(b).

[**30:**16.3.4]

66.16.3.7

To be considered protected by Table 66.16.5.2.9 and Table 66.16.5.2.10, rigid nonmetallic intermediate bulk containers shall be listed and labeled in accordance with UL 2368, *Fire Exposure Testing of Intermediate Bulk Containers for Flammable and Combustible Liquids*; FM ~~Class~~ 6020, *Approval Standard for Composite Intermediate Bulk Containers*; or an equivalent test procedure. [**30:**16.3.7]

66.16.4.1

Where automatic sprinkler systems or low-expansion foam-water sprinkler systems are used to protect storage of ignitible (flammable or combustible) liquids, Figure 66.16.4.1(a), Figure 66.16.4.1(b), or Figure 66.16.4.1(c), whichever is applicable, and the appropriate table in 66.16.5 shall be used to determine protection criteria. [**30:**16.4.1]

Figure 66.16.4.1(a) Fire Protection Criteria Decision Tree for Miscible and Nonmiscible Ignitible (Flammable or Combustible)~~Flammable and Combustible~~ Liquids in Metal Containers. [30:~~-~~Figure 16.4.1(a)]

****INSERT FIGURE****

Figure 66.16.4.1(b) Fire Protection Criteria Decision Tree for Miscible and Nonmiscible Ignitible (Flammable or Combustible)~~Flammable and Combustible~~ Liquids in Nonmetallic Containers. [30: Figure 16.4.1(b)]

****INSERT FIGURE****

Figure 66.16.4.1(c) Fire Protection Criteria Decision Tree for Water-Miscible Ignitible (Flammable or Combustible)~~Flammable and Combustible~~ Liquids in Nonmetallic Containers. [30:~~-~~Figure 16.4.1(c)]

****INSERT FIGURE****

66.16.4.1.1

Figure 66.16.4.1(a) shall be used for miscible and nonmiscible ignitible (flammable or combustible) ~~flammable and combustible~~ liquids in metal containers, metal portable tanks, and metal intermediate bulk containers. [**30:**16.4.1.1]

66.16.4.1.2

Figure 66.16.4.1(b) shall be used for miscible and nonmiscible ignitible (flammable or combustible)~~flammable and combustible~~ liquids in nonmetallic containers and in nonmetallic intermediate bulk containers. [**30:**16.4.1.2]

66.16.4.1.3

Figure 66.16.4.1(c) shall be used for water-miscible ignitible (flammable or combustible)~~flammable and combustible~~ liquids in nonmetallic containers and in nonmetallic intermediate bulk containers. [**30:**16.4.1.3]

66.16.5.1.2

When foam or foam-water fire protection systems are provided, discharge densities shall be determined based on the listing criteria of the foam discharge devices selected, the foam concentrate, the specific ignitible (flammable or combustible) liquids to be protected, and the criteria in the appropriate table in this section. Where the discharge densities given in the tables differ from those in the listing criteria for the discharge devices, the greater of the two shall be used. [**30:**16.5.1.2]

66.16.5.1.3

In-rack sprinklers shall be installed in accordance with the provisions of Section 13.3 and NFPA 13. In addition, the following modifications shall apply:

(1) In-rack sprinklers shall be laid out in accordance with 66.16.5.1.10 and 66.16.6, as applicable.
(2) Sprinklers in multiple-level in-rack sprinkler systems shall be provided with water shields unless they are separated by horizontal barriers or are specifically listed for installation without water shields.
(3) A vertical clear space of at least 6 in. (150 mm) shall be maintained between the sprinkler deflector and the top ~~of the~~ tier of storage.
(4) Sprinkler discharge shall not be obstructed by horizontal rack structural members.
(5) Where in-rack sprinklers are installed below horizontal barriers, the deflector shall be located a maximum of 7 in. (180 mm) below the barrier.
(6) Longitudinal and transverse flue spaces of at least 6 in. (150 mm) shall be maintained between each rack load.

[**30:**16.5.1.3]

66.16.5.1.4

Ceiling sprinklers shall be installed in accordance with Section 13.3 and NFPA 13 and shall be permitted to have the following maximum head spacing:

(1) Class~~es~~ I, Class II, and Class IIIA liquids [FP < 200°F (93°C)]: 100 ft^2 (9.3 m^2) per sprinkler
(2) Class IIIB liquids [FP ≥ 200°F (93°C)]: 120 ft^2 (11.1 m^2) per sprinkler

[**30:**16.5.1.4]

66.16.5.1.10

For the purposes of 66.16.5, the following shall apply to the in-rack sprinkler design layouts specified in Table 66.16.5.2.1 through Table 66.16.5.2.12:

(1) Layout 1, as referenced in Table 66.16.5.2.1, shall mean one line of in-rack sprinklers 8 ft (2.4 m) above the floor in the longitudinal flue space, with sprinklers spaced not more than 10 ft (3 m) on center.

(2) Layout 2, as referenced in Table 66.16.5.2.1, shall mean one line of in-rack sprinklers 6 ft (1.8 m) above the floor and one line of in-rack sprinklers 12 ft (3.6 m) above the floor in the longitudinal flue space, with sprinklers spaced not more than 10 ft (3 m) on center. Sprinklers shall be staggered vertically.

(3) Layout 3, as referenced in Table 66.16.5.2.1 and Table 66.16.5.2.3~~1~~, shall mean one line of in-rack sprinklers in the longitudinal flue space at every storage level above the floor except above the top tier, with sprinklers spaced not more than 10 ft (3 m) on center. Sprinklers shall be staggered vertically, where more than one level of in-rack sprinklers is installed.

(4) Layout 4, as referenced in Table 66.16.5.2.1 and Table 66.16.5.2.3, shall mean one line of in-rack sprinklers in the longitudinal flue space at every other storage level~~,~~ except above the top tier, beginning above the first storage level, with sprinklers spaced not more than 10 ft (3 m) on center. Sprinklers shall be staggered vertically where more than one level of in-rack sprinklers is in~~-~~stalled.

(5) Layout 5, as referenced in Table 66.16.5.2.1, shall mean one line of in-rack sprinklers in the longitudinal flue space at every storage level above the floor except above the top tier and face sprinklers at the first storage level at each rack upright. In-rack sprinklers shall be spaced not more than 9 ft (2.7 m) on center and shall be staggered vertically, where more than one level of in-rack sprinklers is installed.

(6) Layout 6, as referenced in Table 66.16.5.2.1, shall mean one line of in-rack sprinklers in the longitudinal flue space at every other storage level above the first storage level except the top tier and face sprinklers at the first storage level at each rack upright. In-rack sprinklers shall be spaced not more than 10 ft (3 m) on center and shall be staggered vertically, where more than one level of in-rack sprinklers is installed.

~~(7) Layout 7, as referenced in Table 66.16.5.2.8, shall be as shown in Figure 66.16.6.5(a).~~

~~(8) Layout 8, as referenced in Table 66.16.5.2.8, shall be as shown in Figure 66.16.6.5(b) or Figure 66.16.6.5(c).~~

~~(9) Layout 9, as referenced in Table 66.16.5.2.8, shall be as shown in Figure 66.16.6.5(d) or Figure 66.16.6.5(e).~~

[**30:**16.5.1.10]

66.16.5.1.11

~~The "Fire Test Ref." number given f~~For each entry in Table 66.16.5.2.1 through Table 66.16.5.2.12 the "Fire Test Ref." number shall be used to identify the information in Section D.2 of NFPA 30 ~~the information on~~about the fire tests on which the protection criteria for that entry are based.

[**30:**16.5.1.11]

66.16.5.2.1

Table 66.16.5.2.1 shall apply to the following:

(1) Automatic sprinkler protection

(2) Single- or double-row rack storage

(3) All liquid classes except Class IA liquids [FP < 73°F (22.8°C) and BP < 100°F (37.8°C)]~~Nonmiscible liquids and miscible liquids with concentration of flammable or combustible component greater than 50 percent by volume~~

(4) Metal containers, metal portable tanks, metal intermediate bulk containers

(5) Relieving- or nonrelieving-style containers

[**30:**16.5.2.1]

Table 66.16.5.2.1 Design Criteria for Sprinkler Protection of Single- and Double-Row Rack Storage of Ignitible (Flammable or Combustible) Liquids in Metal Containers, Portable Tanks, and IBCs

For SI units, 1 gal = 3.8 L, 1 ft = 0.3 m, 1 ft^2 = 0.09 m^2, 1 gpm/ft^2 = 40.7 L/min/m^2 = 40.7 mm/min.

For definitions of abbreviations used in the Response column, see 66.16.5.1.9(4). See also 66.16.5.1.9(5).

(1) In-rack sprinkler design shall be based on the following:
    (a) Where one level of in-rack sprinklers is installed, the design shall include the eight~~8~~ most hydraulically remote sprinklers.
    (b) Where two levels of in-rack sprinklers are installed, the design shall include the six~~6~~ most hydraulically remote sprinklers on each level.
    (c) Where three or more levels of in-rack sprinklers are installed, the design shall include the ~~6~~six most hydraulically remote sprinklers on the top three levels.
(2) Protection for uncartoned or case-cut nonsolid shelf display up to 6.5 ft~~.~~ (2 m) and storage above on pallets in racking and stored on shelf materials, including open wire mesh, or 2 in. × 6 in. (50 mm × 150 mm) wooden slats, spaced a minimum of 2 in. (50 mm) apart.
(3) Increase ceiling density to 0.60 if more than one level of storage exists above the top level of in-rack sprinklers.
(4) Double-row racks limited to maximum 6 ft (1.8 m) depth.
(5) For K=8.0 and larger ceiling sprinklers, increase ceiling density to 0.60 over 2000 ft^2 if more than one level of storage exists above the top level of in-rack sprinklers.
(6) Reduce in-rack sprinkler spacing to maximum 9 ft (2.7 m) centers.
(7) The minimum in-rack discharge pressure shall not be less than 10 psi.

[**30:**Table 16.5.2.1]

66.16.5.2.2

Table 66.16.5.2.2 shall apply to the following:

(1) Automatic sprinkler protection
(2) Palletized or stacked storage
(3) All liquid classes except Class IA liquids [FP < 73°F (22.8°C) and BP < 100°F (37.8°C)]~~Nonmiscible liquids and miscible liquids with concentration of flammable or combustible component greater than 50 percent by volume~~
(4) Metal containers, metal portable tanks, metal intermediate bulk containers
(5) Relieving- or nonrelieving-style containers

[**30:**16.5.2.2]

Table 66.16.5.2.2 Design Criteria for Sprinkler Protection of Palletized and Stacked Storage of Ignitible (Flammable or Combustible) Liquids in Metal Containers, Portable Tanks, and IBCs

For SI units, 1 gal = 3.8 L, 1 ft = 0.3 m, 1 ft^2 = 0.09 m^2, 1 gpm/ft^2 = 40.7 L/min/m^2 = 40.7 mm/min.

For definitions of abbreviations used in the Response column, see 66.16.5.1.9(4). See also 66.16.5.1.9(5).

[#]See 66.4.14~~4.2~~ for details on classification scheme.

Notes:

(1) Minimum hose stream demand can be reduced to 250 gpm for 2 hours.
(2) Sprinklers must also be hydraulically calculated to provide a density of 0.80 gpm/ft^2 over 1000 ft^2.
(3) Drums must be placed on open slatted pallet, not nested, to allow pressure relief from drums on lower levels.

[**30:**-Table 16.5.2.2]

66.16.5.2.3

Table 66.16.5.2.3 shall apply to the following:

(1) Foam-water sprinkler protection
(2) Single- or double-row rack storage
(3) All liquid classes except Class IA liquids [FP < 73°F (22.8°C) and BP < 100°F (37.8°C)]~~Nonmiscible liquids and miscible liquids with concentration of flammable or combustible component greater than 50 percent by volume~~
(4) Metal containers, metal portable tanks, metal intermediate bulk containers
(5) Relieving- or nonrelieving-style containers

[**30:**16.5.2.3]

Table 66.16.5.2.3 Design Criteria for Foam-Water Sprinkler Protection of Single- or Double-Row Rack Storage of Ignitible (Flammable or Combustible) Liquids in Metal Containers, Portable Tanks, and IBCs

For SI units, 1 gal = 3.8 L, 1 ft = 0.3 m, 1 ft^2 = 0.09 m^2, 1 gpm/ft^2 = 40.7 L/min/m^2 = 40.7 mm/min.
For definitions of abbreviations used in the Response column, see 66.16.5.1.9(4). See also 66.16.5.1.9(5).
[#] See 66.4.1 for details on classification scheme.

Notes:

(1) In-rack sprinkler design based on the six~~6~~ most hydraulically remote sprinklers in each of the upper three levels.
(2) Design area can be reduced to 1500 ft^2 when using a preprimed foam-water system installed in accordance with NFPA 16 and maintained according to NFPA 25.
(3) Design area can be reduced to 2000 ft^2 when using a preprimed foam-water system installed in accordance with NFPA 16 and maintained according to NFPA 25.
(4) In-rack sprinkler hydraulic design can be reduced to three sprinklers operating per level, with three levels operating simultaneously, when using a preprimed foam-water sprinkler system designed in accordance with NFPA 16 and maintained in accordance with NFPA 25.
(5) The minimum in-rack sprinkler discharge pressure shall not be less than a gauge pressure of 10 psi.

[**30:**-Table 16.5.2.3]

66.16.5.2.4

Table 66.16.5.2.4 shall apply to the following:

(1) Foam-water sprinkler protection

(2) Palletized or stacked storage
(3) All liquid classes except Class IA liquids [FP < 73°F (22.8°C) and BP < 100°F (37.8°C)]~~Nonmiscible liquids and miscible liquids with concentration of flammable or combustible component greater than 50 percent by volume~~
(4) Metal containers, metal portable tanks, metal intermediate bulk containers
(5) Relieving- or nonrelieving-style containers

[**30:**16.5.2.4]

Table 66.16.5.2.4 Design Criteria for Foam-Water Sprinkler Protection of Palletized and Stacked Storage of Ignitible (Flammable or Combustible) Liquids in Metal Containers, Portable Tanks, and IBCs

For SI units, 1 gal = 3.8 L, 1 ft = 0.3 m, 1 ft^2 = 0.09 m^2, 1 gpm/ft^2 = 40.7 L/min/m^2 = 40.7 mm/min.
For definitions of abbreviations used in the Response column, see 66.16.5.1.9(4). See also 66.16.5.1.9(5).
[#] See 66.4.1 for details on classification scheme.

Notes:
(1) Design area can be reduced to 2000 ft^2 when using a pre-primed foam-water system installed in accordance with NFPA 16 and maintained according to NFPA 25.
(2) Both $^3/_4$ in. (20 mm) and 2 in. (50 mm) listed pressure-relieving mechanisms are required on containers greater than 6 gal (23 L) capacity.
(3) Drums placed on open slatted pallet, not nested, to allow pressure relief from drums on lower levels. [**30:**-Table 16.5.2.4]

66.16.5.2.5

Table 66.16.5.2.5 shall apply to the following:
(1) Automatic sprinkler protection
(2) Single-, double-, or multiple-row rack storage
(3) Class IIIB liquids [FP ≥ 200°F (93°C)]~~Class IIIB nonmiscible liquids and Class IIIB miscible liquids with concentration of flammable or combustible component greater than 50 percent by volume~~
(4) Nonmetallic containers or intermediate bulk containers
(5) Cartoned or uncartoned

[**30:**16.5.2.5]

Table 66.16.5.2.5 Design Criteria for Sprinkler Protection of Single-, Double-, and Multiple-Row Rack Storage of Class IIIB Liquids [FP ≥ 200°F (93°C)] in Nonmetallic Containers
For SI units, 1 gal = 3.8 L, 1 ft = 0.3 m, 200°F = 93°C, 375°F = 190°C.
Note: Construction of intermediate bulk container to be a minimum of 8 layers of paperboard, with a minimum nominal thickness of $1^1/_2$ in. (38 mm) at the center of any side panel.
[**30:**-Table 16.5.2.5]

66.16.5.2.6

Table 66.16.5.2.6 shall apply to the following:

(1) Automatic sprinkler protection
(2) Shelf storage
(3) All liquid classes except Class IA liquids [FP < 73°F (22.8°C) and BP < 100°F (37.8°C)]~~Nonmiscible liquids and miscible liquids with concentration of flammable or combustible component greater than 50 percent by volume~~
~~(3)~~(4) Metal containers
~~(4)~~(5) Nonrelieving-style ~~metal~~ containers

[**30:**16.5.2.6]

Table 66.16.5.2.6 Design Criteria for Sprinkler Protection of Shelf Storage of Ignitible (Flammable or Combustible) Liquids in Metal Containers

For SI units, 1 gal = 3.8 L, 1 ft = 0.3 m, 1 ft^2 = 0.09 m^2, 1 gpm/ft^2 = 40.7 L/min/m^2 = 40.7 mm/min.
For definitions of abbreviations used in the Response column, see 66.16.5.1.9(4). See also 66.16.5.1.9(5).

Notes:
(1) Protection limited to mercantile shelving that is 2 ft (600 mm) or less in depth per side, with backing between each side.
(2) Minimum hose stream demand can be reduced to 250 gpm for 2 hours. ~~[**30:** Table 16.5.2.6]~~
(3) The minimum aisle width shall not be less than 5 ft (1.5 m).

[**30:** Table 16.5.2.6]

66.16.5.2.7

Table 66.16.5.2.7 shall apply to the following:
(1) Automatic sprinkler protection
(2) Single- or double-row rack storage
(3) Water-miscible ignitible (flammable or combustible) liquids with concentration ~~of flammable or combustible component~~ greater than 50 percent by volume
(4) Glass or plastic containers
(5) Cartoned or uncartoned
~~(6) Minimum 8 ft (2.4 m) aisle width~~

[**30:**16.5.2.7]

Table 66.16.5.2.7 Design Criteria for Sprinkler Protection of Single- and Double-Row Rack Storage of Water-Miscible Ignitible (Flammable or Combustible) Liquids in Glass or Plastic Containers

For SI units, 1 gal = 3.8 L, 1 ft = 0.3 m.

Notes:
(1) Minimum aisle width in all cases is 8 ft (2.4 m).
(2) Maximum rack depth in all cases is 9 ft (2.7 m).

[**30:**Table 16.5.2.7]

66.16.5.2.8

Table 66.16.5.2.8 shall apply to the following:

(1) Automatic sprinkler protection
(2) Single- or double-row rack storage or palletized storage
(3) All liquid classes except Class IA liquids [FP < 73°F (22.8°C) and BP < 100°F (37.8°C)]~~Nonmiscible liquids and miscible liquids with concentration of flammable or combustible component greater than 50 percent by volume~~
(4) Relieving-style ~~metal~~ containers

[**30:**16.5.2.8]

Table 66.16.5.2.8 Design Criteria for Sprinkler Protection of Single-Row Rack, Double-Row Rack, and Palletized Storage of Ignitible (Flammable or Combustible) Liquids in Relieving-Style Metal Containers

For SI units, 1 gal = 3.8 L, 1 ft = 0.3 m, 1 psi = 6.9 kPa.

For definitions of abbreviations used in the Response column, see 16.5.1.9(4). See also 16.5.1.9(5).

[#] See 66.4.1 for details on classification scheme.

Notes:

(1) The in-rack sprinkler water demand shall be based on the simultaneous operation of the most hydraulically remote sprinklers as follows:
    (a) Seven sprinklers where only one level of in-rack sprinklers is installed.
    (b) Fourteen sprinklers (seven on each of the two top levels) where more than one level of in-rack sprinklers is installed.
(2) The in-rack sprinkler water demand should be balanced with the ceiling sprinkler water demand at their point of connection.
(3) One-gallon and 1-quart containers are not required to be relieving style.
(4) Provide minimum 3 in. transverse flue at rack uprights.
(5) For Class IIIB liquids [FP ≥ 200°F (93°C)], see also Table 66.16.5.2.5.
(6) Racks can have open-mesh wire intermediate shelving on lower levels.
(7) The minimum in-rack sprinkler discharge pressure shall not be less than a gauge pressure of 10 psi.

66.16.5.2.9

Table 66.16.5.2.9 shall apply to the following:

(1) Automatic sprinkler protection
(2) Palletized storage
(3) Class IIIB liquids [FP ≥ 200°F (93°C)]~~Class II and Class III nonmiscible and Class II and Class III miscible liquids~~
(4) Listed and labeled rigid nonmetallic intermediate bulk containers

[**30:**16.5.2.9]

Table 66.16.5.2.9 Design Criteria for Sprinkler Protection of Palletized Storage of Class II and Class III Liquids in Listed and Labeled Rigid Nonmetallic IBCs

For SI units, 1 gal = 3.8 L, 1 ft = 0.3 m, 1 gpm/ft^2 = 40.7 L/min/m^2 = 40.7 mm/min, 1 ft^2 = 0.09 m^2.

For definitions of abbreviations used in the Response column, see 66.16.5.1.9(4). See also 66.16.5.1.9(5).

Note: See also 16.5.2.9.1 through 16.5.2.9.3.

[**30:**Table 16.5.2.9]

~~Notes:~~

~~(1)~~

66.16.5.2.9.1

Foam-water sprinkler protection shall be permitted to be substituted for water sprinkler protection, provided the same design criteria are used. [**30:**16.5.2.9.1]

66.16.5.2.9.2

~~(2)~~ Rigid nonmetallic intermediate bulk containers shall be listed and labeled in accordance with UL 2368, *Fire Exposure Testing of Intermediate Bulk Containers for Flammable and Combustible Liquids*; *FM Class 6020, Approval Standard for Intermediate Bulk Containers*; or an equivalent test procedure. [**30:**16.5.2.9.2]

66.16.5.2.9.3

~~(3)~~ The sprinkler operating gauge pressure shall be a minimum 30 psi (207 kPa). [**30:**16.5.2.9.3]

~~[**30:** Table 16.5.2.9]~~

66.16.5.2.10

Table 66.16.5.2.10 shall apply to the following:

(1) Automatic sprinkler protection
(2) Single- or double-row rack storage
(3) Class II and ~~Class~~ III nonmiscible and Class II and ~~Class~~ III miscible liquids [FP ≥ 100°F (37.8°C)]
(4) Listed and labeled rigid nonmetallic intermediate bulk containers

[**30:**16.5.2.10]

Table 66.16.5.2.10 Design Criteria for Sprinkler Protection of Single- and Double-Row Rack Storage of Class II and ~~Class~~ III Liquids [FP ≥ 100°F (37.8°C)] in Listed and Labeled Rigid Nonmetallic IBCs

For SI units, 1 gal = 3.8 L, 1 ft = 0.3 m.

Notes:

(1) Rigid nonmetallic intermediate bulk containers are listed and labeled in accordance with UL 2368, *Fire Exposure Testing of Intermediate Bulk Containers for Flammable and Combustible Liquids*, or an equivalent test procedure.
(2) Maximum rack depth is 9 ft (2.7 m).
(3) Minimum aisle width is 8 ft (2.4 m).

[**30:** Table 16.5.2.10]

66.16.5.2.11

Table 66.16.5.2.11 shall apply to the following:

(1) Automatic sprinkler protection
(2) Palletized or stacked storage
(3) Unsaturated polyester resins (UPRs) with not more than 50 percent by weight of Class IC, Class II, or Class IIIA liquid [73°F (22.8°C) ≤ FP < 200°F (93°C)]
(4) Metal containers~~;~~
~~(4)~~(5) ~~non-~~Relieving-style metal containers; nonrelieving-style allowed only up to 6 gal (23 L)

[**30:**16.5.2.11]

Table 66.16.5.2.11 Design Criteria for Sprinkler Protection of Palletized or Stacked Storage of Unsaturated Polyester Resins in Metal Containers

For SI units, 1 gal = 3.8 L, 1 ft = 0.3 m, 1 ft^2 = 0.09 m^2, 1 gpm/ft^2 = 40.7 L/min/m^2 = 40.7 mm/min.
For definitions of abbreviations used in the Response column, see 66.16.5.1.9(4). See also 66.16.5.1.9(5).

Notes:

(1) Drums placed on open, slatted pallet, not nested, to allow pressure relief from drums on lower levels.
(2) Storage areas containing unsaturated polyester resin (UPR) should not be located in the same spill containment area or drainage path of other Class I or Class II liquids [FP < 140°F (60°C)], unless protected as required for such other liquids.
(3) Both $^3/_4$ in. (20 mm) and 2 in. (50 mm) listed and labeled pressure-relieving devices are required on containers that exceed 6 gal (23 L) capacity.

[**30:**~~-~~Table 16.5.2.11]

66.16.5.2.12

Table 66.16.5.2.12 shall apply to the following:

(1) Automatic sprinkler protection
(2) Palletized or stacked storage
(3) Miscible liquids with concentration of ignitible (flammable or combustible) ~~flammable or combustible components~~ no greater than 80 percent by volume
(4) Glass or plastic containers

[**30:**16.5.2.12]

Table 66.16.5.2.12 Design Criteria for Sprinkler Protection of Palletized or Stacked Storage of Miscible Ignitible (Flammable or Combustible) Liquids in Glass or Plastic Containers

For SI units, 1 gal = 3.8 L, 1 ft = 0.3 m, 1 ft^2 = 0.09 m^2, 1 gpm/ft^2 = 40.7 L/min/m^2 = 40.7 mm/min.
For definitions of abbreviations used in the Response column, see 66.16.5.1.9(4). *(See also 66.16.5.1.9(5).)* [**30:**~~-~~Table 16.5.2.12]

66.16.6.1 Fire Protection System Design Scheme "A."

66.16.6.1.1

Horizontal barriers of plywood having a minimum thickness of $^{3}/_{8}$ in. (10 mm) or of sheet metal of minimum 22 gauge thickness shall be installed in accordance with Figure 66.16.6.1.1(a), Figure 66.16.6.1.1(b), or Figure 66.16.6.1.1(c), whichever is applicable. All ignitible (flammable or combustible) liquid storage shall be located beneath a barrier. All ignitible (flammable or combustible) liquid storage shall be located beneath a barrier. *[See also 66.16.6.1.9 for liquids with flash points equal to or greater than 450°F (230°C).]* [**30:**16.6.1.1]

Figure 66.16.6.1.1(a) Single-Row Rack Sprinkler Layout for Design Scheme "A." [30:-Figure 16.6.1.1(a)]
****INSERT FIGURE****

Figure 66.16.6.1.1(b) Double-Row Rack Sprinkler Layout for Design Scheme "A." [30:-Figure 16.6.1.1(b)]
****INSERT FIGURE****

Figure 66.16.6.1.1(c) Multiple-Row Rack Sprinkler Layout for Design Scheme "A." [30:-Figure 16.6.1.1(c)]
****INSERT FIGURE****

66.16.6.1.5 *

Where adjacent rack bays are not dedicated to storage of ignitible (flammable or combustible) liquids, the barrier and in-rack sprinkler protection shall be extended at least 8 ft (2.4 m) beyond the area devoted to ignitible (flammable or combustible) liquid storage. In addition, barrier and in-rack sprinkler protection shall be provided for any rack across the aisle within 8 ft (2.4 m) of the perimeter of the ignitible (flammable or combustible) liquid storage in accordance with 66.16.6.1. [**30:**16.6.1.5]

66.16.6.1.8

Ceiling sprinklers shall meet the following requirements:

(1) Ceiling sprinkler protection shall be designed to protect the surrounding occupancy.
(2) Any sprinkler type shall be acceptable.
(3) If standard spray sprinklers are used, they shall be capable of providing not less than 0.20 gpm/ft^2 over 3000 ft^2 (8 mm/min over 270 m^2).
(4) If the ignitible (flammable or combustible) liquid storage does not extend to the full height of the rack, protection for commodities stored above the top horizontal barrier shall meet the requirements of Section 13.3 and NFPA 13 for the commodities stored, based on the full height of the rack.

[**30:**16.6.1.8]

66.16.6.2 Fire Protection System Design Scheme "B."

66.16.6.2.1

Horizontal barriers of plywood having a minimum thickness of $^{3}/_{8}$ in. (10 mm) or of sheet metal of minimum 22 gauge thickness shall be installed in accordance with Figure 66.16.6.2.1(a), Figure

66.16.6.2.1(b), or Figure 66.16.6.2.1(c), whichever is applicable. All ignitible (flammable or combustible) liquid storage shall be located beneath a barrier. [**30:**16.6.2.1]

Figure 66.16.6.2.1(a) Single-Row Rack Sprinkler Layout for Design Scheme "B" — Sprinklers in Center of Rack. [30:-Figure 16.6.2.1(a)]
****INSERT FIGURE****

Figure 66.16.6.2.1(b) Single-Row Rack Sprinkler Layout for Design Scheme "B" — Sprinklers on Face of Rack. [30:-Figure 16.6.2.1(b)]
****INSERT FIGURE****

Figure 66.16.6.2.1(c) Double-Row Rack Sprinkler Layout for Design Scheme "B." [30:-Figure 16.6.2.1(c)]
****INSERT FIGURE****

66.16.6.2.2

In-rack sprinklers shall be installed in accordance with Figure 66.16.6.2.1(a), Figure 66.16.6.2.1(b), or Figure 66.16.6.2.1(c), whichever is applicable. [**30:**16.6.2.2]

66.16.6.2.4

In-rack sprinklers shall meet the following requirements:

(1) In-rack sprinklers shall be ordinary temperature–rated quick-response sprinklers and shall have a nominal K-factor equal to or greater than 8.0. Intermediate-temperature sprinklers shall be used where ambient conditions require.
(2) In-rack sprinklers shall be installed below each barrier level.
(3) For containers that do not exceed 60 gal (230 L) capacity, in-rack sprinklers shall provide a minimum discharge flow of 57 gpm (220 L/min) out of each of the hydraulically most remote six sprinklers (six on one line or three on two lines) if one barrier level is provided, or out of each of the hydraulically most remote eight sprinklers (eight on one line or four on two lines on the same level)~~,~~ if two or more barrier levels are provided. The minimum in-rack sprinkler discharge pressure shall not be less than a gauge pressure of 10 psi (0.69 bar).
(4) For containers that exceed 60 gal (230 L) capacity, but do not exceed 793 gal (3000 L), in-rack sprinklers shall provide a minimum discharge flow of 57 gpm (220 L/min) out of each of the hydraulically most remote 12 sprinklers (12 on one line or six on two lines on the same level). The minimum in-rack sprinkler discharge pressure shall not be less than a gauge pressure of 10 psi (0.69 bar).

[**30:**16.6.2.4]

66.16.6.2.5

If there are adjacent rack bays that are not dedicated to storage of ignitible (flammable or combustible) liquids, the barrier and in-rack sprinkler protection shall be extended beyond the area devoted to ignitible (flammable or combustible) liquid storage as follows:

(1) For containers that do not exceed 1 gal (3.8 L) capacity, protection shall be extended at least 8 ft (2.4 m) beyond the area devoted to ignitible (flammable or combustible) liquid storage. In addition, adjacent racks across the aisles on each side of the ignitible (flammable or

combustible) liquid storage shall be protected in accordance with Section 13.3 and NFPA 13 for the commodity stored.

(2) For containers that exceed 1 gal (3.8 L) capacity, but do not exceed 793 gal (3000 L), protection shall be extended at least 8 ft (2.4 m) beyond the area devoted to ignitible (flammable or combustible) liquid storage. In addition, protection shall be provided for~~to~~ any rack across the aisle within 8 ft (2.4 m) of the perimeter of the ignitible (flammable or combustible) liquid storage in accordance with 66.16.6.2.

[**30:**16.6.2.5]

66.16.6.2.6

Ceiling sprinklers for containers that do not exceed 1 gal (3.8 L) capacity shall meet the following requirements:

(1) Ceiling sprinklers shall be designed to protect the surrounding occupancy.
(2) Ceiling sprinkler water demand shall not be included in the hydraulic calculations for the in-rack sprinkler protection.
(3) Water demand at the point of supply shall be calculated separately for in-rack and ceiling sprinklers and shall be based on the greater of the two.
(4) Any sprinkler type shall be acceptable for the ceiling sprinkler protection.
(5) If standard spray sprinklers are used, they shall be capable of providing not less than 0.20 gpm/ft^2 over 3000 ft^2 (8 L/min over 270 m^2).
(6) If the ignitible (flammable or combustible) liquid storage does not extend to the full height of the rack, protection for commodities stored above the top horizontal barrier shall meet the requirements of Section 13.3 and NFPA 13 for the commodities stored, based on the full height of the rack.

[**30:**16.6.2.6]

66.16.6.3 Fire Protection System Design Scheme "C."

66.16.6.3.1

Horizontal barriers of plywood having a minimum thickness of $^3/_8$ in. (10 mm) or of sheet metal of minimum 22 gauge thickness shall be installed in accordance with Figure 66.16.6.3.1(a), Figure 66.16.6.3.1(b), or Figure 66.16.6.3.1(c), whichever is applicable. All ignitible (flammable or combustible) liquid storage shall be located beneath a barrier. [**30:**16.6.3.1]

Figure 66.16.6.3.1(a) Single-Row Rack Sprinkler Layout for Design Scheme "C." [30:-Figure 16.6.3.1(a)]
****INSERT FIGURE****

Figure 66.16.6.3.1(b) Double-Row Rack Sprinkler Layout for Design Scheme "C." [30:-Figure 16.6.3.1(b)]
****INSERT FIGURE****

Figure 66.16.6.3.1(c) Multiple-Row Rack Sprinkler Layout for Design Scheme "C." [30:-Figure 16.6.3.1(c)]
****INSERT FIGURE****

66.16.6.3.4

If there are adjacent bays of in-rack arrays that are not dedicated to storage of ignitible (flammable or combustible) liquids, the barrier and in-rack sprinkler protection shall be extended at least 8 ft (2.4 m) beyond the area devoted to ignitible (flammable or combustible) liquid storage. [**30:**16.6.3.4]

66.16.6.3.7

Ceiling sprinklers shall meet the following requirements:

(1) Ceiling sprinkler protection shall be designed to protect the surrounding occupancy.
(2) Any sprinkler type shall be acceptable.
(3) If standard spray sprinklers are used, they shall be capable of providing not less than 0.20 gpm/ft^2 over 3000 ft^2 (8 mm/min over 270 m^2).
(4) If the ignitible (flammable or combustible) liquid storage does not extend to the full height of the rack, protection for commodities stored above the top horizontal barrier shall meet the requirements of Section 13.3 and NFPA 13 for the commodities stored, based on the full height of the rack.

[**30:**16.6.3.7]

66.16.6.4 Fire Protection System Design Scheme "D."

66.16.6.4.1

In-rack sprinklers shall meet the following requirements:

(1) In-rack sprinklers shall be installed in accordance with Figure 66.16.6.4.1(a) or Figure 66.16.6.4.1(b), whichever is applicable.
(2) In-rack sprinklers shall be ordinary-temperature-rated, quick-response sprinklers.
(3) In-rack sprinklers shall have a K-factor of 8.0 (115).
(4) In-rack sprinklers shall provide a minimum discharge flow of 30 gpm (113 L/min) out of the hydraulically most remote:
    (a) Eight sprinklers on one level if one level of in-racks (8 total)
    (b) Seven sprinklers on two levels if two or more levels of in-racks (14 total)

[**30:**16.6.4.1]

Figure 66.16.6.4.1(a) Single-Row Rack Sprinkler Layout for Design Scheme "~~E~~D." [30:16.6.4.1(a)]
****INSERT FIGURE****

Figure 66.16.6.4.1(b) Double-Row Rack Sprinkler Layout for Design Scheme "~~E~~D." [30:16.6.4.1(b)]
****INSERT FIGURE****

66.16.6.4.2

If there are adjacent bays of in-rack arrays that are not dedicated to ignitible (flammable or combustible) storage of liquids, in-rack sprinkler protection shall be extended at least 8 ft (2.4 m) beyond the area devoted to ignitible (flammable or combustible) liquid storage. [**30:**16.6.4.2]

66.16.6.4.3

Ceiling sprinklers shall be designed to provide a minimum density of 0.3 gpm/ft^2 (12.2 mm/min) over the most remote 2000 ft^2 (185 m^2) using ordinary-temperature-rated, standard-response spray sprinklers, having a nominal K-factor of 8.0 or 11.2. [**30:**16.6.4.3]

66.16.6.4.4

The ceiling and in-rack sprinkler water demands shall be balanced at the point of connection to the water supply. [**30:**16.6.4.4]

66.16.6.4.5

A 500 gpm (1890L/min) hose stream allowance shall be provided. [**30:**16.6.4.5]

66.16.6.4.6

A 1-hour duration shall be provided for the fire protection water demand. [**30:**16.6.4.6]

~~66.16.6.4~~ 66.16.6.5 Fire Protection System Design Scheme "E."

~~66.16.6.4.1~~66.16.6.5.1

~~Sprinklers and horizontal barriers shall be in-stalled in accordance with Figure 66.16.6.4.1(a) or Figure 66.16.6.4.1(b), whichever is applicable.~~ Horizontal barriers ~~shall be~~ of plywood having a minimum thickness of $^3/_8$ in. (10 mm) or of sheet metal of minimum 22 gauge thickness shall be installed in accordance with Figure 66.16.6.4.1(a) or Figure 66.16.6.4.1(b), whichever is applicable. ~~All liquid storage shall be located beneath a barrier.~~

[**30:**16.6.5~~4~~.1]

66.16.6.5.2

All ignitible (flammable or combustible) liquid storage shall be located beneath a barrier. [**30:**16.6.5.2]

~~66.16.6.4.2~~66.16.6.5.3

Vertical baffles shall not be installed between in-rack sprinklers. [**30:**16.6.5.3~~4.2~~]

~~66.16.6.4.3~~66.16.6.5.4

In-rack sprinklers shall meet the following requirements:

(1) In-rack sprinklers shall be intermediate temperature~~-~~ rated, pendent sprinklers with a nominal K-factor of 25.2, RTI of 50 (m/sec)$^{1/2}$ or less, and ~~shall~~ be listed as extended coverage control mode density/area storage sprinklers.

(2) In-rack sprinklers shall be ~~positioned in a transverse flue~~installed below each barrier level.

~~(3) In-rack sprinklers shall not be positioned within 3.5 ft (1 m) of a rack upright.~~

~~(4)~~(3) The minimum in-rack sprinkler discharge pressure shall not be less than a gauge pressure of 30 psi ~~(207 kPa)~~.

~~(5)~~(4) Where one level of in-rack sprinklers is installed, the design shall include the four~~3~~ most hydraulically remote sprinklers (i.e., ~~on a~~four on one line). ~~single line.~~

~~(6)~~(5) Where two levels of in-rack sprinklers are installed, the design shall include the ~~3~~three most hydraulically remote sprinklers on each level~~a single line, and the 2 most hydraulically remote sprinklers on the next adjacent level~~.

~~(7)~~(6) Where three or more levels of in-rack sprinklers are installed, the design shall include the ~~3~~three most hydraulically remote sprinklers on the top three levels~~a single line, and the 2 most hydraulically remote sprinklers on the next two adjacent levels~~.

~~(8)~~(7) Foam-water sprinkler protection shall be permitted to be substituted for water sprinkler protection, provided the same design criteria is used.~~, and that the sprinkler is listed for use with foam.~~

[**30:**16.6.~~4.3~~5.4]

~~66.16.6.4.4~~66.16.6.5.5

If there are adjacent bays of in-rack arrays that are not dedicated to storage of ignitible (flammable or combustible) liquids, the barrier and in-rack sprinkler protection shall be extended at least ~~6~~8 ft (2.4~~1.8~~ m) beyond the area devoted to ignitible (flammable or combustible) liquid storage. [**30:**16.6.5.5~~4.4~~]

~~66.16.6.4.5~~66.16.6.5.6

Ceiling sprinkler demand shall not be included in the hydraulic calculations for in-rack sprinklers where standard-response sprinklers are used for ceiling-level protection.~~.~~ [**30:**16.6.5~~4~~.6~~5~~]

66.16.6.5.7 Water Demand.

~~66.16.6.4.6~~66.16.6.5.7.1

Water demand at point of supply shall be calculated separately for in-rack and ceiling sprinklers. [**30:**16.6.5.7.1]

66.16.6.5.7.2

Water demand~~and~~ shall be based on the greater demand between in-rack and ceiling sprinklers. [**30:**16.6.~~4.6~~5.7.2]

~~66.16.6.4.7~~66.16.6.5.8

Ceiling sprinklers shall meet the following requirements:

(1) Ceiling sprinkler protection shall be designed to protect the surrounding occupancy.

(2) Any sprinkler type shall be acceptable.

(3) *If standard spray sprinklers are used, they shall be capable of providing not less than 0.30 gpm/ft^2 over 3000 ft^2 (8 mm/min over 270 m^2) when supplied with water. ~~Design area can be reduced to 2000 ft^2 when using a preprimed foam-water system installed in accordance with NFPA 16 and maintained in accordance with NFPA 25.~~

(4) If the ignitible (flammable or combustible) liquid storage does not extend to the full height of the rack, protection for commodities stored above the top horizontal barrier shall meet the requirements of NFPA 13 for the commodities stored, based on the full height of the rack.

[**30:**16.6.5.8~~4.7~~]

A.66.16.6.5.8(3)

Design area can be reduced to 2000 ft^2 when using a preprimed foam-water system installed in accordance with NFPA 16 and maintained in accordance with NFPA 25. [**30:**A.16.6.5.8(3)]

~~66.16.6.4.8~~66.16.6.5.9

A 500 gpm (1900 L/min) hose stream allowance shall be provided. [**30:**16.6.5.9~~4.8~~]

66.16.6.6 Fire Protection System Design Scheme "F."

66.16.6.6.1

In-rack sprinklers shall meet the following requirements:

(1) In-rack sprinklers shall be ordinary temperature-rated, quick-response sprinklers.
(2) In-rack sprinklers shall have a K-factor of 8.0 (115) or 11.2 (160).
(3) In-rack sprinklers shall be installed on 20 ft (6 m) vertical increments in accordance with Figure 66.16.6.6.1(a) and Figure 66.16.6.6.1(b) with the in-rack pattern shown in Figure 66.16.6.6.1(b) repeated from rack face to rack face for multiple-row racks.
(4) In-rack sprinklers shall provide a minimum discharge flow of 30 gpm (110 L/min) out of the hydraulically most remote sprinkler as follows:
    (a) Six in-rack sprinklers on one level if one level of in-racks (6 total)
    (b) Six in-rack sprinklers on two levels if two levels of in-racks (12 total)
    (c) Six in-rack sprinklers on three levels if three or more levels of in-racks (18 total)

[**30:**16.6.6.1]

Figure 66.16.6.6.1(a) Single-Row Rack Sprinkler Layout for Design Scheme "F." [30:16.6.6.1(a)]
****INSERT FIGURE****

Figure 66.16.6.6.1(b) Double-Row Rack Sprinkler Layout for Design Scheme "F." (Multiple row racks shall extend the same sprinkler pattern through the rack.) [30:16.6.6.1(b)]
****INSERT FIGURE****

66.16.6.6.2

If there are adjacent bays of rack storage that are not dedicated to ignitible (flammable or combustible) liquid storage, the in-rack sprinkler protection shall be extended at least 8 ft (2.4 m) beyond the area devoted to ignitible (flammable or combustible) liquid storage. [**30:**16.6.6.2]

66.16.6.6.3

The ceiling and in-rack sprinkler demands shall be balanced at the point of connection to the water supply. [**30:**16.6.6.3]

66.16.6.6.4

A 500 gpm (1890L/min) hose stream allowance shall be provided. [**30:**16.6.6.4]

66.16.6.6.5

A 1-hour duration shall be provided for the fire protection water demand. [**30:**16.6.6.5]

~~66.16.6.5~~66.16.6.7 In-Rack Sprinkler Layouts for Table 66.16.5.2.8.

Where indicated in Table 66.16.5.2.8 and Table 66.16.5.2.16, in-rack sprinklers shall be installed as follows:

(1) Where Layout 7 is required, in-rack sprinklers shall be installed in accordance with Figure 66.16.6.~~5~~7(a).
(2) Where Layout 8 is required, in-rack sprinklers shall be installed in accordance with Figure 66.16.6.~~5~~7(b) or Figure 66.16.6.~~5~~7(c).
(3) Where Layout 9 is required, in-rack sprinklers shall be installed in accordance with Figure 66.16.6.~~5~~7(d), or Figure 66.16.6.~~5~~7(e), whichever is applicable.

[**30:**16.6.7~~5~~]

Figure 66.16.6.7~~5~~(a) Double-Row Rack Sprinkler Layout ~~G~~7. [30:-Figure 16.6.7~~5~~(a)]
****INSERT FIGURE****

Figure 66.16.6.7~~5~~(b) Double-Row Rack Sprinkler Layout 8~~I~~ — Option #1. [30:-Figure 16.6.~~5~~7(b)]
****INSERT FIGURE****

Figure 66.16.6.7~~5~~(c) Double-Row Rack Sprinkler Layout ~~I~~8 — Option #2. [30:-Figure 16.6.~~5~~7(c)]
****INSERT FIGURE****

Figure 66.16.6.7~~5~~(d) Double-Row Rack Sprinkler Layout ~~H~~9 — Option #1. [30:-Figure 16.6.~~5~~7(d)]
****INSERT FIGURE****

Figure 66.16.6.7~~5~~(e) Double-Row Rack Sprinkler Layout ~~H~~9 — Option #2. [30:-Figure 16.6.7~~5~~(e)]
****INSERT FIGURE****

66.16.7 Water Supply.

Water supplies for automatic sprinklers, other water-based protection systems, hose streams, and hydrants shall be capable of supplying the anticipated water flow demand for a minimum of 2 hours. [**30:**16.7]

66.16.8.1

Containment or containment and drainage shall be provided in accordance with Figure 66.16.8.1, when protection systems are installed in accordance with the provisions of this section. [**30:**16.8.1]

Figure 66.16.8.1 Spill Containment and Liquid Spread Control for Protected Storage. [30:Figure 16.8.1]
****INSERT FIGURE****

A.66.16.8.2

Subsection 66.16.8 requires that control of liquid spread be provided to prevent a pool fire on the floor from spreading and opening more sprinkler heads than the design of the sprinkler system anticipates. For example, if the sprinkler system is designed to provide 0.45 gpm/ft^2 over 3000 ft^2 (18 mm/min over 280 m^2), 66.16.8.2 requires that the spread of liquid also be limited to 3000 ft^2 (280 m^2). Various means are available to achieve this control. [**30:**A.16.8.2]

Typical methods use trench or spot drains that divide the floor of the storage area into rectangles having areas equal to or less than the design area of the sprinkler system. Drains are centered under racks, and the floor is sloped toward the drain trenches with a minimum slope of 1 percent. The floor is made highest at the walls. See Figure A.66.16.8.2(a) and Figure A.66.16.8.2(b). Trenches are arranged as described in NFPA 15 and as shown in Figure A.66.16.8.2(c). Note particularly the dimensions of the trenches, and note that the solid covering spans one-third of the width on either side of the open grate and the open grate spans the middle third. Spot drains can be similarly arranged. Another method, shown in Figure A.66.16.8.2(d), uses spot drains located at building columns, where the area between any four columns does not exceed the design area of the sprinkler system. The floor is sloped to direct water flow to the drains. [**30:**A.16.8.2]

Connections to the drains are provided at trapped sumps, arranged as described in NFPA 15. See Figure A.66.16.8.2(e). To provide a safety factor, the drain pipes are sometimes sized to carry 150 percent of anticipated sprinkler discharge. The following equation can be used to calculate the flow of the drain pipe:

[A.66.16.8.2]

$$F = 1.5DA$$

where:
F = flow (gpm or L/min)
D = sprinkler design density (gpm/ft^2 or L/min/m^2)
A = sprinkler design area (ft^2 or m^2)

[**30:**A.16.8.2]

Additional information can be found in *Guidelines for Safe Warehousing of Chemicals*, Center for Chemical Process Safety, American Institute of Chemical Engineers. [**30:**A.16.8.2]

Figure A.66.16.8.2(a) General Scheme for Warehouse Spill Control of Liquids. [30:-Figure A.16.8.2(a)]
****INSERT FIGURE****

Figure A.66.16.8.2(b) Plan View of Warehouse Spill Control of Liquids. [30:-Figure A.16.8.2(b)]
****INSERT FIGURE****

Figure A.66.16.8.2(c) Details of Drainage Trench Design. [30:-Figure A.16.8.2(c)]
****INSERT FIGURE****

Figure A.66.16.8.2(d) Typical Arrangement of Floor Drains. [30:-Figure A.16.8.2(d)]
****INSERT FIGURE****

Figure A.66.16.8.2(e) Details of Liquid-Seal Trap. [30:-Figure A.16.8.2(e)]
****INSERT FIGURE****

66.17.1.1 *

This section shall apply where the processing of ignitible (flammable or combustible) liquids is the principal activity, except as covered elsewhere in this *Code* or in other NFPA standards. *(See 66.1.4.)* [**30:**17.1.1]

66.17.1.2

Provisions of this section shall not prohibit the use of movable tanks for the dispensing of ignitible (flammable or combustible) ~~flammable or combustible~~ liquids into fuel tanks of motorized equipment outside on premises not accessible to the public, where such use has the approval of the AHJ. [**30:**17.1.2]

66.17.3.1

Ignitible (flammable or combustible) ~~L~~liquid processing operations shall be located and operated so that they do not constitute a significant fire or explosion hazard to life, to property of others, or to important buildings or facilities within the same plant. [**30:**17.3.1]

66.17.3.2

Specific requirements shall depend on the inherent risk in the operations themselves, including the ignitible (flammable or combustible) liquids being processed, operating temperatures and pressures, and the capability to control any ignitible (flammable or combustible) liquid or vapor releases or fire incidents that could occur. [**30:**17.3.2]

66.17.3.6

Processing and handling of Class II and Class III liquids [FP ≥ 100°F (37.8°C)] heated at or above their flash point shall follow the requirements for Class I liquids [FP < 100°F (37.8°C)], unless an engineering evaluation conducted in accordance with Section 66.6 justifies following the requirements for some other liquid class. *(See 66.6.4.1.2 and A.66.6.4.1.2.)* [**30:**17.3.6]

66.17.3.7

When a process heats an ignitible (flammable or combustible)~~a~~ liquid to a temperature at or above its flashpoint, the following shall apply:

(1) The process vessel shall be closed to the room in which it is located and vented to the outside of the building.
(2) If the vessel needs to be opened to add ingredients, the room ventilation shall meet the requirements of 66.17.11 and the process heating controls will be interlocked with the ventilation such that the process heat will shut down if the ventilation fails or is turned off.

(3) The process vessel shall be equipped with an excess temperature control set to limit excessive heating of the ignitible (flammable or combustible) liquid and the subsequent release of vapors.
(4) If a heat transfer medium is used to heat the ignitible (flammable or combustible) liquid and the heat transfer fluid can heat the ignitible (flammable or combustible) liquid to its boiling point on failure of the process and excess temperature heat controls, a redundant excess temperature control shall be provided.

[**30:**17.3.7]

66.17.4 Location of Process Vessels and Equipment.

66.17.4.1

Ignitible (flammable or combustible) ~~L~~liquid-processing vessels and equipment shall be located in accordance with the requirements of this section. [**30:**17.4.1]

66.17.4.3

The minimum distance of a processing vessel to a property line that is or can be built upon, including the opposite side of a public way; to the nearest side of a public way; or to the nearest important building on the same property shall be determined by one of the following:

(1) In accordance with Table 66.17.4.3
(2) In accordance with an engineering evaluation of the process, followed by application of sound fire protection and process engineering principles

[**30:**17.4.3]

Table 66.17.4.3 Location of Process Vessels with Respect to Property Lines, Public Ways, and the Nearest Important Building on the Same Property — Protection for Exposures Is Provided

	Minimum Distance (ft)										
Vessel Maximum Operating Liquid Capacity (gal)	From Property Line that Is or Can Be Built upon, Including Opposite Side of Public Way						From Nearest Side of Any Public Way or from Nearest Important Building on Same Property that Is Not an Integral Part of the Process				
	Stable Liquid Emergency Relief*			Unstable Liquid Emergency Relief*			Stable Liquid Emergency Relief*			Unstable Liquid Emergency Relief*	
	Not Over 2.5 psi	Over 2.5 psi		Not Over 2.5 psi	Over 2.5 psi		Not Over 2.5 psi	Over 2.5 psi		Not Over 2.5 psi	Over 2.5 psi

275 or less	5	25		50	100		5	25		50	100
276 to 750	10	25		50	100		5	25		50	100
751 to 12,000	15	25		50	100		5	25		50	100
12,001 to 30,000	20	30		50	100		5	25		50	100
30,001 to 50,000	30	45		75	120		10	25		50	100
50,001 to 100,000	50	75		125	200		15	25		50	100
Over 100,000	80	120		200	300		25	40		65~~50~~	100

For SI units, 1 gal = 3.8 L; 1 ft = 0.3 m; 1 psi = a gauge pressure of 6.9 kPa.
Note: Double all of above distances where protection for exposures is not provided.
*Gauge pressure. [**30:**-Table 17.4.3]

66.17.4.3.1

Processing vessels used solely to process stable Class IIIB liquids [FP ≥ 200°F (93°C)] shall be located in accordance with Table 22.4.1.6 of NFPA 30. [**30:**17.4.3.1]

66.17.4.6 *

Ignitible (flammable or combustible) ~~L~~liquid-processing equipment, such as pumps, heaters, filters, and exchangers, shall not be located closer than 25 ft (7.6 m) to property lines where the adjoining property is or can be built upon or to the nearest important building on the same property that is not an integral part of the process. This spacing requirement shall be permitted to be waived where exposures are protected in accordance with 66.17.4.3. [**30:**17.4.6]

66.17.5 Accessibility.

Each process unit or building containing ignitible (flammable or combustible) liquid-processing equipment shall be accessible from at least one side for fire fighting and fire control. [**30:**17.5]

66.17.6.1

Process buildings or structures used for ignitible (flammable or combustible) liquid operations shall be constructed consistent with the operations being conducted and with the classes of liquids handled. They shall be constructed to minimum Type II (000) construction, as defined in *NFPA 5000*, and shall be constructed in accordance with Table 66.17.6.1. [**30:**17.6.1]

Table 66.17.6.1 Minimum Separation Distances for Buildings or Structures Used for Ignitible (Flammable or Combustible) Liquid Handling and Operations

		Minimum Separation Distance (ft)	
Liquid Class	**Minimum Type of Construction***	**To Street, Alley, or Public Way**	**To Adjacent Property Line that Is or Can Be Built Upon**
	II (222)	5	10

Class I liquids [FP < 100°F (37.8°C)]; unstable liquids of any class; liquids of any class heated above their flash points†	II (111)	5	25
	II (000)	10	50
Class II liquids [100°F (37.8°C) ≤ FP < 140°F (60°C)]	II (111)	5	10
	II (000)	5	25
Class III [FP ≥ 140°F (60°C)]	II (000)	5	10

For SI units, 1 ft = 0.3 m.

Note: Distances apply to properties that have protection for exposures, as defined in this code. If there are exposures for which protection does not exist, the distances should be doubled, in accordance with 66.17.6.3.

*Construction types are defined in NFPA 220. [**30:**-Table 17.6.1]

†For stable liquids of any class heated above their flash points, see 66.6.4.1.2 and A.66.6.4.1.2.1.

66.17.6.5

Buildings or structures used solely for blending, mixing, or dispensing of Class IIIB liquids [FP ≥ 200°F (93°C)] at temperatures below their flash points shall be permitted to be constructed of combustible construction, subject to the approval of the AHJ. [**30:**17.6.5]

66.17.6.6

Buildings or structures used for processing or handling of ignitible (flammable or combustible) liquids where the quantities of ignitible (flammable or combustible) liquids do not exceed 360 gal (1360 L) of Class I and Class II liquids [FP < 140°F (60°C)] and 720 gal (2725 L) of Class IIIA liquids [140°F (60°C) ≤ FP < 200°F (93°C)] shall be permitted to be constructed of combustible construction, subject to the approval of the AHJ. [**30:**17.6.6]

66.17.6.7

Buildings or structures used for processing or handling of ignitible (flammable or combustible) liquids protected with automatic sprinklers or equivalent fire protection systems shall be permitted to be constructed of combustible construction, subject to the approval of the AHJ. [**30:**17.6.7]

66.17.6.8 *

Load-bearing building supports and load-bearing supports of vessels and equipment capable of releasing quantities of ignitible (flammable or combustible) liquids that could result in a fire capable of causing substantial property damage shall be protected by one or more of the following:

(1) Drainage to a safe location to prevent ignitible (flammable or combustible) liquids from accumulating under vessels or equipment or around load-bearing supports
(2) Fire-resistive construction
(3) Fire-resistant protective coatings or systems
(4) Water spray systems designed and installed in accordance with NFPA 15
(5) Other alternate means acceptable to the AHJ

[**30:**17.6.8]

66.17.6.9

Class I liquids [FP < 100°F (37.8°C)] shall not be handled or used in basements. [**30:**17.6.9]

66.17.6.9.1

Where Class I liquids [FP < 100°F (37.8°C)] are handled or used above grade within buildings with basements or closed pits into which flammable vapors can travel, such belowgrade areas shall be provided with mechanical ventilation designed to prevent the accumulation of flammable vapors. [**30:**17.6.9.1]

66.17.6.9.2

Means shall be provided to prevent ignitible (flammable or combustible) liquid spills from running into basements. [**30:**17.6.9.2]

66.17.6.13

Indoor areas where Class IA liquids [FP < 73°F (22.8°C) and BP < 100°F (37.8°C)],~~or~~ unstable liquids, or other liquids intentionally heated to or above their BP are in use shall be designed to direct flame, combustion gases, and pressures resulting from a deflagration away from important buildings or occupied areas through the use of damage-limiting construction in accordance with NFPA 68. [**30:**17.6.13]

66.17.6.13.1

The damage-limiting construction design shall be ~~in accordance with recognized standards and shall be acceptable to the AHJ.~~both of the following: *(See A.66.9.15.1.)*

1) In accordance with recognized standards
2) Acceptable to the AHJ

[**30:**17.6.13.1]

66.17.6.13.2

Where unstable liquids are in use, an approved engineered construction method that is designed to limit damage from an explosion (i.e., deflagration or detonation, depending on the characteristics of the liquid) shall be used. [**30:**17.6.13.2]

66.17.10.1 *

A facility shall be designed and operated to prevent the discharge of ignitible (flammable or combustible) liquids to public waterways, public sewers, or adjoining property. [**30:**17.10.1]

66.17.10.2

Emergency drainage systems shall be provided to direct ignitible (flammable or combustible) liquid leakage and fire protection water to a safe location. [**30:**17.10.2]

66.17.11.8

Where equipment such as dispensing stations, open centrifuges, plate and frame filters, and open

vacuum filters is used in a building, the equipment and ventilation of the building shall be designed to limit flammable vapor–air mixtures under normal operating conditions to the interior of equipment and to not more than 5 ft (1.5 m) from equipment that exposes Class I liquids [FP < 100°F (37.8°C)] to the air. [**30:**17.11.10]

66.17.14 *Process Equipment and Vessels.

Equipment shall be designed and arranged to prevent the unintentional escape of ignitible (flammable or combustible) liquids and vapors and to minimize the quantity escaping in the event of accidental release. [**30:**17.14]

66.17.15.1

This section shall apply to the management methodology used to identify, evaluate, and control the hazards involved in processing and handling of ignitible (flammable or combustible) ~~flammable and combustible~~ liquids. These hazards include, but are not limited to, preparation; separation; purification; and change of state, energy content, or composition. [**30:**17.15.1]

66.17.15.2

Operations involving ignitible (flammable or combustible)~~flammable and combustible~~ liquids shall be reviewed to ensure that fire and explosion hazards resulting from loss of containment of ignitible (flammable or combustible) liquids are provided with corresponding fire prevention and emergency action plans. [**30:**17.15.2]

66.17.15.2.1

~~Exception No. 1:~~ Operations where ignitible (flammable or combustible) liquids are used solely for on-site consumption as fuels shall not be required to comply with 66.17.15.2. [**30:**17.15.2.1]

66.17.15.2.2

~~Exception No. 2:~~ Operations where Class II or Class III liquids [FP ≥ 100°F (37.8°C)] are stored in atmospheric tanks or transferred at temperatures below their flash points shall not be required to comply with 66.17.15.2. [**30:**17.15.2.2]

66.17.15.2.3

~~Exception No. 3:~~ Mercantile occupancies, crude petroleum exploration, drillings, and well servicing operations, and normally unoccupied facilities in remote locations shall not be required to comply with 66.17.15.2. [**30:**17.15.2.3]

66.17.15.4

A written emergency action plan that is consistent with available equipment and personnel shall be established to respond to fires and related emergencies. This plan shall include the following:

(1) Procedures to be followed in case of fire or release of ignitible (flammable or combustible) liquids or vapors, such as sounding the alarm, notifying the fire department, evacuating personnel, and controlling and extinguishing the fire

(2) Procedures and schedules for conducting drills of these procedures
(3) Appointment and training of personnel to carry out assigned duties, which shall be reviewed at the time of initial assignment, as responsibilities or response actions change, and whenever anticipated duties change
(4) Procedures for maintenance of the following:
    (a) Fire protection equipment and systems
    (b) Drainage and containment systems
    (c) Ventilation equipment and systems
(5) Procedures for shutting down or isolating equipment to reduce, control, or stop the release of ignitible (flammable or combustible) liquid or vapors, including assigning personnel responsible for maintaining critical plant functions or shutdown of plant processes and safe startup following isolation or shutdown
(6) Alternative measures for the safety of occupants

[**30:**17.15.4]

66.18 Dispensing, Handling, Transfer, and Use of Ignitible (Flammable or Combustible) Liquids.

66.18.1 Scope.

This section applies where ignitible (flammable or combustible) liquids are handled, dispensed, transferred, or used, including in process areas. [**30:**18.1]

66.18.3 General Requirements.

Processing and handling of Class II and Class III liquids [FP ≥ 100°F (37.8°C)] heated at or above their ~~flash point~~FP shall follow the requirements for Class I liquids [FP < 100°F (37.8°C)], unless an engineering evaluation conducted in accordance with Section 66.6 justifies following the requirements for some other liquid class. *(See 66.6.4.1.2 and A.66.6.4.1.2.)* [**30:**18.3]

66.18.4.1

Class I liquids [FP < 100°F (37.8°C)] shall be kept in closed tanks or containers when not actually in use. Class II and Class III liquids [FP ≥ 100°F (37.8°C)] shall be kept in closed tanks or containers when not actually in use when the ambient or process temperature is at or above their FP~~flash points~~. [**30:**18.4.1]

66.18.4.2

Where ignitible (flammable or combustible) liquids are used or handled, provisions shall be made to promptly and safely mitigate and dispose of leakage or spills. [**30:**18.4.2]

66.18.4.3

Class I liquids [FP < 100°F (37.8°C)] shall not be used outside closed systems where there are open flames or other ignition sources within the classified areas set forth in Section 66.7. [**30:**18.4.3]

66.18.4.4

Transfer of ignitible (flammable or combustible) liquids among vessels, containers, tanks, and piping

systems by means of air or inert gas pressure shall be permitted only under all of the following conditions:

(1) The vessels, containers, tanks, and piping systems shall be designed for such pressurized transfer and shall be capable of withstanding the anticipated operating pressure.
(2) Safety and operating controls, including pressure-relief devices, shall be provided to prevent overpressure of any part of the system.
(3) Only inert gas shall be used to transfer Class I liquids [FP < 100°F (37.8°C)]. Only inert gas shall be used to transfer Class II and Class III liquids [FP ≥ 100°F (37.8°C)] that are heated above their FP~~flash points~~.

[**30:**18.4.4]

66.18.4.4.1

Dispensing of Class I liquids [FP < 100°F (37.8°C)] from a container by means of air shall be permitted under the following conditions:

(1) The pressure shall be generated by means of a listed hand-operated device.
(2) Pressure shall not exceed a gauge pressure of 6 psi (41 kPa) and pressure relief shall be provided.
(3) The container shall not exceed 119 gal (450 L) and shall be capable of withstanding the maximum pressure generated by the device.
(4) The device shall be bonded and grounded or shall be demonstrated as not being capable of generating a static charge under any operating condition.
(5) The device shall be constructed of ~~The~~ material ~~of construction of the device shall be~~ compatible with the ignitible (flammable or combustible) liquid dispensed.

[**30:**18.4.4.1]

66.18.4.8 *

The staging of ignitible (flammable or combustible) liquids in containers, intermediate bulk containers, and portable tanks shall be limited to the following:

(1) Containers, intermediate bulk containers, and portable tanks that are in use
(2) Containers, intermediate bulk containers, and portable tanks that were filled during a single shift
(3) Containers, intermediate bulk containers, and portable tanks needed to supply the process for one continuous 24-hour period
(4) Containers, intermediate bulk containers, and portable tanks that are stored in accordance with Section 66.9

[**30:**18.4.8]

66.18.4.9

Class I, Class II, or Class IIIA liquids [FP < 200°F (93°C)] used in a process and staged in the process area shall not be filled in the process area. [**30:**18.4.9]

66.18.4.9.1

~~Exception No. 1:~~ Intermediate bulk containers and portable tanks that meet the requirements of Section 66.9 shall be permitted to be filled in the process area. [**30:**18.4.9.1]

66.18.4.9.2

~~Exception No. 2:~~ Intermediate products that are manufactured in the process area shall be permitted to be filled in the process area. [**30:**18.4.9.2]

66.18.5 Incidental Operations.

66.18.5.1 *

This section shall apply to areas where the use, handling, and storage of ignitible (flammable or combustible) liquids is only a limited activity to the established occupancy classification. [**30:**18.5.1]

A.66.18.5.1

Incidental operations are operations that utilize liquids only as a limited activity to that which establishes the occupancy classification. Examples include automobile assembly, assembly of electronic equipment, furniture manufacturing, and areas within refineries, distilleries, and chemical plants where the use of liquids is incidental, such as in maintenance shops, offices, or vehicle repair shops. Some more detailed descriptions follow:

(1) *Vehicle Assembly.* Vehicle assembly operations usually involve both process and incidental use of liquids. An example of a process operation would be paint storage and mixing utilized for application of the vehicle primer, color coats, and clear coats. For these operations, the requirements of Chapter 17 of NFPA 30 apply. Examples of incidental use would be sealer deck wipedown operations, windshield washer solvent dispensing, brake fluid filling, and final line paint repair operations. These operations might be continuous. However, the quantities of liquids used and the vapor exposures are significantly reduced from larger volume usage found within vehicle body component paint mixing and storage operations.

(2) *Assembly of Electrical Equipment.* Examples of incidental use of liquids in these types of occupancies might include “photoresist” coating operations, “softbaking” operations, wave solder operations, and wipedown operations.

(3) *Chemical Plant Maintenance Shop.* Incidental use of liquids is commonplace in maintenance shops located within a chemical plant. Examples are cutting oils used in a machine shop, Class II solvents for degreasing, and Class I and Class II paint solvents and fuels associated with automotive and industrial truck repair.

(4) *Cleaning and Sanitation.* Under provisions established by the U.S. Food and Drug Administration (FDA) in 21 CFR, “GMP for Medical Devices,” Class I and Class II liquids [FP < 140°F (60°C)] can be used for cleaning and sanitation purposes. Limited quantities are used to remove manufacturing materials, mold release compounds, and other contaminants not intended to be on the final product. An example would be the use of isopropyl alcohol (IPA), transferred to a cleaning wipe via a plunger-type liquid-dispensing container. The cleaning wipe is then used to remove manufacturing materials not intended to be on the final product. The key point here is not that the liquid is not part of the final product, but that limited quantities of liquid are used and the use is incidental to the manufacturing operation that produces the product.

[**30:**A.18.5.1]

66.18.5.2

Class I liquids [FP < 100°F (37.8°C)] or Class II and Class III liquids [FP ≥ 100°F (37.8°C)] that are heated up to or above their ~~flash points~~FP shall be drawn from or transferred into vessels, containers, or portable tanks as follows:

(1) From original shipping containers with a capacity of 5.3 gal (20 L) or less
(2) From safety cans
(3) Through a closed piping system
(4) From portable tanks or containers by means of a device that has antisiphoning protection and that draws through an opening in the top of the tank or container
(5) By gravity through a listed self-closing valve or self-closing faucet

[**30:**18.5.2]

66.18.5.2.3

Where pumps are used for ignitible (flammable or combustible) liquid transfer, means shall be provided to deactivate liquid transfer in the event of ~~a~~ an ignitible (flammable or combustible) liquid spill or fire. [**30:**18.5.2.3]

66.18.5.3

Storage of ignitible (flammable or combustible) liquids other than those governed by 66.18.5.4 and 66.18.5.5 shall comply with Section 66.9. [**30:**18.5.3]

66.18.5.4

The maximum allowable quantities (MAQs) of ignitible (flammable or combustible) liquids in containers in use in incidental operations in a control area shall not exceed the greater of the following:

(1) * The amount required to supply incidental operations for one continuous 24-hour period, provided the hazard analysis required in Section 66.6 accounts for these quantities
(2) The aggregate sum of the quantities provided in Table 66.18.5.4

Table 66.18.5.4 MAQ of ~~Flammable and Combustible~~ Liquids Per Control Area for Incidental Operations

	Open Use		Use — Closed Containers	
Liquid Class(es)#	**gal**	**L**	**gal**	**L**
IA	10	38	30	115
IB and IC	30	115	120	460
II	30	115	120	460
IIIA	80	300	330	1,265
IIIB	3,300	12,650	13,200	50,600

#See 66.4.1 for details on the classification scheme.

Notes:

1) Quantities are permitted to be increased 100 percent where stored in approved Class I liquids [FP < 100°F (37.8°C)] ~~flammable liquids~~ storage cabinets or in safety cans. Where note (2) also applies, the increase for both notes is permitted to be applied accumulatively.

2) Quantities are permitted to be increased 100 percent in buildings equipped throughout with an approved automatic sprinkler system installed in accordance with NFPA 13. Where Note (1) also applies, the increase for both notes is permitted to be applied accumulatively.

[**30:**18.5.4]

A.66.18.5.4(1)

The intent of this requirement is to allow the quantities of flammable and combustible (ignitible) liquids needed to safely and efficiently operate for the actual operating hours in any 24-hour period. As an example, if the facility operates only 8 hours out of 24 (i.e., a single shift) and uses 50 gal (190 L) of liquid during that time, then 50 gal (190 L) is the allowable quantity for the continuous 24-hour period. If the facility increases operations to two shifts, then the allowable quantity doubles to 100 gal (380 L). [**30:**A.18.5.4(1)]

66.18.5.4.1

Where the quantities of ignitible (flammable or combustible) liquids in incidental operations are governed by 66.18.5.4(2), the aggregate quantity of liquids in storage and in use shall not exceed the maximum allowable quantity per control area in Section 66.9. [**30:**18.5.4.1]

66.18.5.4.2

Control areas shall be in accordance with Section 66.9. [**30:**18.5.4.2]

66.18.5.5

Where quantities of ignitible (flammable or combustible) liquids in excess of the limits in 66.18.5.4.1 are necessary, storage shall be in tanks that meet all applicable requirements of Section 66.17, Sections 66.21 through 66.25, and Section 66.27. [**30:**18.5.5]

66.18.5.6

Areas in which ignitible (flammable or combustible) liquids are transferred from one tank or container to another container shall be provided with the following:

(1) Separation from other operations where potential ignition sources are present by distance or by fire-resistant construction
(2) Drainage or other means to control spills
(3) Natural or mechanical ventilation that meets the requirements of 66.17.11

[**30:**18.5.6]

66.18.6 Ventilation for Dispensing Areas.

66.18.6.1 Ventilation Type.

66.18.6.1.1

~~Liquid storage a~~Areas where dispensing is conducted shall be provided with either a gravity system or a continuous mechanical exhaust ventilation system. [**30:**18.6.1.1]

66.18.6.1.2

~~Liquid storage areas where dispensing is conducted shall be provided with either a gravity system or a continuous mechanical exhaust ventilation system.~~ Mechanical ventilation shall be used if Class I liquids [FP < 100°F (37.8°C)] are dispensed within the room. [**30:**18.6.1.2]

66.18.6.~~1~~2

Exhaust air shall be taken from a point near a wall on one side of the room and within 12 in. (300 mm) of the floor, with one or more make-up inlets located on the opposite side of the room within 12 in. (300 mm) of the floor. [**30:**18.6.2~~1~~]

~~66.18.6.2~~66.18.6.3

The location of both the exhaust and inlet air openings shall be arranged to provide air movement across all portions of the floor to prevent accumulation of flammable vapors. [**30:**18.6.3~~2~~]

~~66.18.6.3~~66.18.6.4 *

Exhaust ventilation discharge shall be to a safe location outside the building. [**30:**18.6.4~~3~~]

~~A.66.18.6.3~~A.66.18.6.4

A "safe location" should be selected as the location of a vent discharge to minimize the potential for ignitible vapors to travel to a source of ignition after discharge from the vent. Electrical equipment that does not meet the requirements for hazardous locations can serve as an ignition source. The Technical Committee advises that vent discharge locations should consider ~~such~~ factors such as the following:

(1) Characteristics of the exhausted material (vapor density, toxicity, velocity of discharge, etc.)
(2) Proximity to potential ignition sources
(3) Building openings such as doors, windows, air intakes, and so forth~~.~~
(4) Dispersion characteristics (distance to discharge within the flammable range, direction of discharge, atmospheric conditions, and the influence of building and neighboring buildings on discharged vapors)
(5) Likelihood of vapor accumulation following discharge, such as accumulation under building eaves
(6) Likelihood of sufficient discharge volume to allow an ignitible concentration to reach an ignition source

[**30:**A.18.6.4~~3~~]

Historically, NFPA 30 has provided prescriptive guidance, often based on area classification requirements, and results have been acceptable. Closer distances should be accepted only if an engineering study by a qualified engineer justifies closer distances. Similarly, the specified distances might not be acceptable for all installations, thus the guidance provided above. [**30:**A.18.6.~~3~~4]

~~66.18.6.3.1~~66.18.6.4.1

Recirculation of the exhaust air shall be permitted only when it is monitored continuously using a fail-safe system that is designed to automatically sound an alarm, stop recirculation, and provide full exhaust to the outside in the event that vapor-air mixtures in concentrations over one-fourth of the lower flammable limit are detected. [**30:**18.6.4~~3~~.1]

~~66.18.6.4~~66.18.6.5

If ducts are used, they shall not be used for any other purpose and shall comply with NFPA 91. [**30:**18.6.5~~4~~]

~~66.18.6.4.1~~66.18.6.5.1

If make-up air to a mechanical system is taken from within the building, the opening shall be equipped with a fire door or damper, as required in NFPA 91. [**30:**18.6.5~~4~~.1]

~~66.18.6.4.2~~66.18.6.5.2

For gravity systems, the make-up air shall be supplied from outside the building. [**30:**18.6.5~~4~~.2]

66.18.6.6

Mechanical ventilation systems shall provide at least 1 cfm of exhaust air for each square foot of floor area (0.3 m^3/min/m^2), but not less than 150 cfm (4 m^3/min). [**30:**18.6.6]

~~66.18.6.5.1~~66.18.6.6.1

The mechanical ventilation system for dispensing areas shall be ~~equipped with an airflow switch or other equally reliable method that is interlocked to sound an audible alarm upon failure of the ventilation system~~designed to provide an alarm notification upon loss of airflow. [**30:**18.6.6~~5.1~~]

66.18.6.6.2

Dispensing operations shall be stopped upon loss or failure of the ventilation. [**30:**18.6.6.2]

66.19.1 Scope.

This section shall apply to the handling and use of ~~flammable and combustible~~ liquids in specific operations as herein described. [**30:**19.1]

66.19.2.1 *Cooking Oil.

Where used in this section, cooking oil shall be ~~defined~~ classified as a Class IIIB ~~combustible~~ liquid [FP ≥ 200°F (93°C)]. This definition shall apply to both fresh, or new, cooking oil and waste, or used, cooking oil. [**30:**19.2.1]

A.66.19.2.1

Cooking oil is a Class IIIB liquid [FP ≥ 200°F (93°C)] with a high ~~flash point~~FP typically above 500°F (260°C). Because of its high ~~flash point~~FP, cooking oil presents a lower fire hazard than Class IIIB liquids [FP ≥ 200°F (93°C)] having ~~flash points~~FP lower than 500°F (260°C). Fresh, or new, cooking oil is supplied to the user for cooking operations. As the oil becomes degraded through repeated use, it must be replaced with fresh oil. This waste, or used, cooking oil is recovered from the cooking appliance and temporarily stored for offsite removal. To maintain fluidity in the transfer process, the waste oil is heated to approximately 100°F (38°C), well below the ~~flash point~~FP temperature. [**30:**A.19.2.1]

A.66.19.4.3.1

Heat transfer fluid systems have the potential for releasing large quantities of heated flammable or combustible (ignitible) liquids. Low--point drains piped to a safe location provide the ability to remove heat transfer fluid from a breached piping system in order to minimize the total quantity of fluid released. An engineering analysis should be used to determine the location and design of low-point drains. The engineering analysis should consider system inventory, the amount of heat transfer fluid that can be released in a specific fire area, the exposure created by a release, and the fire protection provided. [**30:**A.19.4.3.1]

66.19.5.2.1

Tanks and equipment shall have independent venting for overpressure or vacuum conditions that could occur from malfunction of the vapor recovery or vapor processing system. [**30:**19.5.2.1]

66.19.5.2.2

E~~xception: For tanks, v~~Venting of tanks shall comply with 66.21.4.3. [**30:**19.5.2.2]

66.19.5.4.1

Vapor collection piping shall be designed to prevent trapping ignitible (flammable or combustible) liquid. [**30:**19.5.4.1]

66.19.5.4.2

Vapor recovery and vapor processing systems that are not designed to handle ignitible (flammable or combustible) liquid shall be provided with a means to eliminate any ignitible (flammable or combustible) liquid that carries over to or condenses in the vapor collection system. [**30:**19.5.4.2]

66.19.5.5.1 *

A liquid knock-out vessel used in the vapor collection system shall have means to verify the ignitible (flammable or combustible) liquid level and a high liquid level sensor that activates an alarm. [**30:**19.5.5.1]

66.19.5.5.2

For unattended facilities, the high liquid level sensor shall initiate shutdown of ignitible (flammable or combustible) liquid transfer into the vessel and shutdown of vapor recovery or vapor processing systems. [**30:**19.5.5.2]

66.19.5.6.1

Storage tanks served by vapor processing or vapor recovery systems shall be equipped with overfill protection in accordance with ~~66.~~21.7.1 of NFPA 30. [**30:**19.5.6.1]

66.19.5.7.1 Vapor Release.

Tank or equipment openings provided for purposes of vapor recovery shall be protected against possible vapor release in accordance with ~~66.23.13.7 and~~ 66.28.11.1.8.1 and 23.13.7 of NFPA 30. [**30:**19.5.7.1]

A.66.19.5.7.3

NFPA 77 and API ~~RP~~ 2003, *Protection Against Ignition Arising Out of Static, Lightning, and Stray Currents*, can be used as a reference for protections against static ignition. [**30:**A.19.5.7.3]

66.19.6.1.1

This section shall apply to solvent distillation units having distillation chambers or still pots that do not exceed 60 gal (227 L) nominal capacity and are used to recycle Class I, Class II, or Class IIIA liquids [FP < 200°F (93°C)]. [**30:**19.6.1.1]

66.19.7.1.3 *

Where there are conflicts between the requirements of this section and requirements of other sections of this ~~c~~*Code*, the requirements of this section shall take precedence. [**30:**19.7.1.3]

A.66.19.7.1.3

The goal of 66.19.7 is to consolidate in one location all requirements for commercial kitchen cooking oil storage and operations. There are a number of chapters in NFPA 30 that apply to these systems, including chapters on storage tanks and piping systems, transferring and dispensing of liquids, and so forth. Many of these requirements are more applicable to industrial or process situations and commercial kitchen cooking oil storage and use was not anticipated. All applicable chapters have been assessed in detail. Those specific requirements in this section that are in potential conflict with other sections of this *C~~c~~ode* have been identified~~,~~ and alternate methods or exceptions have been developed where appropriate. This approach eliminates the need to add exceptions throughout the existing *C~~c~~ode*, improving ease of use particularly for fire officials. [**30:**A.19.7.1.3]

66.19.7.2.1 Materials of Construction.

Tanks shall be ~~constructed of materials~~ of metallic or nonmetallic construction. [**30:**19.7.2.1]

66.19.7.2.1.2 *

For tanks storing waste cooking oil, ~~the materials of construction of~~ the tanks and their appurtenances shall be constructed of materials compatible with cooking oil at a minimum temperature~~s~~ of 140°F (60°C) continuous and 235°F (113°C) intermittent. [**30:**19.7.2.1.2]

A.66.19.7.2.1.2

Waste oil is drained from commercial cooking equipment via a transfer pump and transfer lines to a waste oil storage tank. The oil might be as hot as 375°F (190°C), still well below the oil's FP~~flash point~~. Experience shows that the oil loses significant heat in the transfer process. The maximum temperature of waste cooking oil entering the storage tank is typically below 235°F (113°C). The storage tank should be constructed of materials compatible with cooking oil in that temperature range. [**30:**A.19.7.2.1.2]

A.66.19.7.2.2.1

Existing steel tanks listed for flammable and combustible (ignitible) ~~flammable and combustible~~ liquids

are considered acceptable for waste oil use. These tank standards contain design and construction requirements that would not meet food code requirements, making the tanks unacceptable for storage of liquid food products (i.e., fresh cooking oil). [**30:**A.19.7.2.2.1]

A.66.19.7.2.5

Although generally not required for tanks storing Class IIIB liquids [FP ≥ 200°F (93°C)], overfill protection is considered necessary for cooking oil storage tanks to prevent inadvertent spillage. [**30:**A.19.7.2.5]

66.19.7.3.2.3

Where a tank is located in areas subject to flooding, the method for anchoring the tank ~~to the floor~~ shall be capable of preventing the tank, either full or empty, from floating during a rise in water level up to the established maximum flood stage. Engineering evaluation by a qualified, impartial outside agency shall be an acceptable method of meeting this requirement. [**30:**19.7.3.2.3]

66.19.7.4.2 *

In areas where tanks are located, no additional ventilation shall be required beyond that ~~required~~ necessary for comfort ventilation, ~~and~~ provided that all cooking equipment is ~~provided~~ equipped with exhaust systems in accordance with NFPA 96. [**30:**19.7.4.2]

A.66.19.7.5.1

Waste oil lines are generally pumped until there is little residual oil remaining in the lines. Fresh cooking oil lines are likely to contain residual oil after fill and removal operations. Restricting the fresh oil line size to 1.25 in. (32 mm) maximum inside diameter limits the amount of oil in the line. Additionally, the requirement for check valves or antisiphon valves on the lines at points where the lines connect to the tank eliminates the possibility of a compromised line siphoning the contents of the tank. To the extent possible, transfer lines should avoid being routed over seating areas. These requirements are designed to minimize fire risk by limiting cooking oil quantities in transfer lines that could become involved in a fire. In buildings protected by automatic ~~fire~~ sprinklers, the need to add sprinklers in previously unprotected spaces (assuming the transfer lines are located in these spaces) should be considered in accordance with the requirements of NFPA 13. [**30:**A.19.7.5.1]

66.21 Storage of Ignitible (Flammable or Combustible) Liquids in Tanks — Requirements for All Storage Tanks.

66.21.1 Scope.

This section shall apply to the following:

(1) The storage of ~~flammable and combustible~~ liquids, as defined in 3.3.178.1 and 3.3.178.2 and Section 66.4, in fixed tanks that exceed 60 gal (230 L) capacity
(2) The storage of ~~flammable and combustible~~ liquids in portable tanks that exceed 660 gal (2500 L) capacity
(3) The storage of ~~flammable and combustible~~ liquids in intermediate bulk containers that exceed 793 gal (3000 L) capacity

(4) The design, installation, testing, operation, and maintenance of such tanks, portable tanks, and bulk containers

[**30:**21.1]

66.21.3.1

Storage of Class II and Class III liquids [FP ≥ 100°F (37.8°C)] heated at or above their ~~flash point~~FP shall follow the requirements for Class I liquids [FP < 100°F (37.8°C)], unless an engineering evaluation conducted in accordance with Section 66.6 and 66.21.6 justifies following the requirements for some other liquid class. [**30:**21.3.1]

66.21.4.1.5 Combustible Materials.

66.21.4.1.5.1

Tanks shall be permitted to be constructed of combustible materials ~~when~~ where approved. [**30:**21.4.1.5.1]

66.21.4.1.5.2

~~Tanks shall be permitted to be constructed of combustible materials when approved.~~ Tanks constructed of combustible materials shall be limited to any of the following:

(1) Underground installation
(2) Use where required by the properties of the ignitible (flammable or combustible) liquid stored
(3) Aboveground storage of Class IIIB liquids [FP ≥ 200°F (93°C)] in areas not exposed to a spill or leak of Class I or Class II liquids [FP < 140°F (60°C)]
(4) Storage of Class IIIB liquids [FP ≥ 200°F (93°C)] inside a building protected by an approved automatic fire-extinguishing system

[**30:**21.4.1.5.2]

66.21.4.1.5.3*

Use of electrical immersion heaters in nonmetallic tanks shall be prohibited. [**30:**21.4.1.5.3]

A.66.21.4.1.5.3

Electrical immersion heaters pose a potential hazard to melt through plastic tanks and/or cause ignition. If these heaters are proposed for use in plastic tanks because of operational needs, a hazard analysis required by 6.4.1 should consider engineering controls such as, but not limited to, the following:

(1) Low-liquid-level alarm
(2) High-temperature alarm
(3) Over-temperature and low-liquid-level automatic shutoff of the immersion heater

[**30:**A.21.4.1.5.3]

66.21.4.1.5.4

Exposed combustible components of nonmetallic tanks shall be spaced at least 3 ft (0.9 m) away from any surface heated to a temperature above 140°F (60°C) and at least 6 ft (1.8 m) away from any open flame. [**30:**21.4.1.5.4]

66.21.4.2.1.1 *

Atmospheric tanks ~~shall be~~ designed and constructed in accordance with any of the following recognized engineering standards~~. Atmospheric tanks that meet any of the following standards~~ shall be deemed as meeting the requirements of 66.21.4.2.1:

(1) API Specification 12B, *Bolted Tanks for Storage of Production Liquids*
(2) API Specification 12D, *Field Welded Tanks for Storage of Production Liquids*
(3) API Specification 12F, *Shop Welded Tanks for Storage of Production Liquids*
(4) API Standard 650, *Welded Tanks for Oil Storage*
(5) UL 58, *Steel Underground Tanks for Flammable and Combustible Liquids*
(6) UL 80, *Steel Tanks for Oil~~-~~-Burner Fuels and Other Combustible Liquids*
(7) UL 142, *Steel Aboveground Tanks for Flammable and Combustible Liquids*
~~(7)~~(8) UL 142A, *Safety for Special Purpose Aboveground Tanks for Specific Flammable or Combustible Liquids*
~~(8)~~(9) UL 1316, *Glass-Fiber Reinforced Plastic Underground Storage Tanks for Petroleum Products, Alcohols, and Alcohol-Gasoline Mixtures*
~~(9)~~(10) ~~UL 1746, *External Corrosion Protection Systems for Steel Underground Storage Tanks*~~
~~(10)~~(11) UL 2080, *Fire Resistant Tanks for Flammable and Combustible Liquids*
(12) UL 2085, *Protected Aboveground Tanks for Flammable and Combustible Liquids*
~~(11)~~(13) UL 2258, *Aboveground Nonmetallic Tanks for Fuel Oil and Other Combustible Liquids*, where used in accordance with the provisions in 66.21.4.1.5

[**30:**21.4.2.1.1]

A.66.21.4.2.1.1

Atmospheric tanks include tanks of compartmented design and tanks that incorporate secondary containment. [**30:**A.21.4.2.1.1]

~~For shop-fabricated steel generator base, work bench, lube oil, used oil, and day tanks, see~~ UL 142A, ~~*Outline of Investigation for*~~ *Special Purpose Aboveground Tanks for Specific Flammable or Combustible Liquids*, covers shop-fabricated steel special-purpose generator base, work bench, lube oil, used oil, and day-tank types. [**30:**A.21.4.2.1.1]

66.21.4.2.1.2

Tanks shall be limited to operation from atmospheric to a gauge pressure of 0.5 psi (3.5 kPa) unless permitted in 66.21.4.2.1.3 and 66.21.4.2.1.5. [**30:**21.4.2.1.2]

66.21.4.2.1.2

Atmospheric tanks designed and constructed in accordance with Appendix F of API Standard 650, *Welded Tanks for Oil Storage*, shall be permitted to operate at pressures from atmospheric to a gauge pressure of ~~1.0~~ 2.5 psi (17.2~~6.9~~ kPa). ~~All other tanks shall be limited to operation from atmospheric to a~~

~~gauge pressure of 0.5 psi (3.5 kPa) except as permitted in 66.21.4.2.1.3 and 66.21.4.2.1.4.~~
[**30:**21.4.2.1.3~~2~~]

66.21.4.2.1.3.1
Tanks shall be anchored as required by Annex F of API Standard 650, *Welded Tanks for Oil Storage*. [**30:**21.4.2.1.3.1]

66.21.4.2.1.4
Atmospheric tanks that are not designed and constructed in accordance with Appendix F of API Standard 650, *Welded Tanks for Oil Storage*, shall be permitted to operate at pressures from atmospheric to a gauge pressure of 1.0 psi (6.9 kPa) only if an engineering analysis is performed to determine that the tank can withstand the elevated pressure. [**30:**21.4.2.1.4]

66.21.4.2.1.5~~4~~
Horizontal cylindrical and rectangular tanks built according to any of the standards specified in 66.21.4.2.1.1 shall be permitted to operate at pressures from atmospheric to a gauge pressure of 1.0 psi (6.9 kPa) and shall be limited to a gauge pressure of 2.5 psi (17 kPa) under emergency venting conditions. [**30:**21.4.2.1.5~~4~~]

66.21.4.2.1.6~~5~~
Low-pressure tanks and pressure vessels shall be permitted to be used as atmospheric tanks. [**30:**21.4.2.1.6~~5~~]

66.21.4.2.1.7~~6~~
Atmospheric tanks shall not be used to store a ignitible (flammable or combustible) liquid at a temperature at or above its boiling point. [**30:**21.4.2.1.7~~6~~]

66.21.4.3.1 Storage Tank Venting.

66.21.4.3.1.1*
Storage tanks shall be vented to prevent the development of vacuum or pressure that can distort the tank or exceed the rated design vacuum or rated design pressure of the tank~~pressure of the tank~~ when the tank is filled or emptied or because of atmospheric temperature changes. [**30:**21.4.3.1.1]

A.66.21.4.3.1.1 ~~A.66.21.4.3.2~~
Normal venting is not required for the interstitial space of a secondary containment tank. [**30:**A.21.4.3.1.1~~2~~]

66.21.4.3.1.2
Normal vents shall be located above the maximum normal liquid level. [**30:**21.4.3.1.2]

~~**66.21.4.3.2** *~~

~~Normal venting shall be provided for primary tanks and each primary compartment of a compartmented tank. [**30:**21.4.3.2]~~

~~**66.21.4.3.3**~~

~~Normal vents shall be sized in accordance with either API Standard 2000, *Venting Atmospheric and Low-Pressure Storage Tanks*, or another approved standard. Alternatively, the normal vent shall be at least as large as the largest filling or withdrawal connection, but in no case shall it be less than 1.25 in. (32 mm) nominal inside diameter. [**30:**21.4.3.3]~~

~~66.21.4.3.4~~66.21.4.3.2 *

Atmospheric storage tanks shall be vented so as not to exceed the tank's design operating pressure or a gauge pressure of 1.0 psi (6.9 kPa), whichever is less, and shall be vented to prevent the development of vacuum. [**30:**21.4.3.24]

~~A.66.21.4.3.4~~A.66.21.4.3.2

Tanks intended for normal operation at pressures greater than a gauge pressure of 1.0 psi (6.9 kPa) are designed in accordance with 66.21.4.2.3. It is recognized that a slight vacuum is necessary to operate a vacuum vent. [**30:**A.21.4.3.24]

66.21.4.3.3~~66.21.4.3.5~~

Low-pressure tanks and pressure vessels shall be vented to prevent the development of pressure or vacuum that exceeds the rated design pressure of the tank or vessel. Means shall also be provided to prevent overpressure from any pump discharging into the tank or vessel when the pump discharge pressure can exceed the design pressure of the tank or vessel. [**30:**21.4.3.35]

66.21.4.3.4~~66.21.4.3.6~~

If any tank or pressure vessel has more than one fill or withdrawal connection and simultaneous filling or withdrawal can be made, the vent size shall be based on the maximum anticipated simultaneous flow. [**30:**21.4.3.46]

66.21.4.3.5~~66.21.4.3.7~~

For tanks equipped with vents that permit pressures to exceed a gauge pressure of 2.5 psi (17 kPa) and for low-pressure tanks and ~~for~~ pressure vessels, the outlet of all vents and vent drains shall be arranged to discharge in a manner that prevents localized overheating of or flame impingement on any part of the tank, if vapors from the vents are ignited. [**30:**21.4.3.57]

66.21.4.3.6~~66.21.4.3.8~~

Tanks and pressure vessels that store Class IA liquids [FP < 73°F (22.8°C) and BP < 100°F (37.8°C)] shall be equipped with venting devices that are closed, except when venting under pressure or vacuum conditions. [**30:**21.4.3.68]

66.21.4.3.7~~66.21.4.3.9~~

Tanks and pressure vessels that store Class IB and Class IC liquids [FP < 100°F (37.8°C) and BP ≥ 100°F (37.8°C)] shall be equipped with venting devices or with listed flame arresters. When used, vent devices shall be closed, except when venting under pressure or vacuum conditions. [**30:**21.4.3.7~~9~~]

66.21.4.3.8~~66.21.4.3.10~~

Tanks of 3000 barrels (bbl) [126,000 gal or (475 m^3)] capacity or less that store crude petroleum in crude-producing areas and outside aboveground atmospheric tanks of less than 1000 gal (3785 L) capacity that contain other than Class IA liquids [FP < 73°F (22.8°C) and BP < 100°F (37.8°C)] shall be permitted to have open vents. [**30:**21.4.3.8~~10~~]

66.21.4.3.9~~66.21.4.3.11~~ *

Flame arresters or venting devices required in 66.21.4.3.~~8~~ 6 and 66.21.4.3.7~~9~~ shall be permitted to be omitted on tanks that store Class IB or Class IC liquids [FP < 100°F (37.8°C) and BP ≥ 100°F (37.8°C)] where conditions are such that their use can, in case of obstruction, result in damage to the tank. [**30:**21.4.3.9~~11~~]

~~A.66.21.4.3.11~~A.66.21.4.3.9

Liquid properties that justify omitting such devices include, but are not limited to, condensation, corrosiveness, crystallization, polymerization, freezing, or plugging. When any of these conditions exist, consideration should be given to heating, use of devices that employ special materials of construction, use of liquid seals, or inerting. See NFPA 69. [**30:**A.21.4.3.9~~11~~]

66.21.4.3.10~~66.21.4.3.12~~

Piping for normal vents shall be designed in accordance with Section 66.27. [**30:**21.4.3.10~~2~~]

66.21.4.4 *Tank Fill Pipes.

Fill pipes that enter the top of a tank shall terminate within 6 in. (150 mm) of the bottom of the tank. Fill pipes shall be installed or arranged so that vibration is minimized.

Exception No. 1: Fill pipes in tanks whose vapor space under the expected range of operating conditions is not in the flammable range or is inerted need not meet this requirement.
Exception No. 2: Fill pipes in tanks handling ignitible (flammable or combustible) liquids with minimal potential for accumulation of static charge need not meet this requirement, provided that the fill line is designed and the system is operated to avoid mist generation and to provide residence time downstream of filters or screens to allow dissipation of the generated static charge. [**30:**21.4.4]

66.21.5.1.2

An approved listing mark on a tank shall be considered to be evidence of compliance with 66.21.5.1. Tanks not so marked shall be tested before they are placed in service in accordance with the applicable requirements for testing in the ~~codes~~ standards listed in 66.21.4.2.1.1, 66.21.4.2.2.1, or 66.21.4.2.3.1 or in accordance with recognized engineering standards. Upon satisfactory completion of testing, a permanent record of the test results shall be maintained by the owner. [**30:**21.5.1.1]

66.21.5.2.2

Air pressure shall not be used to test tanks that contain ~~flammable or combustible~~ liquids or vapors. *(See ~~66.27.7~~Section 27.7 of NFPA 30 for testing pressure piping.)* [**30:**21.5.2.2]

66.21.5.2.3

For field-erected tanks, the tests required by 66.21.5.1.2 or ~~66.~~21.5.1.2 of NFPA 30 shall be permitted to be considered the test for tank tightness. [**30:**21.5.2.3]

66.21.6.3.2

Maintenance and operating procedures and practices at tank storage facilities shall be established and implemented to control leakage and prevent spillage and release of ignitible (flammable or combustible) liquids. [**30:**21.6.6.2]

66.21.6.3.3

Ground areas around tank storage facilities shall be kept free of weeds, trash, ~~or~~and other unnecessary combustible materials. [**30:**21.6.6.3]

66.21.7.2.1 Identification for Emergency Responders.

A sign or marking that meets the requirements of NFPA 704 or another approved system~~,~~ shall be applied to storage tanks containing ignitible (flammable or combustible) liquids. The marking shall be located where it can be seen, such as on the side of the tank, the shoulder of an accessway or walkway to the tank or tanks, or on the piping outside of the diked area. If more than one tank is involved, the markings shall be so located that each tank can be identified. [**30:**21.7.2.1]

66.21.7.3.1 Tank~~Water~~ Loading.

66.21.7.3.1.1

The filling of a tank to be protected by water or product loading shall be started as soon as floodwaters are predicted to reach a dangerous flood stage. [**30:**21.7.3.1.1]

66.21.7.3.1.2

Where independently fueled ~~water~~ pumps are relied on, sufficient fuel shall be available at all times to permit continuing operations until all tanks are filled. [**30:**21.7.3.1.2]

66.21.7.3.1.3

Tank valves shall be locked in a closed position when ~~water~~ loading has been completed. [**30:**21.7.3.1.3]

66.21.7.4 *Leak Detection and Inventory Records for Underground Storage Tanks.

Accurate inventory records or a leak detection program shall be maintained on all Class I liquid [FP < 100°F (37.8°C)] storage tanks for indication of leakage from the tanks or associated piping. [**30:**21.7.5]

66.22 Storage of Ignitible (Flammable or Combustible) Liquids in Tanks — Aboveground Storage Tanks.

66.22.1 Scope.

This section shall apply to the following:

(1) The storage of ~~flammable and combustible~~ liquids, as defined in 3.3.178.1 and 3.3.178.2 and Section 66.4, in fixed tanks that exceed 60 gal (230 L) capacity

(2) The storage of ~~flammable and combustible~~ liquids in portable tanks that exceed 660 gal (2500 L) capacity

(3) The storage of ~~flammable and combustible~~ liquids in intermediate bulk containers that exceed 793 gal (3000 L)

(4) The design, installation, testing, operation, and maintenance of such tanks, portable tanks, and bulk containers

[**30:**22.1]

66.22.2 Definitions Specific to Section 66.22.

For the purpose of this section, the terms in this section shall have the definitions given. [**30:**22.2]

66.22.3 General Requirements.

Storage of Class II and Class III liquids [FP ≥ 100°F (37.8°C)] heated at or above their ~~flash point~~FP shall follow the requirements for Class I liquids [FP < 100°F (37.8°C)], unless an engineering evaluation conducted in accordance with Section 66.6 justifies following the requirements for some other liquid class. [**30:**22.3]

66.22.4.1.1

Tanks storing Class I, Class II, or Class IIIA stable liquids [FP < 200°F (93°C)] whose internal pressure is not permitted to exceed a gauge pressure of 2.5 psi (17 kPa) shall be located in accordance with Table 66.22.4.1.1(a) and Table 66.22.4.1.1(b). Where tank spacing is based on a weak roof-to-shell seam design, the user shall present evidence certifying such construction to the AHJ upon request. [**30:**22.4.1.1]

~~29~~Table 66.22.4.1.1(a) Location of Aboveground Storage Tanks Storing Stable Liquids — Internal Pressure Not to Exceed a Gauge Pressure of 2.5 psi (17 kPa) [30:22.4.1.1(a)]

		Minimum Distance (ft)	
Type of Tank	**Protection**	**From Property Line That Is or Can Be Built Upon, Including the Opposite Side of a Public Way[a]**	**From Nearest Side of Any Public Way or from Nearest Important Building on the Same Property[a]**
Floating roof	Protection for exposures~~c~~[b]	$^1/_2$ × diameter of tank	$^1/_6$ × diameter of tank
	None	Diameter of tank but need not exceed 175 ft	$^1/_6$ × diameter of tank

Vertical with weak roof-to-shell seam	Approved foam or inerting system[c] on tanks not exceeding 150 ft in diameter[d]	$^1/_2$ × diameter of tank	$^1/_6$ × diameter of tank
	Protection for exposures[~~c~~b]	Diameter of tank	$^1/_3$ × diameter of tank
	None	2 × diameter of tank but need not exceed 350 ft	$^1/_3$ × diameter of tank
Horizontal and vertical tanks with emergency relief venting to limit pressures to 2.5 psi (gauge pressure of 17 kPa)	Approved inerting system[~~b~~c] on the tank or approved foam system on vertical tanks	$^1/_2$ × value in Table 66.22.4.1.1(b)	$^1/_2$ × value in Table 66.22.4.1.1(b)
	Protection for exposures[b]	Value in Table 66.22.4.1.1(b)	Value in Table 66.22.4.1.1(b)
	None	2 × value in Table 66.22.4.1.1(b)	Value in Table 66.22.4.1.1(b)
Protected aboveground tank	None	$^1/_2$ × value in Table 66.22.4.1.1(b)	$^1/_2$ × value in Table 66.22.4.1.1(b)

For SI units, 1 ft = 0.3 m.

[a]The minimum distance cannot be less than 5 ft (1.5 m).

[b]See definition 3.3.46 of NFPA 30, Protection for Exposures.

[c]See NFPA 69.

[d]For tanks over 150 ft (45 m) in diameter, use “Protection for Exposures” or “None,” as applicable. [**30:** Table 22.4.1.1(a)]

~~30~~Table 66.22.4.1.1(b) Reference Table for Use with Tables 66.22.4.1.1(a), 66.22.4.1.3, and 66.22.4.1.5

	Minimum Distance (ft)	
Tank Capacity (gal)	**From Property Line that Is or Can Be Built Upon, Including the Opposite Side of a Public Way**	**From Nearest Side of Any Public Way or from Nearest Important Building on the Same Property**
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 units, 1 ft = 0.3 m; 1 gal = 3.8 L. [**30:** Table 22.4.1.1(b)]

66.22.4.1.2

Vertical tanks with weak roof-to-shell seams *(see ~~66.~~22.7.2 of NFPA 30)* that store Class IIIA liquids [FP < 200°F (93°C)] shall be permitted to be located at one-half the distances specified in Table 66.22.4.1.1(a), provided the tanks are not within the same diked area as, or within the drainage path of, a tank storing a Class I or Class II liquid [FP < 140°F (60°C)]. [**30:**22.4.1.2]

66.22.4.1.3

Tanks storing Class I, Class II, or Class IIIA stable liquids [FP < 200°F (93°C)] and operating at pressures that exceed a gauge pressure of 2.5 psi (17 kPa), or are equipped with emergency venting that will permit pressures to exceed a gauge pressure of 2.5 psi (17 kPa), shall be located in accordance with Table 66.22.4.1.3 and Table 66.22.4.1.1(b). [**30:**22.4.1.3]

~~31~~Table 66.22.4.1.3 Location of Aboveground Storage Tanks Storing Stable Liquids — Internal Pressure Permitted to Exceed a Gauge Pressure of 2.5 psi (17 kPa)

		Minimum Distance (ft)	
Type of Tank	**Protection**	**From Property Line that Is or Can Be Built Upon, Including the Opposite Side of a Public Way**	**From Nearest Side of Any Public Way or from Nearest Important Building on the Same Property**
Any type	Protection for exposures*	$1^1/_2$ × value in Table 66.22.4.1.1(b) but not less than 25 ft	$1^1/_2$ × value in Table 66.22.4.1.1(b) but not less than 25 ft

	None	3 × value in Table 66.22.4.1.1(b) but not less than 50 ft	$1^1/_2$ × value in Table 66.22.4.1.1(b) but not less than 25 ft

For SI units, 1 ft = 0.3 m.

*See definition 3.3.46 of NFPA 30, Protection for Exposures. [**30:**Table 22.4.1.3]

66.22.4.1.4

Tanks storing ignitible (flammable or combustible) liquids with boil-over characteristics shall be located in accordance with Table 66.22.4.1.4. Liquids with boil-over characteristics shall not be stored in fixed roof tanks larger than 150 ft (45 m) in diameter, unless an approved inerting system is provided on the tank. [**30:**22.4.1.4]

~~32~~Table 66.22.4.1.4 Location of Aboveground Storage Tanks Storing Boil-Over Ignitible (Flammable or Combustible) Liquids

		Minimum Distance (ft)	
Type of Tank	**Protection**	**From Property Line that Is or Can Be Built Upon, Including the Opposite Side of a Public Way[a]**	**From Nearest Side of Any Public Way or from Nearest Important Building on the Same Property[a]**
Floating roof	Protection for exposures[b]	$^1/_2$ × diameter of tank	$^1/_6$ × diameter of tank
	None	Diameter of tank	$^1/_6$ × diameter of tank
Fixed roof	Approved foam or inerting system[c]	Diameter of tank	$^1/_3$ × diameter of tank
	Protection for exposures[b]	2 × diameter of tank	$^2/_3$ × diameter of tank
	None	4 × diameter of tank but need not exceed 350 ft	$^2/_3$ × diameter of tank

For SI units, 1 ft = 0.3 m.

[a]The minimum distance cannot be less than 5 ft.

[b]See definition 3.3.46 of NFPA 30, Protection for Exposures.

[c]See NFPA 69. [**30:**Table 22.4.1.4]

66.22.4.1.5

Tanks storing unstable liquids shall be located in accordance with Table 66.22.4.1.5 and Table 66.22.4.1.1(b). [**30:**22.4.1.5]

~~33~~Table 66.22.4.1.5 Location of Aboveground Storage Tanks Storing Unstable Liquids

		Minimum Distance (ft)

Type of Tank	Protection	From Property Line that Is or Can Be Built Upon, Including the Opposite Side of a Public Way	From Nearest Side of Any Public Way or from Nearest Important Building on the Same Property[a]
Horizontal and vertical tanks with emergency relief venting to permit pressure not in excess of a gauge pressure of 2.5 psi (17 kPa)	Tank protected with any one of the following: approved water spray, approved inerting,[a] approved insulation and refrigeration, approved barricade	Value in Table 66.22.4.1.1(b) but not less than 25 ft	Not less than 25 ft
	Protection for exposures[b]	$2^1/_2$ × value in Table 66.22.4.1.1(b) but not less than 50 ft	Not less than 50 ft
	None	5 × value in Table 66.22.4.1.1(b) but not less than 100 ft	Not less than 100 ft
Horizontal and vertical tanks with emergency relief venting to permit pressure over a gauge pressure of 2.5 psi (17 kPa)	Tank protected with any one of the following: approved water spray, approved inerting,[a] approved insulation and refrigeration, approved barricade	2 × value in Table 66.22.4.1.1(b) but not less than 50 ft	Not less than 50 ft
	Protection for exposures[b]	4 × value in Table 66.22.4.1.1(b) but not less than 100 ft	Not less than 100 ft
	None	8 × value in Table 66.22.4.1.1(b) but not less than 150 ft	Not less than 150 ft

For SI units, 1 ft = 0.3 m.

[a]See NFPA 69.

[b]See definition 3.3.46 of NFPA 30, Protection for Exposures. [**30:**Table 22.4.1.5]

66.22.4.1.6

Tanks storing Class IIIB stable liquids [FP ≥ 200°F (93°C)] shall be located in accordance with Table 66.22.4.1.6.

~~34~~**Table 66.22.4.1.6 Location of Aboveground Storage Tanks Storing Class IIIB Liquids [FP ≥ 200°F (93°C)]**

	Minimum Distance (ft)	
Tank Capacity (gal)	**From Property Line that Is or Can Be Built Upon, Including the Opposite Side of a Public Way**	**From Nearest Side of Any Public Way or from Nearest Important Building on the Same Property**
12,000 or less	5	5
12,001 to 30,000	10	5
30,001 to 50,000	10	10
50,001 to 100,000	15	10
100,001 or more	15	15

For SI units, 1 ft = 0.3 m; 1 gal = 3.8 L. [**30:**-Table 22.4.1.6]

Exception: If located within the same diked area as, or within the drainage path of, a tank storing a Class I or Class II liquid [FP < 140°F (60°C)], the tank storing Class IIIB liquid [FP ≥ 200°F (93°C)] shall be located in accordance with 66.22.4.1.1. [**30:**22.4.1.6]

66.22.4.2.1 *

Tanks storing Class I, Class II, or Class IIIA stable liquids [FP < 200°F (93°C) and any BP] shall be separated by the distances given in Table 66.22.4.2.1. [**30:**22.4.2.1]

~~35~~Table 66.22.4.2.1 Minimum Shell-to-Shell Spacing of Aboveground Storage Tanks

		-Fixed Roof or Horizontal Tanks	
Tank Diameter	**-Floating Roof Tanks**	**-Class I or II Liquids [FP < 140°F (60°C)**	**-Class IIIA Liquids [140°F (60°C) ≤ FP < 200°F (93°C)]**
All tanks not over 150 ft (45 m) in diameter	-$^1/_6$ × sum of adjacent tank diameters but not less than 3 ft (0.9 m)	-$^1/_6$ × sum of adjacent tank diameters but not less than 3 ft (0.9 m)	-$^1/_6$ × sum of adjacent tank diameters but not less than 3 ft (0.9 m)
Tanks larger than 150 ft (45 m) in diameter:			
—If remote impounding is provided in accordance with 66.22.11.1	-$^1/_6$ × sum of adjacent tank diameters	-$^1/_4$ × sum of adjacent tank diameters	-$^1/_6$ × sum of adjacent tank diameters
—If open diking is provided in accordance with 66.22.11.2	-$^1/_4$ × sum of adjacent tank diameters	-$^1/_3$ × sum of adjacent tank diameters	-$^1/_4$ × sum of adjacent tank diameters

Note: The "sum of adjacent tank diameters" means the sum of the diameters of each pair of tanks that are adjacent to each other. See also A.66.22.4.2.1. [**30:**-Table 22.4.2.1]

66.22.4.2.1.1

Tanks that store crude petroleum, have individual capacities not exceeding 3000 bbl [(126,000 gal ~~or~~

(480 m^3)], and are located at production facilities in isolated locations shall not be required to be separated by more than 3 ft (0.9 m). [**30:**22.4.2.1.1]

66.22.4.2.1.2

Tanks used only for storing Class IIIB liquids [FP ≥ 200°F (93°C)] shall not be required to be separated by more than 3 ft (0.9 m) provided they are not within the same diked area as, or within the drainage path of, a tank storing a Class I or Class II liquid [FP < 140°F (60°C)]. If located within the same diked area as, or within the drainage path of, a tank storing a Class I or Class II liquid [FP < 140°F (60°C)], the tank storing Class IIIB liquid [FP ≥ 200°F (93°C)] shall be spaced in accordance with the requirements for Class IIIA liquids [140°F (60°C) ≤ FP < 200°F (93°C)] in Table 66.22.4.2.1. [**30:**22.4.2.1.2]

66.22.4.2.2

A tank storing unstable liquid shall be separated from any other tank containing either an unstable liquid or a Class I, Class II, or Class III liquid (any FP or BP) by a distance not less than one-half the sum of their diameters. [**30:**22.4.2.2]

66.22.4.2.3

Where tanks are in a diked area containing Class I or Class II liquids [FP < 140°F (60°C)] or in the drainage path of Class I or Class II liquids [FP < 140°F (60°C)] and are compacted in three or more rows or in an irregular pattern, greater spacing or other means shall be permitted to be required by the AHJ to make tanks in the interior of the pattern accessible for fire-fighting purposes. [**30:**22.4.2.3]

66.22.4.2.4

The minimum horizontal separation between an LP-Gas container and a Class I, Class II, or Class IIIA [FP< 200°F (93°C)] liquid storage tank shall be 20 ft (6 m). [**30:**22.4.2.4]

66.22.4.2.4.1

Means shall be provided to prevent Class I, Class II, or Class IIIA liquids- [FP < 200°F (93°C)] from accumulating under adjacent LP-Gas containers by means of dikes, diversion curbs, or grading. [**30:**22.4.2.4.1]

66.22.4.2.4.2

Where ~~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 ft (3 m) away from the centerline of the wall of the diked area. [**30:**22.4.2.4.2]

66.22.4.2.5

If a tank storing a Class I, Class II, or Class IIIA liquid [FP < 200°F (93°C)] liquid operates at pressures exceeding a gauge pressure of 2.5 psi (17 kPa) or is equipped with emergency relief venting that will permit pressures to exceed a gauge pressure of 2.5 psi (17 kPa), it shall be separated from an LP-Gas container by the appropriate distance given in Table 66.22.4.2.1. [**30:**22.4.2.5]

A.66.22.5.2.1

Appendix E of API Standard 650, *Welded Steel Tanks for Oil Storage*, and Appendix B of API 620,

~~*Recommended Rules for the*~~ *Design and Construction of Large, Welded, Low-Pressure Storage Tanks*, provide information on tank foundations. [**30:**A.22.5.2.1]

66.22.5.2.3

Where tanks storing Class I, Class II, or Class IIIA liquids [FP < 200°F (93°C)] are supported above their foundations, tank supports shall be of concrete, masonry, or protected steel.
Exception: Single wood timber supports (not cribbing), laid horizontally, shall be permitted to be used for outside aboveground tanks if not more than 12 in. (300 mm) high at their lowest point. [**30:**22.5.2.3]

66.22.5.2.4 *

Steel support structures or exposed piling for tanks storing Class I, Class II, or Class IIIA liquids [FP < 200°F (93°C)] shall be protected by materials having a fire resistance rating of not less than 2 hours.

Exception No. 1: Steel saddles do not need to be protected if less than 12 in. (300 mm) high at their lowest point.
Exception No. 2: At the discretion of the AHJ, water spray protection in accordance with NFPA 15 or NFPA 13~~,~~ is permitted to be used. [**30:**22.5.2.4]

66.22.5.2.5

Where a tank is located in an area subject to flooding, provisions shall be taken to prevent tanks, either full or empty, from floating or sliding during a rise in water level up to the established maximum flood stage. *(See 66.21.7.3.)* [**30:**22.5.2.5]

66.22.7.1.1.3

Tanks storing Class IIIB liquids [FP ≥ 200°F (93°C)] that are larger than 12,000 gal (45,400 L) capacity and are not within the diked area or the drainage path of tanks storing Class I or Class II liquids [FP < 140°F (60°C)] shall not be required to meet the requirements of 66.22.7.1.1. [**30:**22.7.1.1.3]

66.22.7.2.2

Emergency relief vent devices shall be vaportight and restricted to~~shall be permitted to be any~~ one of the following:

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

[**30:**22.7.3.2.1]

66.22.8 *Fire Protection for Aboveground Storage Tanks~~Control~~.

A fire-extinguishing system in accordance with an applicable NFPA standard shall be provided or made available for a storage tank where all of the following conditions apply:

(1) The tank is a vertical atmospheric storage tank that has a capacity of 50,000 gal (190 m3) or more.
(2) The tank contains a Class I liquid [FP < 100°F (37.8°C)].

(3) The tank is located in a congested area where there is an unusual exposure hazard to the tank from adjacent property or to adjacent property from the tank.
(4) The tank has a fixed-roof or a combination fixed- and floating-roof that does not meet the requirements of 66.22.2.2(2) or (3) to be classified as a floating roof tank.

[**30:**22.8]

~~**66.22.8.1** *~~

~~A fire-extinguishing system in accordance with an applicable NFPA standard shall be provided or shall be available for vertical atmospheric fixed-roof storage tanks larger than 50,000 gal (190 m³) capacity, storing Class I liquids, if located in a congested area where there is an unusual exposure hazard to the tank from adjacent property or to adjacent property from the tank. [**30:**22.8.1]~~

A.66.22.8~~.1~~

Requirements in this section might also apply to Class II and Class III liquids [FP ≥ 100°F (37.8°C)] that are heated at or above their flashpoint. This was previously stated in subsection 66.22.8.2 in the 2018 edition and in prior editions, but was later deleted because Section 66.22.3 had been added to apply that requirement to the entirety of Chapter 22. [**30:**A.22.8]

Protection against fire or explosion required for large flammable liquid storage tanks should consider the use of fixed, semi-fixed, or portable protection system designed in conformance with good engineering practice such as those described in NFPA 11, NFPA 15, and NFPA 69. Ordinary combustibles (such as wood) would be subject to radiant heat unpiloted ignition from a burning tank, when such exposures are located a distance of less than about 150 percent of the tank diameter (assuming no wind effects). Exposure from adjacent property to the tanks would depend on the specific products and storage arrangement and may require some engineering analysis based on the occupancy and its exposure potential. [**30:**A.22.8~~.1~~]

~~**66.22.8.2**~~

~~Fixed-roof tanks storing Class II or Class III liquids at temperatures below their flash points and floating-roof tanks storing any liquid shall not require protection when installed in accordance with this section. [**30:**22.8.2]~~

66.22.11 *Control of Spills from Aboveground Storage Tanks.

Every tank that contains a Class I, Class II, or Class IIIA liquid [FP < 200°F (93°C)] shall be provided with means to prevent an accidental release of liquid from endangering important facilities and adjoining property or from reaching waterways. Such means shall meet the requirements of 66.22.11.1, 66.22.11.2, 66.22.11.3, or 66.22.11.4, whichever is applicable. [**30:**22.11]

66.22.11.1 Remote Impounding.

Where control of spills is provided by drainage to a remote impounding area so that spilled ignitible (flammable or combustible) liquid does not collect around tanks, the requirements of 66.22.11.1.1 through 66.22.11.1.4 shall apply. [**30:**22.11.1]

66.22.11.2 Impounding Around Tanks by Open Diking.

Where control of spills is provided by means of impounding by open diking around the tanks, such systems shall meet the requirements of 22.11.2.1 through 22.11.2.8 of NFPA 30. [**30:**22.11.2]

66.22.11.2.1

Where provision is made for draining water from diked areas, such drains shall be controlled to prevent ignitible (flammable or combustible) liquids from entering natural water courses, public sewers, or public drains. [**30:**22.11.2.7]

66.22.12.2.1

Drainage shall be provided to prevent accumulation of any ignitible (flammable or combustible) liquid under the piping by providing a slope of not less than 1 percent away from the piping for at least 50 ft (15 m). [**30:**22.12.2.1]

66.22.13.3

Openings for gauging on tanks storing Class I liquids [FP < 100°F (37.8°C)] shall be provided with a vaportight cap or cover. [**30:**22.13.3]

66.22.13.4

Filling and emptying connections for Class I, Class II, and Class IIIA liquids [FP < 200°F (93°C)] that are connected and disconnected shall be located outside of buildings at a location free from any source of ignition. [**30:**22.13.4]

66.22.13.4.2

Such connections for any ignitible (flammable or combustible) liquid shall be closed and liquidtight when not in use and shall be properly identified. [**30:**22.13.4.2]

66.23 Storage of Ignitible (Flammable or Combustible) Liquids in Tanks — Underground Tanks.

66.24.3.1.1 *

Listed portable fire extinguishers shall be provided for facilities in such quantities, sizes, and types as could be needed for special storage hazards as determined in accordance with ~~66.~~21.6.1.2 of NFPA 30. [**30:**24.6.1.1]

66.24.3.1.2 *

Where the need is indicated in accordance with ~~66.~~21.6.3 of NFPA 30, water shall be utilized through standpipe and hose systems, or through hose connections from sprinkler systems using combination spray and straight stream nozzles to permit effective fire control. [**30:**24.6.1.2]

66.24.3.1.3

Where the need is indicated in accordance with ~~66.~~21.6.3 of NFPA 30, mobile foam apparatus shall be provided. [**30:**24.6.1.3]

66.24.3.2.3 *

Where the need is indicated by the hazards of storage or exposure as determined by ~~66.~~21.6.3 of NFPA 30, fixed protection shall be required utilizing approved foam, foam-water sprinkler systems, sprinkler systems, water spray systems, deluge systems, gaseous extinguishing systems, dry chemical extinguishing systems, fire-resistive materials, or a combination of these. [**30:**24.6.2.3]

A.66.24.3.2.3

See NFPA 13, NFPA 15, and NFPA 16 for information on these subjects. [**30:**A.24.6.2.3]

For certain fuel types, such as ketones, esters, and alcohols, the minimum required densities established in the listing criteria for foam discharge devices are often higher than the general densities specified for protection of flammable and combustible (ignitible) liquids. When determining the design criteria for extinguishing systems using foam, it is important to ensure that the listing criteria, which are typically based on empirical data from fire tests, are not overlooked. Otherwise, the fire protection system design can be inadequate for proper protection. [**30:**A.24.6.2.3]

66.24.3.2.3.1

When foam or foam-water fire protection systems are provided, discharge densities shall be determined based on the listing criteria for selected foam discharge devices, the foam concentrate, and the specific ~~flammable or combustible~~ liquids to be protected. [**30:**24.6.2.3.1]

66.24.3.2.4

If provided, fire control systems shall be designed, installed, and maintained in accordance with the following NFPA standards:

(1) NFPA 11~~*, Standard for Low-, Medium-, and High-Expansion Foam*~~
(2) NFPA 12~~*, Standard on Carbon Dioxide Extinguishing Systems*~~
(3) NFPA 12A~~*, Standard on Halon 1301 Fire Extinguishing Systems*~~
(4) NFPA 13~~*, Standard for the Installation of Sprinkler Systems*~~
(5) NFPA 15~~*, Standard for Water Spray Fixed Systems for Fire Protection*~~
(6) NFPA 16~~*, Standard for the Installation of Foam-Water Sprinkler and Foam-Water Spray Systems*~~
(7) NFPA 17~~*, Standard for Dry Chemical Extinguishing Systems*~~
(8) NFPA 25~~*, Standard for the Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems*~~

[**30:**24.6.2.4]

66.24.5.2

The facility shall be designed and operated to prevent the discharge of ~~flammable or combustible~~ liquids to public waterways, public sewers, or adjoining property under normal operating conditions. [**30:**24.9.2]

66.24.5.4

Openings to adjacent rooms or buildings shall be provided with noncombustible, liquidtight raised sills

or ramps at least 4 in. (100 mm) in height or shall be otherwise designed to prevent the flow of ignitible (flammable or combustible) liquids to the adjoining areas. [**30:**24.9.4]

66.24.5.5

Means shall be provided to prevent ignitible (flammable or combustible) liquid spills from running into basements. [**30:**24.9.5]

66.24.5.7

Emergency drainage systems shall be provided to direct ~~flammable or combustible~~ liquid leakage and fire-protection water to a safe location. [**30:**24.9.7]

66.24.9.5.1

Emergency relief vents on protected aboveground tanks complying with UL 2085 containing Class II and Class III liquids [FP ≥ 100°F (37.8°C)] shall be allowed to discharge inside the building. [**30:**~~-~~24.13.5.1]

66.24.11.2

Those areas, including buildings, where the potential exists for a Class I~~flammable~~ liquid [FP < 100°F (37.8°C)] spill shall be monitored as appropriate. Such methods shall include both of the following:

(1) Personnel observation or patrol
(2) Monitoring equipment that indicates a spill or leak has occurred in an unattended area

[**30:**24.15.2]

A.66.25.3.1

Inspections are recommended for shop~~-~~-fabricated aboveground tanks. One guide is SP001, *Standard for Inspection of Aboveground Storage Tanks*, which is published by the Steel Tank Institute. In addition, the tank owner ~~might~~ may desire to conduct additional inspections to ensure the ongoing integrity of tanks and equipment. Because the interior of a vault will ordinarily remain dry and temperature-moderated, environmental effects on tanks and equipment inside vaults will be reduced as compared to aboveground tanks that are not protected from weather exposure. Accordingly, inspection and maintenance frequencies for exterior surfaces of tanks and piping in vaults are typically less critical than for aboveground tanks installed outdoors. Nevertheless, inspection and maintenance of emergency vents and overfill prevention devices are still necessary. [**30:**A.25.3.1]

Clearance between the shell of a tank or equipment in a vault and the interior vault wall should be sufficient to accommodate visual inspections and maintenance that ~~might~~ may be needed. In addition, consideration should be given to the need for inspection and maintenance of tank interior surfaces that may be impacted by internal corrosion. [**30:**A.25.3.1]

Clearance should be adequate to permit the following:

(1) Entry into the vault interior by an inspector or maintenance worker
(2) Access to manipulate, repair, or replace any equipment or fittings in the vault

(3) Access within the vault to visually inspect, either by direct sight or with the aid of an optical vision extension tools, interior vault surfaces and exterior surfaces of tanks and equipment, to determine the source of any leakage that may occur, and to conduct any needed repairs

[**30:**A.25.3.1]

Because vaults are designed to provide for entry by inspectors or maintenance workers, consideration should also be given to providing access for rescue by emergency responders who ~~might~~ may be called upon to rescue an individual from a vault. Such consideration ~~can~~ may include providing a minimum access hatch dimension of 36 in. (915 mm) and a minimum dimension for walkways in vault interior spaces of 30 in. (760 mm) to permit an emergency responder with an SCBA to maneuver and providing, in some cases, a second means of access to the vault interior. [**30:**A.25.3.1]

66.27.1.1

This section shall apply to the design, installation, testing, operation, and maintenance of piping systems for ~~flammable and combustible~~ liquids or flammable vapors. Such piping systems shall include but not be limited to pipe, tubing, flanges, bolting, gaskets, valves, fittings, flexible connectors, the pressure-containing parts of other components including but not limited to expansion joints and strainers, and devices that serve such purposes as mixing, separating, snubbing, distributing, metering, control of flow, or secondary containment. [**30:**27.1.1]

66.27.1.2

This section shall not apply to any of the following:

(1) Tubing or casing on any oil or gas wells and any piping connected directly thereto
(2) Motor vehicles, aircraft, boats, or piping that ~~are~~ is integral to a stationary engine assembly
(3) Piping within the scope of any applicable boiler and pressure vessel code

[**30:**27.1.2]

66.27.2.3 Leak.

An unintended release of ignitible (flammable or combustible) liquid or vapor from the piping system due to failure of the piping system. [**30:**27.2.3]

66.27.3.1.1

The design, fabrication, assembly, test, and inspection of piping systems shall be suitable for the working pressures and structural stresses to be encountered by the piping system. [**30:**27.3.1.1]

66.27.3.1.2

Compliance with ASME B31.1, *Power Piping*; ASME B31.3, *Process Piping*; or ASME B31.4, *Pipeline Transportation Systems for Liquids and Slurries*~~applicable sections of ASME B31, *Code for Pressure Piping*~~, and the provisions of this section shall be considered *prima facie* evidence of compliance with the foregoing provisions. [**30:**27.3.1.2]

66.27.4.1 Materials Specifications.

Pipe, valves, faucets, couplings, flexible connectors, fittings, and other pressure-containing parts shall

meet the material specifications and pressure and temperature limitations of ASME B31.1, ~~*Code for Power*~~*Pressure Piping; ASME B31.3, Process Piping; or ASME B31.4, Pipeline Transportation Systems for Liquids and Slurries*, except as provided for in 66.27.4.2, 66.27.4.3, and 66.27.4.4. [**30:**27.4.1]

66.27.4.2 Ductile Iron.

Ductile (nodular) iron shall meet the specifications of ASTM A395/A395M, *Standard Specification for Ferritic Ductile Iron Pressure-Retaining Castings for Use at Elevated Temperatures*. [**30:**27.4.2]

66.27.4.3 Materials of Construction for Valves.

Valves at storage tanks, as required by 22.14 of NFPA 30 and 66.22.13 ~~and 66.24.10~~, and their connections to the tank shall be of steel or ductile iron, except as provided for in 66.27.4.3.1, 66.27.4.3.2, or 66.27.4.4. [**30:**27.4.3]

A.66.27.4.3.2

For further information, see ASTM E119, *Standard Test Methods for Fire Tests of Building Construction and Materials*, UL 263, *Fire Tests of Building Construction and Materials,* and UL 1709, *Rapid Rise Fire Tests of Protection Materials for Structural Steel*. [**30:**A.27.4.3.2]

66.27.4.3.3

Cast iron, brass, copper, aluminum, malleable iron, and similar materials shall be permitted to be used on tanks described in 66.22.4.2.1.1 or on tanks storing Class IIIB liquids [flash point ≥ 200°F (93°C)] where the tanks are located outdoors and not within a diked area or drainage path of a tank storing a Class I, Class II, or Class IIIA liquid [FP < 200°F (93°C)]. [**30:**27.4.3.3]

66.27.4.4.1

Low melting point materials, as defined in 66.27.2.4, shall be compatible with the ignitible (flammable or combustible) liquids being handled and shall be used within the pressure and temperature limitations of ASME B31.1, ~~*Code for Pressure*~~*Power Piping; ASME B31.3, Process Piping; or ASME B31.4, Pipeline Transportation Systems for Liquids and Slurrie*. [**30:**27.4.4.1]

66.27.4.4.4

Low melting point materials shall be permitted to be used outdoors aboveground, outside a dike, outside a remote impounding area, or inside buildings, provided they meet one of the following conditions:

(1) They are resistant to damage by fire.
(2) They are located so that any leakage resulting from failure will not expose persons, important buildings, tanks, or structures.
(3) They are located where leakage can be controlled by operation of one or more accessible, remotely located valves.
(4) They are included in valves or piping components connected to an aboveground secondary containment tank and located above the tank and within ten feet of a thermally activated fire valve that is upstream of the low melting point materials.

[**30:**27.4.4.4]

A.66.27.4.4.4(4)

A thermally activated fire valve is a valve that meets UL 842, *Valves for Flammable Fluids*; FM 7400, *Liquid and Gas Safety Shutoff Valves*; or API 607, *Fire Tests for Quarter-turn Valves and Valves Equipped with Nonmetallic Seats*. [**30:**A.27.4.4.4(4)]

66.27.4.4.5

Low melting point materials shall be permitted to be used within a dike or within a remote impounding area, provided they meet one of the following:

(1) They are connected above the normal operating liquid level of the tank.

(2) They are connected below the normal operating liquid level of the tank and one of the following conditions is met:

(a) The stored liquid is a Class IIIB liquid [FP ≥ 200°F (93°C)], the tank is located outdoors, and the piping is not exposed to a potential spill or leak of a Class I, Class II, or Class IIIA liquid [FP < 200°F (93°C)].

(b) The low melting point material is protected from fire exposure, such as by using materials that have a fire resistance rating of not less than 2 hours.

[**30:**27.4.4.5]

A.66.27.5.1.2

It is expected that some joints ~~might~~ may leak under fire conditions but will not come apart. [**30:**A.27.5.1.2]

66.27.5.1.4

Joints in piping systems handling Class I liquids [FP < 100°F (37.8°C)] shall be welded when located in concealed spaces within buildings. [**30:**27.5.1.4]

66.27.5.2 Flexible Connectors.

Flexible connectors shall be listed and labeled in accordance with UL 2039, *Flexible Connector Pipe for Fuels*~~, and shall be installed in accordance with 66.27.5.3~~. [**30:**27.5.2]

66.27.7.1.1

Where the outlets of vent pipes for tanks storing Class I liquids [FP < 100°F (37.8°C)] are adjacent to buildings or public ways, they shall be located so that vapors are released at a safe point outside of buildings and not less than 12 ft (3.6 m) above the adjacent ground level. [**30:**27.8.1.1]

66.27.7.1.5

Vent piping for tanks storing Class I liquids [FP < 100°F (37.8°C)] shall not be manifolded with vent piping for tanks storing Class II or Class III liquids [FP ≥ 100°F (37.8°C)] unless positive means are provided to prevent the following:

(1) Vapors of Class I liquids [FP < 100°F (37.8°C)] from entering tanks storing Class II or Class III liquids [FP ≥ 100°F (37.8°C)]

(2) Contamination
(3) Possible change in classification of the less volatile liquid

[**30:**27.8.1.5]

66.27.7.1.6 *Extension of Emergency Vent Piping.

Piping to or from approved emergency vents ~~devices~~ for atmospheric and low-pressure tanks shall be sized to provide emergency vent flows that limit the back pressure to less than the maximum pressure permitted by the design of the tank. Piping to or from approved emergency vents ~~devices~~ for pressure vessels shall be sized in accordance with the ASME *Boiler and Pressure Vessel Code*. Calculations demonstrating compliance with this paragraph shall include the start-to-open pressure of an approved emergency vent device, where provided. [**30:**27.8.1.6]

A.66.27.7.1.6

Vent sizing formula~~se~~ and prescriptive vent sizes, such as those established by UL 142, *Steel Aboveground Tanks for Flammable and Combustible Liquids*, are typically based on the direct installation of a venting device onto a tank. When the outlet of a vent must be extended to a remote location, such as for tanks located in buildings, which require vent discharges, to be located outside, a significant reduction in vent flow can occur unless the size of the vent and connecting piping is increased. In such cases, the size of vents and vent pipe extensions should be calculated to ensure that a tank will not be over-pressurized during a fire exposure. [**30:**A.27.8.1.6]

66.27.7.2.1 *

Vent pipes from underground tanks storing Class I liquids [FP < 100°F (37.8°C)] shall be located so that the discharge point is outside of buildings, higher than the fill pipe opening, and not less than 12 ft (3.6 m) above the adjacent ground level. [**30:**27.8.2.1]

66.27.7.2.5

Vent piping shall be sized in accordance with Table ~~66.~~23.6.2 of NFPA 30. [**30:**27.8.2.5]

66.27.7.2.6

Vent pipes from tanks storing Class II or Class IIIA liquids [100°F (37.8°C) ≤ FP < 200°F (93°C)] shall terminate outside of the building and higher than the fill pipe opening. [**30:**27.8.2.6]

66.27.7.2.13

Vent piping for tanks storing Class I liquids [FP < 100°F (37.8°C)] shall not be manifolded with vent piping for tanks storing Class II or Class III liquids [FP ≥ 100°F (37.8°C)] unless positive means are provided to prevent the following:

(1) Vapors of Class I liquids [FP < 100°F (37.8°C)] from entering tanks storing Class II or Class III liquids [FP ≥ 100°F (37.8°C)]
(2) Contamination
(3) Possible change in classification of the less volatile liquid

[**30:**27.8.2.13]

A.66.27.9

Where loading and unloading risers for Class II or Class IIIA liquids [100°F (37.8°C) ≤ FP < 200°F (93°C)] are located in the same immediate area as loading and unloading risers for Class I liquids [FP < 100°F (37.8°C)], consideration should be given to providing positive means, such as different pipe sizes, connection devices, special locks, or other methods designed to prevent the erroneous transfer of Class I liquids [FP < 100°F (37.8°C)] into or from any container or tank used for Class II or Class IIIA liquids [100°F (37.8°C) ≤ FP < 200°F (93°C)]. Note that such consideration might not be necessary for water-miscible liquids, where the class is determined by the concentration of liquid in water, or where the equipment is cleaned between transfers. [**30:**A.27.10]

66.27.10.2

The interior of the flexible connectors shall be compatible with the ignitible (flammable or combustible) liquid handled. [**30:**27.11.2]

66.27.10.3*

The exterior of the flexible connectors shall be resistant to or shielded from salt water and fresh water, ultraviolet radiation, physical damage, and damage by fire. [**30:**27.11.3]

A.66.27.10.3

A special marina use rating for aboveground piping systems is addressed in UL 1369, *Above Ground Piping for Flammable and Combustible Liquids*. [**30:**A.27.11.3]

66.27.10.4

The flexible connectors shall be suitable for the intended pressures and shall be tested in accordance with ~~66.~~27.7 of NFPA 30. [**30:**27.11.4]

66.28.3.1.1

Bonding for the control of static electricity shall not be required where the following conditions exist:

(1) Where tank cars and tank vehicles are loaded exclusively with products that do not have static-accumulating properties, such as asphalts (including cutback asphalts), most crude oils, residual oils, and water-soluble ignitible (flammable or combustible) liquids

(2) Where no Class I liquids [FP < 100°F (37.8°C)] are handled at the loading facility and where the tank cars and tank vehicles loaded are used exclusively for Class II and Class III liquids [FP ≥ 100°F (37.8°C)] at temperatures below their flash points

(3) Where tank cars and tank vehicles are loaded or unloaded through closed connections

[**30:**28.3.1.1]

66.28.3.1.2 *

Loading and unloading facilities that are used to load ignitible (flammable or combustible) liquids into tank vehicles through open domes shall be provided with a means for electrically bonding to protect against static electricity hazards. [**30:**28.3.1.2]

66.28.3.1.3

Loading and unloading facilities that are used to transfer ignitible (flammable or combustible) liquids into and from tank cars through open domes shall be protected against stray currents by permanently bonding the fill pipe to at least one rail and to the facility structure, if of metal. [**30:**28.3.1.3]

66.28.3.1.3.2

In areas where excessive stray currents are known to exist, all pipelines entering the area shall be provided with insulating sections to electrically isolate them from the facility piping.

Exception: These precautions need not be required where only Class II or Class III liquids [FP ≥ 100°F (37.8°C)], at temperatures below their flash points, are handled and where there is no probability that tank cars will contain vapors from previous cargoes of Class I liquids [FP < 100°F (37.8°C)]. [**30:**28.3.1.3.2]

66.28.4.1

Tank vehicle and tank car loading and unloading facilities shall be separated from aboveground tanks, warehouses, other plant buildings, or the nearest line of adjoining property that can be built upon by a distance of at least 25 ft (7.6 m) for Class I liquids [FP < 100°F (37.8°C)] and for Class II and Class III liquids [FP ≥ 100°F (37.8°C)] handled at temperatures at or above their FP~~flash points~~ and at least 15 ft (4.6 m) for Class II and Class III liquids [FP ≥ 100°F (37.8°C)] handled at temperatures below their FP~~flash points~~, measured from the nearest fill spout or transfer connection. [**30:**28.4.1]

66.28.10.1

Equipment such as piping, pumps, and meters used for the transfer of Class I liquids [FP < 100°F (37.8°C)] between storage tanks and the fill stem of the loading facility shall not be used for the transfer of Class II or Class III liquids [FP ≥ 100°F (37.8°C)] unless one of the following conditions exists:

(1) Only water-miscible ignitible (flammable or combustible) liquid mixtures are handled, and the class of the mixture is determined by the concentration of liquid in water.
(2) The equipment is cleaned between transfers.

[**30:**28.10.1]

66.28.11.1.1

Ignitible (flammable or combustible) liquids~~Liquids~~ shall be loaded only into cargo tanks whose material of construction is compatible with the chemical characteristics of the liquid. The liquid being loaded shall also be chemically compatible with the liquid hauled on the previous load unless the cargo tank has been cleaned. [**30:**28.11.1.1]

66.28.11.1.3

When transferring Class I liquids [FP < 100°F (37.8°C)], or Class II or Class III liquids [FP ≥ 100°F (37.8°C)] ~~liquids~~ at temperatures at or above their ~~flash points~~FP, engines of tank vehicles or motors of auxiliary or portable pumps shall be shut down during the making and breaking of hose connections. [**30:**28.11.1.3]

66.28.11.1.4

If loading or unloading is done without requiring the use of the motor of the tank vehicle, the motor

shall be shut down throughout any transfer operations involving Class I liquids [FP < 100°F (37.8°C)]. [**30:**28.11.1.4]

66.28.11.1.6

When top loading a tank vehicle with Class I or Class II liquids [FP < 140°F (60°C)] without a vapor control system, valves used for the final control of flow shall be of the self-closing type and shall be manually held open except where automatic means are provided for shutting off the flow when the vehicle is full. [**30:**28.11.1.6]

66.28.11.1.7

When bottom loading a tank vehicle, a positive means shall be provided for loading a predetermined quantity of ignitible (flammable or combustible) liquids~~liquid~~, together with a secondary automatic shutoff control to prevent overfill. [**30:**28.11.1.7]

66.28.11.1.11

Hose materials used for transfer shall be compatible with the ignitible (flammable or combustible) liquids being handled. [**30:**28.11.1.11]

66.28.11.2.1

Ignitible (flammable or combustible) liquids~~Liquids~~ shall be loaded only into tank cars whose material of construction is compatible with the chemical characteristics of the liquid. The liquid being loaded shall also be chemically compatible with the liquid hauled on the previous load unless the tank car has been cleaned. [**30:**28.11.2.1]

66.28.11.2.2 *

Filling through open domes into tank cars that contain vapor–air mixtures within the flammable range, or where the ignitible (flammable or combustible) liquid being filled can form such a mixture, shall be by means of a downspout that extends to within 6 in. (150 mm) of the bottom of the tank unless the liquid is not an accumulator of static electric charges. [**30:**28.11.2.2]

66.28.11.2.5

Hose materials used for transfer shall be compatible with the ignitible (flammable or combustible) liquids being handled. [**30:**28.11.2.5]

66.28.11.3 *Switch Loading.

To prevent hazards due to a change in FP~~flash point~~ of liquids, any tank car or tank vehicle that has previously contained a Class I liquid [FP < 100°F (37.8°C)] shall not be loaded with a Class II or Class III liquid [FP ≥ 100°F (37.8°C)] unless proper precautions are taken. [**30:**28.11.3]

A.66.28.11.3

The term *switch loading* describes a situation that warrants special consideration. [**30:**A.28.11.3]

When a tank is emptied of a cargo of Class I liquid [FP < 100°F (37.8°C)], a mixture of vapor and air is left,

which can be, and often is, within the flammable range. When such a tank is refilled with a Class I liquid [FP < 100°F (37.8°C)], any charge that reaches the tank shell will be bled off by the required bond wire. Also, there will be no flammable mixture at the surface of the rising oil level because the Class I liquid [FP < 100°F (37.8°C)] produces at its surface a mixture too rich to be ignitible. This is the situation commonly existing in tank vehicles in gasoline service. If, as occasionally happens, a static charge does accumulate on the surface sufficient to produce a spark, it occurs in a too-rich, nonignitible atmosphere and thus causes no harm. [**30:**A.28.11.3]

A very different situation arises if the liquid is "switch loaded," that is, when a Class II or Class III liquid [FP ≥ 100°F (37.8°C)] is loaded into a tank vehicle that previously contained a Class I liquid [FP < 100°F (37.8°C)]. [**30:**A.28.11.3]

Class II or Class III liquids [FP ≥ 100°F (37.8°C)] are not necessarily more potent static generators than the Class I liquid [FP < 100°F (37.8°C)] previously loaded, but the atmosphere in contact with the rising oil surface is not enriched to bring it out of the flammable range. If circumstances are such that a spark should occur either across the oil surface or from the oil surface to some other object, the spark occurs in a mixture that can be within the flammable range, and an explosion can result. [**30:**A.28.11.3]

It is emphasized that bonding the tank to the fill stem is not sufficient; a majority of the recorded explosions have occurred when it was believed the tank had been adequately bonded. The electrostatic potential that is responsible for the spark exists inside the tank on the surface of the liquid and cannot be removed by bonding. Measures to reduce the chan~~c~~ge of such internal static ignition can be one or more of the following:

(1) Avoid spark promoters. Conductive objects floating on the oil surface increase the charge of sparking to the tank wall. Metal gauge rods or other objects projecting into the vapor space can create a spark gap as the rising liquid level approaches the projection. A common precaution is to require that fill pipes (downspouts) reach as close to the bottom of the tank as practicable. Any operation such as sampling, taking oil temperature, or gauging that involves lowering a conductive object through an opening into the vapor space on the oil should be deferred until at least 1 minute after flow has ceased. This will permit any surface charge to relax.
(2) Reduce the static generation by one or more of the following:
    (a) Avoid splash filling and upward spraying of oil where bottom filling is used.
    (b) Employ reduced fill rates at the start of filling through downspouts, until the end of the spout is submerged. Some consider 3 ft/sec (0.9 m/sec) to be a suitable precaution.
    (c) Where filters are employed, provide relaxation time in the piping downstream from the filters. A relation time of 30 seconds is considered by some to be a suitable precaution.
(3) Eliminate the flammable mixture before switch loadings by gas freeing or inerting.

[**30:**A.28.11.3]

See NFPA 77 and NFPA 385 for further information. [**30:**A.28.11.3]

66.29.1.1

This section shall apply to all wharves, as defined in 3.3.302, whose primary purpose is the bulk transfer

of ignitible (flammable or combustible) liquids. [**30:**29.1.1]

66.29.3.1

General-purpose wharves that handle bulk transfer of ignitible (flammable or combustible) liquids and other commodities shall meet the requirements of Section 28.2 and NFPA 307. [**30:**29.3.1]

66.29.3.2

Incidental handling of packaged cargo of ignitible (flammable or combustible) liquids and loading or unloading of general cargo, such as ships' stores, during transfer of liquids shall be conducted only when approved by the wharf supervisor and the senior officer of the vessel. [**30:**29.3.2]

66.29.3.3

Wharves at which ignitible (flammable or combustible) liquid cargoes are to be transferred in bulk to or from tank vessels shall be at least 100 ft (30 m) from any bridge over a navigable waterway or from any entrance to or superstructure of a vehicular or railroad tunnel under a waterway. [**30:**29.3.3]

66.29.3.8

Tanks used exclusively for ballast water or Class II or Class III liquids [FP ≥ 100°F (37.8°C)] stored at temperatures below their flash points shall be permitted to be installed on a wharf designed to support the weight of the tanks and ~~its~~ their contents. [**30:**29.3.8]

66.29.3.10.3

The hose materials used for transfer shall be compatible with the ignitible (flammable or combustible) liquids being handled. [**30:**29.3.10.3]

66.29.3.11

Piping, valves, and fittings shall meet applicable requirements of Section 66.27 and shall also meet the following requirements:

(1) Flexibility of piping shall be assured by layout and arrangement of piping supports so that motion of the wharf structure resulting from wave action, currents, tides, or the mooring of vessels will not subject the piping to excessive strain.
(2) Pipe joints that depend on the friction characteristics of combustible materials or on the grooving of pipe ends for mechanical continuity of piping shall not be permitted.
(3) Swivel joints shall be permitted to be used in piping to which hose are connected and for articulated swivel-joint transfer systems, provided the design is such that the mechanical strength of the joint will not be impaired if the packing materials should fail, for example, by exposure to fire.
(4) Each line conveying Class I or Class II liquids [FP < 140°F (60°C)] leading to a wharf shall be provided with a readily accessible block valve located on shore near the approach to the wharf and outside of any diked area. Where more than one line is involved, the valves shall be identified as to their specific lines and grouped in one location.
(5) Means shall be provided for easy access to any cargo line valves that are located below the wharf deck.

[**30:**29.3.11]

66.29.3.12

Pipelines on wharves that handle Class I or Class II liquids [FP < 140°F (60°C)], or Class III liquids [FP ≥ 140°F (60°C)] at temperatures at or above their ~~flash points~~FP, shall be bonded and grounded. [**30:**29.3.12]

66.29.3.22

For marine terminals handling ~~flammable liquids and combustible~~Class I liquids [FP < 100°F (37.8°C)] and Class II and Class III liquids [FP ≥ 100°F (37.8°C)] at temperatures at or above their ~~flash points~~FP, Figure 66.29.3.22 shall be used to determine the extent of classified areas for the purpose of installation of electrical equipment. [**30:**29.3.22]

Figure 66.29.3.22 Area Classification for a Marine Terminal Handling ~~Flammable~~Class I Liquids [FP < 100°F (37.8°C)]. [30: Figure 29.3.22]

****INSERT FIGURE****

66.29.3.23

Where a flammable atmosphere can exist in the vessel cargo compartment, cargo transfer systems shall be designed to limit the velocity of the incoming ignitible (flammable or combustible) liquid stream to 3 ft (0.9 m) per second until the compartment inlet opening is sufficiently submerged to prevent splashing. [**30:**29.3.23]

66.29.3.25 *

Spill collection shall be provided around manifold areas to prevent spread of ignitible (flammable or combustible) liquids to other areas of the wharf or under the wharf. [**30:**29.3.25]

A.66.29.3.28

Because of the many variables involved, exact requirements cannot be provided. However, Table A.66.29.3.28 provides guidance on the level of fire protection typically provided at wharves and marine terminals handling Class I~~flammable~~ liquids [FP < 100°F (37.8°C)]. [**30:**A.29.3.28]

~~36~~Table A.66.29.3.28 Typical Fire Protection for Wharves and Marine Terminals

For SI units, 1 gpm = 3.8 L/min; 1 gal = 3.8 L; 1 lb = 0.45 kg.

NR: Not required.

[a]A minimum of two $1^1/_2$ in. (38 mm) hydrant outlets should be provided at each monitor riser.

[b]This can be provided by onshore mobile equipment.

[c]One hose reel at each berth should have foam capability.

[d]The proximity of adjacent berths can reduce the total required.

[e]Under-dock systems are optional. Add water for under-dock system (0.16 × area).

[f]Under-dock systems are optional. Add foam for under-dock system (0.16 × 0.3 × 30 × area). [**30:** Table A.29.3.28]

66.29.3.28.4

Where no fire water main is provided, a minimum of two wheeled~~at least two 150 lb (68 kg)~~ dry chemical extinguishers with minimum ratings of 240-B:C each shall be provided~~shall be provided~~. The extinguishers shall be located within 50 ft (15 m) of pump or manifold areas and shall be easily reached along emergency access paths. Existing 150 lb (68 kg) dry chemical extinguishers that continue to be maintained in accordance with NFPA 10 shall be permitted to remain in service. [**30:**29.3.28.4]

F.1.2.8 ASTM Publications.

~~ASTM D4206, *Standard Test Method for Sustained Burning of Liquid Mixtures using the Small-Scale Open Cup Apparatus*, 1996 (reapproved 2018).~~

~~ASTM D4207, *Standard Test Method for Sustained Burning of Low Viscosity Liquid Mixtures by the Wick Test*, 1991 (withdrawn 1998).~~

~~ASTM E502, *Standard Test Method for Selection and Use of ASTM Standards for the Determination of Flash Point of Chemicals by Closed Cup Methods*, 2007 (reapproved 2013).~~

F.1.2.15 FM Publications.

FM 6090, *Approval Standard for Ignitable Liquid Drainage Floor Assemblies*, 2017.

F.3 References for Extracts in Informational Sections.

NFPA 30, *Flammable and Combustible Liquids Code*, ~~2018~~ 2021 edition.

Public Input No. 83-NFPA 1-2021 [Sections 3.3.4.1, 3.3.4.2]

[This was Public Comment No. 9 with a committee action of Rejected but Held.]

Sections 3.3.4.1, 3.3.4.2

3.3.4.1 ~~Industrial~~ _ Type I Additive Manufacturing.

3D printing operations that ~~utilize~~ does not include on or more of the following hazards:

(1) combustible powders or metals~~,~~

(2) an inert gas supply, or

(3) a combustible dust collection system or that create a hazardous electrical classification area outside of the equipment.

3.3.4.2 ~~Nonindustrial~~ _ Type II Additive Manufacturing.

3D printing operations that ~~do not create a hazardous electrical classification area outside of the equipment and do not utilize~~ include one or more of the following hazards:

(1) combustible powders or metals

(2) an inert gas supply,_ or

(3) combustible dust collection system or that create a hazardous electrical classification area outside of the equipment .

Additional Proposed Changes

File Name	Description	Approved
Public_Comment_No._9.pdf	NFPA 1 Public Comment No. 9	

Statement of Problem and Substantiation for Public Input

NOTE: This Public Input appeared as "Rejected but Held" in Public Comment No. 9 of the A2020 Second Draft Report for NFPA 1 and per the Regs. at 4.4.8.3.1.

The Proposed definition of types of additive manufacturing misleads the reader to base the classification upon occupancy. The Proposed modification addresses this misnomer to avoid potential misapplication when higher hazard types of additive manufacturing are utilized in other than industrial occupancies such as prototyping labs and research facilities.

Submitter Information Verification

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Submittal Date: Mon Feb 15 12:33:15 EST 2021
Committee: FCC-HAZ

Committee Statement

Resolution: The terms industrial and non-industrial additive manufacturing are better descriptors for these types of additive manufacturing rather then Type I and Type II.

Public Comment No. 9-NFPA 1-2019 [Sections 3.3.4.1, 3.3.4.2]

Sections 3.3.4.1, 3.3.4.2

3.3.4.1 ~~Industrial~~ Type I Additive Manufacturing.

3D printing operations that

~~utilize~~

does not include one or more of the following hazards:

combustible powders or metals,

an inert gas supply, or

a combustible dust collection system or that create a hazardous electrical classification area outside of the equipment.

3.3.4.2 ~~Nonindustrial~~

Type II Additive Manufacturing.

3D printing operations that

~~do not create a hazardous electrical classification area outside of the equipment and do not utilize~~

include one or more of the following hazards:

combustible powders or metals,

an inert gas supply , or

a combustible dust collection system or that create a hazardous electrical classification area outside of the equipment .

Statement of Problem and Substantiation for Public Comment

The Proposed definition of types of additive manufacturing misleads the reader to base the classification upon occupancy. The Proposed modification addresses this misnomer to avoid potential misapplication when higher hazard types of additive manufacturing are utilized in other than industrial occupancies such as prototyping labs and research facilities.

Related Item

• Updates Proposed change FR-96

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Committee: FCC-AAA

Committee Statement

Committee Action: Rejected but held

Resolution: Currently, Chapter 46 does not use these terms for the types of additive manufacturing. The committee is interested in looking further into these terms and possibly incorporating them throughout Chapter 46 in the next revision cycle. The committee invites the submitter to provide Public Input in the next revision cycle showing how these terms should be incorporated into the document.

Public Input No. 166-NFPA 1-2021 [New Section after 3.3.24]

TITLE OF NEW CONTENT

3.3.XX Statinary Standby Battery

A battery that spends the majority of the time on continuous float charge or in a high state of charge in readiness for a discharge event.

Statement of Problem and Substantiation for Public Input

Before the advent of the new "energy storage' technologies and applications (partial state of charge and discharge cyclical operations), stationary batteries were regularly referred to as standby batteries. With the newer applications defined under the new tabular as energy storage (e.g. peak shaving, PV or REN + storage, frequency and/or voltage regulation, etc.) it is necessary to distinguish between traditional standby and newer alternative ESS application requirements. The batteries in these cases operate under different operating parameters with different safety requirements. Providing this definition substantiates that distinction. NFPA 70, Articles 480 and 706 recognize and apply this distinction.

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Committee: FCC-HAZ

Committee Statement

Resolution: The content is outside of the scope of NFPA 1 and should be referenced to NFPA 855 or extracted from NFPA 855.

Public Input No. 164-NFPA 1-2021 [Section No. 3.3.24.5]

3.3.24.5* Vented Lead Acid (~~Flooded~~ VLA).

A lead-acid battery consisting of cells that have electrodes immersed in liquid electrolyte. Two colloquial expressions are "flooded" cells or "wet" cells.

Statement of Problem and Substantiation for Public Input

The industry term for this type of stationary lead-acid battery is Vented Lead-Acid and the common abbreviation is VLA (as opposed to VRLA). See IEEE 1881, IEEE ESSB Glossary.

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Committee: FCC-HAZ

Committee Statement

Resolution: FR-34-NFPA 1-2021
Statement: The definition is no longer used in the standard and is being deleted.

Public Input No. 127-NFPA 1-2021 [New Section after 3.3.268]

TITLE OF NEW CONTENT: New Definition

3.3.XX * Stationary Standby Battery

A battery that spends the majority of the time on continuous float charge or in a high state of charge, in readiness for a discharge event.

A3.3.XX Most Uninterruptible Power Supply (UPS) batteries fall under this definition. NFPA 70 article 480 covers stationary standby batteries that are comprised of lead-acid or nickel-cadmium cells. For all other chemistries or for lead-acid and nickel-cadmium energy storage systems that do not fall under the definition of stationary standby batteries, NFPA 70 article 706 applies.

Statement of Problem and Substantiation for Public Input

Definition added to differentiate stationary standby batteries (NEC Article 480) from Energy Storage Systems (NEC Article 706). Stationary standby battery applications using lead-acid and nickel-cadmium batteries have a long history of safe use as reinforced by recent Fire Protection Research Foundation (FPRF), See 2020 Fire Protection Research Foundation report Hazard Assessment of Lead-Acid Batteries, 2017 ConEd NYSERDA report, see finally EAI report TR-CBI-20-06-01 which estimates the fuel load of a 50 kWhr lead-acid battery system(materials included with PI-126). Adding this definition allows for more exact code treatment of both stationary standby batteries and Energy Storage Systems in chapter 52. The definition is consistent with the current draft language in NFPA 70, National Electrical Code and NFPA 70B, Recommended Practice for Electrical Equipment Maintenance.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 126-NFPA 1-2021 [Chapter 52]	This definition is used in PI-126 of Chapter 52
Public Input No. 128-NFPA 1-2021 [Section No. 1.12.8]	Addresses permits for stationary standby batteries
Public Input No. 126-NFPA 1-2021 [Chapter 52]	
Public Input No. 128-NFPA 1-2021 [Section No. 1.12.8]	

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Committee: FCC-HAZ

Committee Statement

Resolution: The content is outside of the scope of NFPA 1 and should be referenced to NFPA 855 or extracted from NFPA 855.

Public Input No. 152-NFPA 1-2021 [Section No. 43.1.1.4]

43.1.1.4

Section 43.1 shall apply to spray application processes or operations that are conducted indoors or outdoors within temporary membrane enclosures. [**33:**1.1.5]

43.1.1.5

Use of inflatable enclosures for flammable or combustible spray applications that are not specifically regulated by NFPA 33 shall be prohibited.

Statement of Problem and Substantiation for Public Input

Inflatable enclosures used to spray flammable finishes are essentially spray booths that lack sufficient fire resistive construction, fire suppression and air filtration to keep flammable mixtures below 25 LFL and are a hazard to those working inside the enclosure. Until such time as NFPA 33 addresses the issue and or a standard is developed to provide requirements, this equipment shall not be used to spray flammable finishes within them. Please renumber the section if this proposal is approved by the technical committee.

Submitter Information Verification

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Submittal Date: Thu Apr 01 12:56:43 EDT 2021
Committee: FCC-HAZ

Committee Statement

Resolution: FR-26-NFPA 1-2021

Statement: Inflatable enclosures used to spray flammable finishes are essentially spray booths that lack sufficient fire resistive construction, fire suppression and air filtration to keep flammable mixtures below 25 LFL and are a hazard to those working inside the enclosure. Until such time as NFPA 33 addresses the issue and or a standard is developed to provide requirements, this equipment shall not be used to spray flammable finishes within them.

Public Input No. 18-NFPA 1-2020 [New Section after 50.1.1]

50.1.1.1 Permits. Permits where required, shall comply with 1.12.
Add to Table 1.12.8(a)
Commercial, mobile and temporary cooking - the placement, operation or construction

Statement of Problem and Substantiation for Public Input

This chapter contains a hazard that should require a permit.

Submitter Information Verification

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Committee: FCC-HAZ

Committee Statement

Resolution: FR-27-NFPA 1-2021
Statement: This chapter contains a hazard that can be permitted at the discretion of the AHJ. The HAZ committee requests that the Correlating Committee add Commercial, mobile, and temporary cooking - the placement, operation or construction to Table 1.12.8(a) as 3 separate line items.

Public Input No. 154-NFPA 1-2021 [Section No. 50.4.4.7.4]

50.4.4.7.4

Changes or modifications to the hazard after installation of the fire-extinguishing systems shall result in re-evaluation of the system design by a properly trained, qualified, and certified person(s). [**96:**10.2.7.4]

50.4.4.7.4.1 A change to a higher temperature fusible link shall be in accordance with the automatic fire-extinguishing system manufacturer's instructions based on the appliance category and approval by the AHJ.

Statement of Problem and Substantiation for Public Input

There is no provision in NFPA 96 or NFPA 1 to prevent someone from installing a fusible link rated at a higher temperature than the classification of the appliance as a means to prevent unintentional activation of a fire suppression system in a hood and duct system . This proposal provides a method and approval requirement to do so if warranted.

Submitter Information Verification

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Submittal Date: Thu Apr 01 13:09:26 EDT 2021
Committee: FCC-HAZ

Committee Statement

Resolution: CI-30-NFPA 1-2021

Statement: There is no provision in NFPA 96 or NFPA 1 to prevent someone from installing a fusible link rated at a higher temperature than the classification of the appliance as a means to prevent unintentional activation of a fire suppression system in a hood and duct system . The committee is proposing to provide a method and approval requirement to do so if warranted. A task group will be looking at this proposal (see CI 28).

Public Input No. 139-NFPA 1-2021 [Section No. 50.8.7.7.1]

50.8.7.7.1

Piping shall be sized and installed in accordance with 6.11.2.2 and 6.11. 3 of NFPA 58 and 50.8.7.7.1.1 through 50.8.7.7.1.13. [**58:**6.26.5.1]

50.8.7.7.1.1

Steel tubing shall have a minimum wall thickness of 0.049 in. (1.2 mm). [**58:**6.26.5.1(A)]

50.8.7.7.1.2

A flexible connector shall be installed between the regulator outlet and the fixed piping system to protect against expansion, contraction, jarring, and vibration strains. [**58:**6.26.5.1(B)]

50.8.7.7.1.3

Flexibility shall be provided in the piping between a cylinder and the gas piping system or regulator. [**58:**6.26.5.1(C)]

50.8.7.7.1.4

Flexible connectors shall be installed in accordance with 6.11.6 of NFPA 58. [**58:**6.26.5.1(D)]

50.8.7.7.1.5

Flexible connectors longer than the length allowed in NFPA 58, or fuel lines that incorporate hose, shall be used only where approved. [**58:**6.26.5.1(E)]

50.8.7.7.1.6

The fixed piping system shall be designed, installed, supported, and secured to minimize the possibility of damage due to vibration, strains, or wear and to preclude any loosening while in transit. [**58:**6.26.5.1(F)]

50.8.7.7.1.7

Piping shall be installed in a protected location. [**58:**6.26.5.1(G)]

50.8.7.7.1.8

Where piping is installed outside the vehicle, it shall be installed as follows:

(1) Piping shall be under the vehicle and below any insulation or false bottom.

(2) Fastening or other protection shall be installed to prevent damage due to vibration or abrasion.

(3) At each point where piping passes through sheet metal or a structural member, a rubber grommet or equivalent protection shall be installed to prevent chafing.

[**58:**6.26.5.1(H)]

50.8.7.7.1.9

Gas piping shall be installed to enter the vehicle through the floor directly beneath or adjacent to the appliance served. [**58:**6.26.5.1(I)]

50.8.7.7.1.10

If a branch line is installed, the tee connection shall be located in the main gas line under the floor and outside the vehicle. [**58:**6.26.5.1(J)]

50.8.7.7.1.11

Exposed parts of the fixed piping system either shall be of corrosion-resistant material or shall be coated or protected to minimize exterior corrosion. [**58:**6.26.5.1(K)]

50.8.7.7.1.12

Hydrostatic relief valves shall be installed in isolated sections of liquid piping as provided in Section 6.15 of NFPA 58. [**58:**6.26.5.1(L)]

50.8.7.7.1.13

Piping systems, including hose, shall be pressure tested and proven free of leaks in accordance with Section 6.16 of NFPA 58. [**58:**6.26.5.1(M)]

Statement of Problem and Substantiation for Public Input

NFPA 1 contains excellent information but because it is critical that the piping be sized correctly for the load it is serving, a direct reference to 6.11.2.2 in NFPA 58 should be made.

Submitter Information Verification

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Committee: FCC-HAZ

Committee Statement

Resolution: This topic is being reviewed on related CI 28 and CI 29, and would also change the extracted text.

Public Input No. 126-NFPA 1-2021 [Chapter 52]

Chapter 52– Stationary Standby Batteries and Energy Storage Systems

52.1 General.

52.1.1* –

Stationary Standby Batteries utilizing lead-acid and nickel-cadmium cells shall comply with Section 52.2.

52.1.2*

Energy storage systems (ESS) and stationary standby batteries other than lead-acid or nickel-cadmium types having an aggregate capacity exceeding the threshold quantities established in Table 1.3 of NFPA 855 shall comply with ~~Chapter~~ Section 52 .3.

52. 2 Stationary Standby Batterie s Utilizing Lead-Acid and Nickel-Cadmium Cells

52.2.1 General.

Stationary standby battery systems having an electrolyte capacity of more than 100 gal (378.5 L) in sprinklered buildings or 50 gal (189.3 L) in unsprinklered buildings containing flooded lead-acid, nickel-cadmium, and valve-regulated lead–acid (VRLA) batteries used for facility standby power, emergency power, or uninterrupted power supplies shall be in accordance with Section 52.2 and Table 52.2. 1 .

~~2 Permits.~~

~~**52.1.2.1**~~ –

Table 52.2.1 Stationary Standby Battery Requirements

	Nonrecombinant Batteries		**Recombinant Batteries**
Requirement	**Flooded Lead-Acid**	**Flooded Nickel-Cadmium (Ni-Cd)**	**Valve-Regulated Lead–Acid (VRLA)**
Safety caps	Venting caps	Venting caps	Self-resealing flame-arresting caps
Thermal runaway management	Not required	Not required	Required
Spill control	Required	Required	Not required
Neutralization	Required	Required	Required
Ventilation	Required	Required	Required
Signage	Required	Required	Required
Seismic control	Required	Required	Required
Fire detection	Required	Required	Required

52.2.2 Permits.

52.2.2.1

Permits, where required, shall comply with Section 1.12 .

52.2.2.2

Prior to installation, plans shall be submitted and approved by the AHJ.

52.2.3 Standby Power System Safety Features.

52.2.3.1 Safety Venting.

Batteries shall be provided with safety venting caps per 52.2.2.1.1 and 52.2.2.1.2 .

52.2.3.1.1 Nonrecombinant Batteries.

Vented lead-acid and nickel-cadmium shall be provided with safety venting caps.

52.2.3.1.2 Recombinant Batteries.

VRLA shall be equipped with self-resealing flame-arresting safety vents.

52.2.3.2 Thermal Runaway.

VRLA systems shall be provided with a listed device or other approved method to preclude, detect, and control thermal runaway.

52.2.3.3 Location and Occupancy Separation.

52.2.3.3.1

Battery systems shall be permitted in the same room as the equipment that they support.

52.2.3.3.2

Battery systems shall be housed in a noncombustible, locked cabinet or other enclosure to prevent access by unauthorized personnel unless located in a separate equipment room accessible only to authorized personnel.

52.2.3.3.3

In other than assembly, educational, detention, and correction facilities; health care, ambulatory health care, and day care centers; and residential board and care and residential occupancies, battery systems shall be located in a room separated from other portions of the building by a minimum of a 1-hour fire barrier.

52.2.3.3.4

In assembly, educational, detention and correction facilities; health care, ambulatory health care, and day care centers; and, residential board and care and residential occupancies, battery systems shall be located in a room separated from other portions of the building by a minimum of a 2-hour fire barrier.

52.2.3.4 Spill Control.

52.2.3.4.1

Rooms, buildings, or areas containing free-flowing liquid electrolyte in individual vessels having a capacity of more than 55 gal (208 L) or multiple vessels having an aggregate capacity exceeding 1000 gal (3785 L) shall be provided with spill control to prevent the flow of liquids to adjoining areas .

52.2.3.4.2 * .

An approved method and materials for the control of a spill of electrolyte shall be provided that will be capable of controlling a spill from the single largest vessel.

52.2.3.4.3

VRLA batteries with immobilized electrolyte shall not require spill control.

52.2.3.5 Neutralization.

**52.2.3.5.1 * **

An approved method to neutralize spilled electrolyte shall be provided.

**52.2.3.5.2 **

For VLA batteries, the method shall be capable of neutralizing a spill from the largest battery to a pH between 7.0 and 9.0.

52.2.3.6 * Ventilation.

For flooded lead-acid, flooded nickel-cadmium, and VRLA batteries, ventilation shall be provided for rooms and cabinets in accordance with the mechanical code and one of the following:

(1) The ventilation system shall be designed to limit the maximum concentration of hydrogen to 1.0 percent of the total volume of the room during the worst-case event of simultaneous "boost" charging of all the batteries, in accordance with nationally recognized standards.

(2) Continuous ventilation shall be provided at a rate of not less than 1 $ft^3/min/ft^2$ (5.1 $L/sec/m^2$) of floor area of the room or cabinet.

52.2.3.7 Environment.

The battery environment shall be controlled or analyzed to maintain temperature in a safe operating range for the specific battery technology used.

52.2.3.8 Signs.

**52.2.3.8.1 **

Doors or accesses into the following shall be provided with approved signs:

**52.2.3.8.2 **

For rooms that contain VRLA batteries, the signs required by 52.2.2.8.1 shall state the following:

This room contains:

(1) Stationary storage battery systems

(2) Energized electrical circuits

**52.2.3.8.3 **

For rooms that contain flooded lead-acid or flooded Ni-Cd batteries, the signs required by 52.2.2.8.1 shall state the following:

This room contains:

(1) Stationary storage battery systems

(2) Energized electrical circuits

(3) Corrosive battery electrolyte

52.2.3.8.4

Battery cabinets shall be provided with exterior labels that identify the manufacturer and model number of the system and electrical rating (i.e., voltage and current) of the contained battery system.

52.2.3.8.5

Signs shall be provided within battery cabinets to indicate the relevant electrical, chemical, and fire hazard.

52.2.3.9 Seismic Protection.

Battery systems shall be seismically braced in accordance with the building code.

52.2.3.10 Smoke Detection.

An approved automatic smoke detection system shall be installed in rooms containing stationary battery storage systems in accordance with *NFPA 72* .

52.2.3.10.1

The required automatic smoke detection system shall be supervised by an approved central, proprietary, or remote station service or a local alarm that will give an audible signal at a constantly attended location.

52.2.3.10.2

Normally unoccupied, stand-alone telecommunications structures with a gross floor area of less than 1,500 ft^2 (140 m^2)shall not be required to have the detection as indicated in 52.2.2.10 .

52.3 * Energy Storage Systems.

52.3.1 Permits.

52.3.1.1

Permits, where required, shall comply with Section 1.12.

52.3. 1.2.~~2~~

Prior to installation, plans shall be submitted and approved by the AHJ.

52. ~~1~~ 3 .2 ~~.3~~ Construction Documentation

Construction documentation shall include the documents required in 4.1.2.1 of NFPA 855.

52.~~1~~ 3 .3 Documentation Location.

A copy of the operations and maintenance manual shall be placed in an approved location to be accessible to AHJs and emergency responders. [**855:**4.1.2.3.2]

52.~~1~~ 3 .4 Emergency Operations Plan.

An emergency operations plan shall be readily available for use by facility operations and maintenance personnel. [**855:**4.1.3.2.1]

52.~~1~~ 3 .4.1

The emergency operations plan shall be readily available to emergency responders as required in 52.1.4.

52.~~1~~ 3 .4.2

Emergency contact numbers for the owner representative/operations and maintenance staff shall be accessible to emergency responders as required in 52.1.4.

52.~~1~~ 3 .5 System Commissioning and Decommissioning.

System commissioning of ESS shall be both of the following:

(1) Performed in accordance with Chapter 6 of NFPA 855

(2) Approved prior to putting the system into service

52.~~1~~ 3 .5.1

A commissioning plan meeting the provisions of Chapter 6 shall be provided to the building owner or their authorized agent and the AHJ. [**855:**4.1.2.4]

52.~~1~~ 3 .5.2

A decommissioning plan shall be both of the following:

(1) Prepared in accordance with Chapter 8 of NFPA 855

(2) Approved prior to putting the system in service

52.~~1~~ 3 .5.3

The AHJ shall be notified prior to decommissioning an ESS. [**855:**8.2.1]

52.~~1~~ 3 .5.4

Recommissioning of existing ESS that have undergone alterations, additions, repositioning, or renovations to the system or any of its components shall be in accordance with Chapter 6 of NFPA 855.

52.~~1~~ 3 .6 Operation, Maintenance, and Testing.

Operation, maintenance, and testing of ESS shall be in accordance with Chapter 7 of NFPA 855.

52.~~1~~ 3 .7* Installations and Locations.

The installation of ESS and related systems shall be in accordance with NFPA 855.

52.~~1~~ 3 .8 Mobile ESS Equipment and Operations.

52.~~1~~ 3 .8.1

The charging, storage, and deployment of mobile ESS shall be in accordance with Section 4.5 of NFPA 855.

52.~~1~~ 2 .8.2

Operational permits might be required, see Table 1.12.8(a).

52.~~1~~ 3 .9 System Interconnections.

All electrical connections and wiring to and from an ESS or the components of an ESS, and connections to fuel gas, liquid fuel, or water shall be in accordance with Chapter 5 of NFPA 855.

52.~~1~~ 3 .10 Combustible Storage.

52.~~1~~ 3 .10.1

Combustible materials not related to the ESS shall not be stored in rooms, cabinets, or enclosures containing ESS equipment. [**855:**4.1.6.1]

52.~~1~~ 3 .10.2

Combustible materials related to the ESS shall not be stored within 3 ft (914 mm) from ESS equipment. [**855:**4.1.6.2]

52.~~1~~ 3 .10.3

Combustible materials in occupied work centers shall comply with Section 10.19 or other applicable fire codes. [**855:**4.1.6.3]

52.~~1~~ 3 .11 Equipment.

52.~~1~~ 3 .11.1 Repairs.

Repairs of ESS shall only be done by qualified persons and documented in the maintenance, testing, and events log required in 4.1.2.3 of NFPA 855. [**855:**4.2.2.1]

52.~~1~~ 3 .11.2 Retrofits.

52.~~1~~ 3 .11.2.1

Retrofitting of ESS shall comply with the following:

(1) Battery systems and modules and capacitor systems and modules shall be listed in accordance with UL 1973.

(2) Battery management and other monitoring systems shall be connected and installed in accordance with the manufacturer's instructions.

(3) The overall installation shall continue to comply with UL 9540 listing requirements, where applicable.

(4) Retrofits shall be documented in the maintenance, testing, and events log required in 4.1.2.3 of NFPA 855.

[**855:**4.2.3.1]

52.~~1~~ 3 .11.2.2

Changing out or retrofitting existing lead-acid or nickel-cadmium battery systems with other lead-acid or nickel-cadmium battery systems less than 50 V ac, 60 V dc in telecommunications facilities for installations of communications equipment under the exclusive control of communications utilities located outdoors or in building spaces used exclusively for such installations that are in compliance with NFPA 76 shall be considered repairs when there is no increase in system size or capacity greater than 10 percent from the original design. [**855:**4.2.3.2]

52.~~1~~ 3 .11.2.3*

Changing out or retrofitting existing lead-acid or nickel-cadmium battery systems with other lead-acid or nickel-cadmium battery systems that are designed in accordance with IEEE C2, used for dc power for control of substations and control or safe shutdown of generating stations under the exclusive control of the electric utility, and located outdoors or in building spaces used exclusively for such installations shall be considered repairs when there is no increase in system size or capacity greater than 10 percent from the original design. [**855:**4.2.3.3]

52.~~1~~ 3 .11.2.4

Changing out or retrofitting existing lead-acid battery systems with other lead-acid battery systems in uninterruptable power supplies listed and labeled in accordance with UL 1778 and utilized for standby power applications shall be considered repairs where there is no increase in system size or capacity greater than 10 percent from the original design. [**855:**4.2.3.4]

52.~~1~~ 3 .11.3 Replacements.

Replacement of ESS shall be considered new ESS installations and comply with the provisions applicable to new ESS. [**855:**4.2.4.1]

52.~~1~~ 3 .12 Increase in Power Rating or Maximum Stored Energy.

52.~~1~~ 3 .12.1

A complete new ESS that is added to an existing installation of one or more existing systems (including traditional standby systems) shall be treated as a new system and meet the applicable requirements of this standard. [**855:**4.2.5.1]

52.~~1~~ 3 .12.2

An increase in maximum stored energy or power rating to an existing ESS shall be considered a retrofit and comply with 52.1.11.2.1. [855:4.2.5.2]

52.~~1~~ 3 .13 Environment.

The temperature, humidity, and other environmental conditions in which an ESS is located shall be maintained in accordance with the listing (if listed) and the manufacturer's specifications. [**855:**4.2.6]

52.~~1~~ 3 .14* Working Space.

At a minimum, ESS equipment shall be provided with working space in accordance with NFPA 70 or IEEE C2, as appropriate, for operation, inspection, troubleshooting, maintenance, or replacement. [**855:**4.3.2]

52.~~1~~ 3 .15 Security of Installations.

52.~~1~~ 3 .15.1

ESS shall be secured against unauthorized entry and safeguarded in an approved manner. [**855:**4.3.8.1]

52.~~1~~ 3 .15.2

Security barriers, fences, landscaping, and other enclosures shall not inhibit the required air flow to or exhaust from the ESS and its components. [**855:**4.3.8.2]

52.~~1~~ 3 .16 Fire Command Centers

In buildings containing ESS and equipped with a fire command center, the command center shall include signage or readily available documentation that describes the location and type of ESS, operating voltages, and location of electrical disconnects as required by *NFPA 70*. [**855:**4.3.12]

52.~~1~~ 3 .17 Reused or Repurposed Equipment.

Storage batteries previously used in other applications, such as electric vehicle propulsion, shall not be permitted unless the equipment is repurposed by a UL 1974 compliant battery repurposing company when reused in ESS applications and the system complies with 4.2.1 of NFPA 855. [**855:**4.2.10.1]

52.~~1~~ 3 .18 Signage.

52.~~1~~ 3 .18.1

Approved signage shall be provided in the following locations:

(1) On the front doors to rooms or areas containing ESS or in approved locations near entrance to ESS rooms

(2) On the front doors to outdoor occupiable ESS containers

(3) In approved locations on outdoor ESS that are not enclosed in occupiable containers or otherwise enclosed

[**855:**4.3.5.1]

52.~~1~~ 3 .18.2*

The signage required in 52.1.18.1 shall be in compliance with ANSI Z535 and include the following information as shown in Figure 52.1.18.2.

(1) "Energy Storage Systems" with symbol of lightning bolt in a triangle

(2) Type of technology associated with the ESS

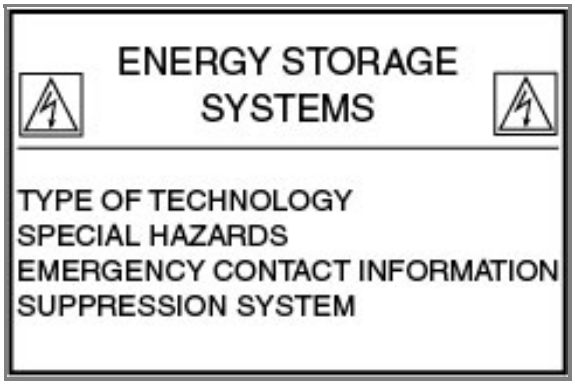
(3) Special hazards associated as identified in Chapters 9 through 15 of NFPA 855

(4) Type of suppression system installed in the area of the ESS

(5) Emergency contact information

[**855:**4.3.5.2]

Figure 52.~~1~~ 3 .18.2 Example of ESS Signage. [855:Figure 4.3.5.2]



52.~~1~~ 3 .19 Impact Protection.

52.~~1~~ 3 .19.1

ESS shall be located or protected to prevent physical damage from impact where such risks are identified. [**855:**4.3.7.1]

52.~~1~~ 3 .19.2

Vehicle impact protection consisting of guard posts or other approved means shall be provided where ESS are subject to impact by motor vehicles. [**855:**4.3.7.2]

52.~~1~~ 3 .20 Means of Egress.

52.~~1~~ 3 .20.1

All areas containing ESS shall provide egress from the area in which they are located in accordance with the local building code. [**855:**4.3.10.1]

52.~~1~~ 3 .20.2

Required egress doors shall be provided with emergency lighting as required by the local building code. [**855:**4.3.10.2]

52.~~1~~ 3 .21 Spill Control.

Rooms, buildings, or areas containing ESS with free-flowing liquid electrolyte in individual vessels having a capacity of more than 55 gal (208 L) or multiple vessels having an aggregate capacity exceeding 1000 gal (3785 L) shall be provided with spill control to prevent the flow of liquids to adjoining areas. [**855:**4.14.1]

52.~~1~~ 3 .22 Fire Suppression and Control.

Where fire suppression and control is provided it shall be in accordance with 4.4.4.3 of NFPA 855.

52.~~1~~ 3 .23* Ventilation.

Where ventilation is provided it shall be in accordance with Section 4.9 of NFPA 855.

52.~~1~~ 3 .24 Smoke and Fire Detection.

Where smoke and fire detection is provided it shall be in accordance with Section 4.10 of NFPA 855.

52.~~1~~ 3 .25 Water Supply.

Where water supplies are provided they shall be in accordance with Section 4.13 of NFPA 855.

52.~~2~~ 3.26 Remediation Measures.

Remediation measures shall be provided in accordance with Section 4.16 of NFPA 855.

52.~~2~~ 3 .26. 1

When, in the opinion of the AHJ, it is essential for public safety that trained personnel be on site to respond to possible ignition or reignition of a damaged or decommissioned ESS, the owner, agent, or lessee shall provide one or more fire mitigation personnel, as required and approved, at their expense. [**855:**4.16.2.1]

52.~~2~~ 3 .26. 2

These personnel shall remain on duty continuously after the fire department leaves the premises until the damaged ESS is removed from the premises or the AHJ indicates they can leave. [**855:**4.16.2.2]

52.~~2~~ 3 .26. 3

On-duty fire mitigation personnel shall have the following responsibilities:

(1) Keep diligent watch for fires, obstructions to means of egress, and other hazards

(2) Immediately contact the fire department if their assistance is needed to mitigate any hazards

(3) Take prompt measures for remediation of hazards and extinguishment of fires that occur

(4) Take prompt measures to assist in the evacuation of the public from the structures

[**855:**4.16.2.3]

52.3.27 * System Interconnection.

Where system interconnections are provided they shall be in accordance with Section 5.1 of NFPA 855.

52.~~4~~ 3.28 Operation and Maintenance.

Operations and maintenance shall be in accordance with Chapter 7 of NFPA 855.

52.~~5~~ 3.29 Electrochemical Energy Storage Systems.

Where electrochemical energy storage systems are provided they shall be in accordance with Chapter 9 of NFPA 855.

52.~~6~~ 3.30 Capacitor Energy Storage Systems.

Where capacitor energy storage systems are provided they shall be in accordance with Chapter 10 of NFPA 855.

52.~~7~~ 3.31 Fuel Cell Energy Storage Systems.

Where fuel cell energy storage systems are provided they shall be in accordance with Chapter 11 of NFPA 855.

52.~~8~~ 3.32 Storage of Used or Off-Specification Batteries.

Where storage of used or off-specification batteries is provided it shall be in accordance with Chapter 14 of NFPA 855.

~~52.9~~ 3.33 * One- and Two-Family Dwelling and Townhouse Units.

Where one-and two-family dwellings and townhouse units are provided they shall be in accordance with Chapter 15 of NFPA 855.

Statement of Problem and Substantiation for Public Input

Progress has been made in NFPA 70 articles 480 and 706 to differentiate between traditional standby battery systems based on lead-acid and nickel-cadmium chemistries (long history of safety) and newer grid interactive Energy Storage Systems based mostly on lithium-ion chemistries (short history of lower safety and higher fire risk). This PI seeks to revert to the 2018 code language for traditional standby battery systems which was very successful and widely adopted. Making this differentiation will allow for increased levels of regulation to be placed on newer lithium-ion based Energy Storage Systems without disruption of existing safety legacy applications of non-flammable chemistries. See 2020 Fire Protection Research Foundation (FRPF) report Hazard Assessment of Lead-Acid Batteries which concludes lead-acid batteries are a relatively low fire risk and aqueous electrolyte in flooded lead acid batteries inhibits fire spread. See 2017 ConEd NYSERDA report which notes lead-acid battery electrolytes are not flammable, the representative lead acid battery did not exhibit flammability and "existing building codes and engineering controls can be adequate in many cases to handle battery safety issues". See finally EAI report TR-CBI-20-06-01 which notes the fuel load of a 50 kWhr lead-acid battery system is comparable to that of a small office photo-copy machine.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 127-NFPA 1-2021 [New Section after 3.3.268]	New definition
Public Input No. 128-NFPA 1-2021 [Section No. 1.12.8]	Corrects permit reference
Public Input No. 127-NFPA 1-2021 [New Section after 3.3.268]	
Public Input No. 128-NFPA 1-2021 [Section No. 1.12.8]	

Submitter Information Verification

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Committee: FCC-HAZ

Committee Statement

Resolution: The content is outside of the scope of NFPA 1 and should be referenced to NFPA 855 or extracted from NFPA 855.

Public Input No. 167-NFPA 1-2021 [Chapter 52 [Title Only]]

Stationary Standby Batteries and Energy Storage Systems

Statement of Problem and Substantiation for Public Input

With the advent of energy storage applications involving newer alternative technologies to the traditional stationary lead-acid and nickel-cadmium batteries used mainly in standby applications over the past scores of decades, it is important that a section be provided to outline the different safety aspects and standards required to differentiate these that have been in existence for many years from those required for newer alternative technologies. This would follow the practices that were included in the NFPA2018 edition.

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Zip:
Submittal Date: Thu Apr 01 17:03:14 EDT 2021
Committee: FCC-HAZ

Committee Statement

Resolution: The definition of Energy Storage Systems include the Stationary Standby Batteries and would not need to be added to the title.

Public Input No. 103-NFPA 1-2021 [New Section after 52.1.1]

One- and Two-Family Dwelling and Townhouse Units

ESS associated with one- and two-family dwellings and townhouse units shall be designed and installed in accordance with Chapter 15 of NFPA 855.

Statement of Problem and Substantiation for Public Input

This proposed change relocates 15.9 to the General article at the beginning of Chapter 52 as a new 52.1.1.1. The current layout can lead the user to believe that any system exceeding the threshold quantities in Table 1.3 of NFPA 855 must comply with the entirety of Chapter 52. Moving 52.9 to the general section makes it clear that the user must go directly to NFPA 855 to find the requirements for one- and two-family dwellings and townhouse units.

The proposal also corrects a grammatical error. The ESS is what is being provided, not the dwelling unit or townhouse.

This proposal was developed by the Vehicle Impact Working Group of the Sustainable Energy Action Committee (SEAC). The proposal received unanimous support of the SEAC Assembly, a body with 40 voting members representing a diversity of stakeholder interests. It also received unanimous support from the SEAC Steering Committee. The submitter, Larry Sherwood, is the SEAC Administrator.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 130-NFPA 1-2021 [Section No. 52.9]	

Submitter Information Verification

Submitter Full Name: Larry Sherwood
Organization: Interstate Renewable Energy Council
Affiliation: Sustainable Energy Action Committee
Street Address:
City:
State:
Zip:
Submittal Date: Tue Mar 09 18:58:53 EST 2021
Committee: FCC-HAZ

Committee Statement

Resolution: FR-31-NFPA 1-2021

Statement: Moving 52.9 to the general section makes it clear that the user must go directly to NFPA 855 to find the requirements for one- and two-family dwellings and townhouse units.

Public Input No. 168-NFPA 1-2021 [New Section after 52.2]

TITLE OF NEW CONTENT

52.2: Stationary Standby Battery Batteries Using Lead-Acid and Nickel-Cadmium Batteries

Statement of Problem and Substantiation for Public Input

There are over several hundred thousand stationary standby lead-acid or nickel-cadmium battery installations that have been safely installed under the established codes and standards that have governed their operations successfully, including NFPA 1's previous editions. While a new set of guidelines/standards is necessary for safety reasons due to newer battery technologies used in stationary battery applications, the standards as established in NFPA 1-2018 and NEC 70, articles 706 and 480 are adequate and proven as reliable safety requirements for lead-acid and nickel-cadmium batteries used in standby applications. These provisions as stated in NFPA 1-2018 should be maintained in this separate section.

Submitter Information Verification

Submitter Full Name: Chris Searles
Organization: IEEE ESSB Committee
Affiliation: BAE Batteries USA
Street Address:
City:
State:
Zip:
Submittal Date: Thu Apr 01 17:10:24 EDT 2021
Committee: FCC-HAZ

Committee Statement

Resolution: The content is outside of the scope of NFPA 1 and should be referenced to NFPA 855 or extracted from NFPA 855.

Public Input No. 140-NFPA 1-2021 [New Section after 52.5]

52.5.1 Existing Lithium-ion technology energy storage systems

52.5.1.1

The owner or operator of an energy storage system (ESS) that utilizes lithium-ion battery technology having capacities exceeding the values in NFPA 855 Table 1.3 Threshold Quantities, and that was installed prior to the jurisdiction's adoption of the 2018 or later edition of NFPA 1 or the adoption of the 2020 edition of NFPA 855, shall provide the fire code official a failure modes and effects analysis (FMEA) or other approved hazard mitigation analysis meeting the requirements of NFPA 855 Sections 4.1.4.2 through 4.1.4.4 for the review and approval of the AHJ.

52.5.1.2

In addition to the requirements of 52.5.1.1, the analysis shall include an assessment of the ability of the installed protection systems to provide for early detection and notification to the fire department of a thermal runaway event in relation to the ability of emergency responders to safely mitigate the size and impact of a thermal runaway event.

52.5.1.3

Where hazards are identified by the failure modes and effects analysis (FMEA), a plan that includes a timetable for corrective action shall be submitted to the AHJ for review and approval. The plan shall include actions and system improvements necessary for eliminating or mitigating any identified hazards, including listed methods for early detection and notification of a thermal runaway event.

Statement of Problem and Substantiation for Public Input

Though both the 2018 NFPA 1 Fire Code and the 2018 International Fire Code, received significant enhancements to provide necessary protection levels which were improved further with the provisions of the 2020 NFPA 855 Energy Storage Systems, the 2021 NFPA 1 and the 2021 International Fire Code, there are numerous installations that do not meet the new and necessary safety requirements. Even after the printing of the 2018 NFPA 1 Fire Code installers continued to install systems that did not meet the new standard of care, taking advantage of earlier editions of the codes that were still being enforced locally. A glaring example of a system that did not meet the requirements of the 2018 or 2021 editions of the Fire Code or NFPA 855 was located in Surprise, Arizona where a thermal runaway event seriously injured 4 members of the fire service.

The purpose of this proposal is to start to address potential dangerous protection shortcomings in the design, installation and maintenance of existing energy storage systems employing lithium-ion technology by requiring that a hazard analysis to be conducted and any identified hazards corrected.

Submitter Information Verification

Submitter Full Name: Robert Davidson
Organization: Davidson Code Concepts, LLC
Street Address:
City:
State:
Zip:
Submittal Date: Wed Mar 31 21:50:26 EDT 2021
Committee: FCC-HAZ

Committee Statement

Resolution: CI-32-NFPA 1-2021

Statement: The committee is considering adding the proposed language for evaluating existing Lithium-ion technology energy storage systems. The purpose of this proposal is to start to address potential dangerous protection shortcomings in the design, installation and maintenance of existing energy storage systems employing lithium-ion technology by requiring that a hazard analysis to be conducted and any identified hazards corrected.There is a potential that NFPA 855 covers this topic and could be extracted at second draft. There is a task group looking at this topic as well.

Public Input No. 130-NFPA 1-2021 [Section No. 52.9]

~~**52.9** * – One- and Two-Family Dwelling and Townhouse Units.~~

~~Where one-and two-family dwellings and townhouse units are provided they shall be in accordance with Chapter 15 of NFPA 855.~~

Statement of Problem and Substantiation for Public Input

This section is proposed to be relocated to a new 15.1.1.1 in PI-103-NFPA 1-2021 in order to aid the user in applying the appropriate rules for ESS associated with one and two-family dwelling and townhouse units.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 103-NFPA 1-2021 [New Section after 52.1.1]	

Submitter Information Verification

Submitter Full Name: Larry Sherwood
Organization: Interstate Renewable Energy Council
Affiliation: Sustainable Energy Action Committee
Street Address:
City:
State:
Zip:
Submittal Date: Wed Mar 31 11:00:14 EDT 2021
Committee: FCC-HAZ

Committee Statement

Resolution: FR-31-NFPA 1-2021

Statement: Moving 52.9 to the general section makes it clear that the user must go directly to NFPA 855 to find the requirements for one- and two-family dwellings and townhouse units.

Public Input No. 5-NFPA 1-2020 [Section No. 52.9]

52.9* One- and Two-Family Dwelling and Townhouse Units.

~~Where one~~ ESS associated with one -and two-family dwellings and townhouse units ~~are provided they~~ shall be in accordance with Chapter 15 of NFPA 855.

Statement of Problem and Substantiation for Public Input

This editorial change corrects a grammar error. The one- and two-family dwellings and units are not what is being provided. It is the ESS installation that needs to comply with Chapter 15 of NFPA 855, not the dwelling unit or units.

The proposed language mirrors the language in 15.1 of NFPA 855, which is more clear and grammatically correct.

Submitter Information Verification

Submitter Full Name: Charles Picard
Organization: Tesla, Inc.
Street Address:
City:
State:
Zip:
Submittal Date: Fri Dec 18 16:22:38 EST 2020
Committee: FCC-HAZ

Committee Statement

Resolution: FR-31-NFPA 1-2021
Statement: Moving 52.9 to the general section makes it clear that the user must go directly to NFPA 855 to find the requirements for one- and two-family dwellings and townhouse units.

Public Input No. 19-NFPA 1-2020 [New Section after 54.1.2]

54.1.3 Permits. Permits where required, shall comply with 1.12.
Add to Table 1.12.8(a)

Ozone gas-generating - the location and operation.

Statement of Problem and Substantiation for Public Input

This chapter contains a hazard that should require a permit.

Submitter Information Verification

Submitter Full Name: Steven Sawyer
Organization: [Not Specified]
Street Address:
City:
State:
Zip:
Submittal Date: Thu Dec 31 08:07:22 EST 2020
Committee: FCC-HAZ

Committee Statement

Resolution: FR-38-NFPA 1-2021
Statement: This chapter contains a hazard that can be permitted at the discretion of the AHJ. The HAZ Technical Committee requests that the Correlating Committee add Ozone gas-generating - the location and operation to Table 1.12.8(a).

Public Input No. 20-NFPA 1-2020 [New Section after 55.1]

55.1.1 Permits. Permits where required, shall comply with 1.12.
Add to Table 1.12.8(a)

Cleaning and purging of flammable gas piping systems - cleaning and purging.

Statement of Problem and Substantiation for Public Input

This chapter contains a hazard that should require a permit.

Submitter Information Verification

Submitter Full Name: Steven Sawyer
Organization: [Not Specified]
Street Address:
City:
State:
Zip:
Submittal Date: Thu Dec 31 08:09:09 EST 2020
Committee: FCC-HAZ

Committee Statement

Resolution: FR-39-NFPA 1-2021

Statement: This chapter contains a hazard that can be permitted at the discretion of the AHJ. The HAZ Technical Committee requests that the correlating committee add to Table 1.12.8(a) "Cleaning and purging of flammable gas piping systems - cleaning and purging."

Public Input No. 6-NFPA 1-2020 [New Section after 60.1.1]

60.1.1.1 Permits. Permits where required, shall comply with 1.12.

Statement of Problem and Substantiation for Public Input

Table 1.12.8(a) requires a permit for hazardous materials but chapter 60, like other chapters, doesn't have language requiring one. For consistency.

Submitter Information Verification

Submitter Full Name: Steven Sawyer
Organization:
Street Address:
City:
State:
Zip:
Submittal Date: Wed Dec 23 09:28:29 EST 2020
Committee: FCC-HAZ

Committee Statement

Resolution: FR-40-NFPA 1-2021
Statement: Table 1.12.8(a) requires a permit for hazardous materials but chapter 60, like other chapters, doesn't have language allowing for permitting.

Public Input No. 91-NFPA 1-2021 [Section No. 60.4.2.1.1.3]

60.4.2.1.1.3

The MAQ of hazardous materials per control area shall be as specified in Table 60.4.2.1.1.3 except as modified by 60.4.2.1.2 through 60.4.2.1.5. Ammonium nitrate shall also comply with Chapter 11 of NFPA 400. [**400:**5.2.1.1.3]

Table 60.4.2.1.1.3 Maximum Allowable Quantities (MAQ) of Hazardous Materials per Control Area

Material	Class	High Hazard Protection Level	Storage			-		Use	
			Solid Pounds	Liquid Gallons (lb)	Gas (at NTP) ft^3 (lb)	-		Solid Pounds	
Physical Hazard Materials	-	-	-	-	-	-	-	-	-
Combustible liquid[c]	II	3	N/A	120[a,b]	N/A	-		N/A	S
	-	IIIA	3	N/A	330[a,b]	N/A	-		N
	-	IIIB	N/A	N/A	13,200[a,d]	N/A	-		N
Combustible metals	See Note 1.	See Note 1.	See Note 1.	See Note 1.	See Note 1.	-		See Note 1.	S
Cryogenic fluid [**55:**Table 6.3.1.1]	Flammable	2	N/A	45[e,f]	N/A	-		N/A	4
	-	Oxidizing	3	N/A	45[a,b]	N/A	-		N
	-	Inert	N/A	N/A	NL	N/A	-		N
Explosives	See Note 1.	See Note 1.	See Note 1.	See Note 1.	See Note 1.	-		See Note 1.	S
Flammable gas[g] [**55:**Table 6.3.1.1]	Gaseous , Category 1A Category 1B	2	N/A	N/A	1000 [a,b] - 162,500 [a,b]		N/A	N/A	1 - 1
	-	Liquefied . Category 1A Category 1B	2	N/A	N/A	(150) [a,b] - (10,000) [a,b]		N/A	N
	-	Liquefied petroleum (LP)	2	N/A	N/A	(300)[h,i,j]	-		N
Flammable liquid[c]	IA	3	N/A	30[a,b]	N/A	-		N/A	S
	-	IB and IC	3	N/A	120[a,b]	N/A	-		N

Material	Class	High Hazard Protection Level	Storage			-		Use	
			Solid Pounds	Liquid Gallons (lb)	Gas (at NTP) ft^3 (lb)	-		Solid Pounds	
	-	Combination (IA, IB, IC)	3	N/A	120[a,b,k]	N/A	-		N
Flammable solid	N/A	3	125[a,b]	N/A	N/A	-		125[a,b]	N
Inert gas	Gaseous	N/A	N/A	N/A	NL	-		N/A	N
	Liquefied	N/A	N/A	N/A	NL	-		N/A	N
Organic peroxide	UD	1	1[a,l]	(1)[a,l]	N/A	-		¼[l]	(
	-	I	2	16[a,b]	(16)[a,b]	N/A	-		8
	-	IIA	3	100[a,b]	(100)[a,b]	N/A	-		5
	-	IIB	3	400	(400)	N/A	-		2
	-	III	3	840[a,b]	(840)[a,b]	N/A	-		8
	-	IV	N/A	NL	NL	N/A	-		N
	V	N/A	NL	NL	N/A	-		NL	N
Oxidizer	4	1	1[a,l]	(1)[a,l]	N/A	-		¼ [l]	(
	-	3[m]	2 or 3	10[a,b]	(10)[a,b]	N/A	-		2
	-	2	3	250[a,b]	(250)[a,b]	N/A	-		2
	-	1	N/A	4000[a,n]	(4000)[a,n]	NA	-		4
Oxidizing gas [**55:**Table 6.3.1.1]	Gaseous	3	N/A	N/A	1500[a,b]	-		N/A	N
	-	Liquefied	3	N/A	N/A	(150)[a,b]	-		N
Pyrophoric	N/A	2	4[a,l]	(4)[a,l]	N/A	-		1[l]	(
Pyrophoric gas [**55:**Table 6.3.1.1]	Gaseous	2	N/A	N/A	50[a, l]	-		N/A	N
	-	Liquefied	2	N/A	N/A	(4)[a,l]	-		N
Unstable (reactive)	4	1	1[a,l]	(1)[a,l]	N/A	-		¼[l]	(
	-	3	1 or 2	5[a,b]	(5)[a,b]	N/A	-		1
	-	2	2	50[a,b]	(50)[a,b]	N/A	-		5
	-	1	N/A	NL	NL	N/A	-		N
Unstable (reactive) gas [**55:**Table 6.3.1.1]	Gaseous	-	-	-	-	-	-	-	-

Material	Class	High Hazard Protection Level	Storage			-		Use	
			Solid Pounds	Liquid Gallons (lb)	Gas (at NTP) ft^3 (lb)	-		Solid Pounds	
	-	4 or 3 detonable	1	N/A	N/A	10[a,l]	-		N
	-	3 non-detonable	2	N/A	N/A	50[a,b]	-		N
	-	2	3	N/A	N/A	750[a,b]	-		N
	-	1	N/A	N/A	N/A	NL	-		N
Unstable (reactive) gas [**55:**Table 6.3.1.1]	Liquefied	-	-	-	-	-	-	-	-
	-	4 or 3 detonable	1	N/A	N/A	(1)[a,l]	-		N
	-	3 non-detonable	2	N/A	N/A	(2)[a,b]	-		N
-	-	-	-	-	-	-	-	-	-
	-	2	3	N/A	N/A	(150)[a,b]	-		N
	-	1	N/A	N/A	N/A	NL	-		N
Water-reactive	3	2	5[a,b]	(5)[a,b]	N/A	-		5[b]	(
	-	2	3	50[a,b]	(50)[a,b]	N/A	-		5
	-	1	N/A	NL	NL	N/A	-		N
Health Hazard Materials									
Corrosive	N/A	4	5000[a,b]	500[a,b]	N/A	-		5000[b]	5
Corrosive gas [**55:**Table 6.3.1.1]	Gaseous	4	N/A	N/A	810[a,b]	-		N/A	N
	-	Liquefied	4	N/A	N/A	(150)[a,b]	-		N
Highly toxic	N/A	4	10[a,b]	(10)[a,b]	N/A	-		10[b]	(
Highly toxic gas [**55:**Table 6.3.1.1]	Gaseous	4	N/A	N/A	20[b,o]	-		N/A	N
	-	Liquefied	4	N/A	N/A	(4)[b,o]	-		N
Toxic	N/A	4	500[a,b]	(500)[a,b]	N/A	-		500[b]	(
Toxic gas	Gaseous	4	N/A	N/A	810[a,b]	-		N/A	N
	-	Liquefied	4	N/A	N/A	(150)[a,b]	-		N

For SI units, 1 lb = 0.454 kg; 1 gal = 3.785 L; 1 ft^3 = 0.0283 m^3. Where quantities are indicated in pounds and when the weight per gallon of the liquid is not provided to the AHJ, a conversion

factor of 10 lb/gal (1.2 kg/L) shall be used.

NTP: Measured at normal temperature and pressure [70°F (21°C) and 14.7 psi (101.3 kPa)].

N/A: Not applicable. NL: Not limited. NP: Not permitted. UD: Unclassified detonable.

Notes:

(1) The hazardous material categories and MAQs that are shaded in this table are not regulated by Chapter 60 or NFPA 400 but are provided here for informational purposes. See Chapter 2 for the reference code or standard governing these materials and establishing the MAQs. In accordance with 1.1.1.2 of NFPA 400, materials having multiple hazards that fall within the scope of NFPA 400 shall comply with NFPA 400.

(2) Table values in parentheses correspond to the unit name in parentheses at the top of the column. The aggregate quantity in use and storage is not permitted to exceed the quantity listed for storage.

(3) The use of explosive materials required by federal, state, or municipal agencies while engaged in normal or emergency performance of duties is not required to be limited. The storage of explosive materials is required to be in accordance with the requirements of NFPA 495.

(4) The storage and use of explosive materials in medicines and medicinal agents in the forms prescribed by the official United States Pharmacopeia or the National Formulary are not required to be limited.

(5) The storage and use of propellant-actuated devices or propellant-actuated industrial tools manufactured, imported, or distributed for their intended purposes are required to be limited to 50 lb (23 kg) net explosive weight.

[a]Quantities are permitted to be increased 100 percent where stored or used in approved cabinets, gas cabinets, exhausted enclosures, gas rooms explosives magazines, or safety cans, as appropriate for the material stored, in accordance with this *Code*. Where footnote b also applies, the increase for both footnote a and footnote b is permitted to be applied accumulatively.

[b]Maximum quantities are permitted to be increased 100 percent in buildings equipped throughout with an automatic sprinkler system in accordance with NFPA 13. Where footnote a also applies, the increase for both footnote a and footnote b is permitted to be applied accumulatively.

[c]Medicines, foodstuffs, cosmetics, and other consumer products that contain not more than 50 percent by volume of water-miscible flammable or combustible liquids, with the remainder of the product consisting of components that do not burn, are not limited where packaged in individual containers that do not exceed a 1.3 gal capacity. *(See 9.1.4 of NFPA 30.)*

[d]The permitted quantities are not limited in a building equipped throughout with an automatic sprinkler system installed in accordance with NFPA 13 and designed in accordance with the protection criteria contained in Chapter 16 of NFPA 30.

[e]None allowed in unsprinklered buildings unless stored or used in gas rooms, approved gas cabinets, or exhausted enclosures, as specified in this *Code*.

[f]With pressure-relief devices for stationary or portable containers vented directly outdoors or to an exhaust hood. [**55:**Table 6.3.1.1]

[g]Flammable gases in the fuel tanks of mobile equipment or vehicles are permitted to exceed the MAQ where the equipment is stored and operated in accordance with this *Code*.

[h]Additional storage locations are required to be separated by a minimum of 300 ft (92 m).

[i]In mercantile occupancies, storage of LP-Gas is limited to a maximum of 200 lb (91 kg) in nominal 1 lb (0.45 kg) LP-Gas containers.

[j]See NFPA 58 for liquefied petroleum gas (LP-Gas) requirements. LP-Gas is not within the

scope of NFPA 400.

[k]Containing not more than the MAQ of Class IA, Class IB, or Class IC flammable liquids, individually, per control area.

[l]Permitted only in buildings equipped throughout with an automatic sprinkler system in accordance with NFPA 13.

[m]A maximum quantity of 220 lb (99 kg) of solid or 22 gal (83 L) of liquid Class 3 oxidizer is permitted where such materials are necessary for maintenance purposes, operation, or sanitation of equipment. Storage containers and the manner of storage are required to be approved.

[n]The permitted quantities are not limited in a building equipped throughout with an automatic sprinkler system installed in accordance with NFPA 13.

[o]Allowed only where stored or used in gas rooms, approved gas cabinets, or exhausted enclosures, as specified in this *Code*.

[**400:**Table 5.2.1.1.3]

Statement of Problem and Substantiation for Public Input

The ICC Fire Code Action Committee (FCAC) had a subcommittee that review requirements for flammable gases. Of concern was the change in definition for Flammable Gas in the GHS regarding the subdivision of Category 1 flammable gases. The change in definition results in Category 1A and Category 1B flammable gases. Category 1B are flammable gases with a low burning velocity. These Category 1B flammable gases are now being used as blowing agents for foam insulation, Group A2L refrigerants, and medical devises. FCAC has developed four changes regarding Category 1B flammable gases. I would recommend that NFPA 1 Committee create a subcommittee to develop similar changes to NFPA 1. The four changes are being submitted for consideration to provide the background information regarding the need for adjusting the maximum allowable quantities.

For additional reference material, see https://cdn-web.iccsafe.org/wp-content/uploads/2021-Group-A-Complete-Proposed-Changes-compressed.pdf, specifically code change proposals: F3-21, F98-21, F192-21 and G41.21.

Submitter Information Verification

Submitter Full Name: Julius Ballanco
Organization: Jb Engr Code Conslt Pc
Affiliation: Daikin U.S.
Street Address:
City:
State:
Zip:
Submittal Date: Fri Feb 19 16:17:28 EST 2021
Committee: FCC-HAZ

Committee Statement

Resolution: CI-33-NFPA 1-2021

Statement: The committee is considering changing the MAQ in regards to flammable gases to align with GHS classifications. This would then permit A2L refrigerants to be stored in greater quantities. The Committee has a task group looking into this issue in regards to A2L refrigerants and quantity limits. Since this table is extracted from NFPA 55 and NFPA

400, those extracted documents would also need to change in order to appropriately address the issue.

Public Input No. 21-NFPA 1-2020 [New Section after 64.1.2]

64.1.3 **Permits. Permits where required, shall comply with 1.12.**

Statement of Problem and Substantiation for Public Input

Table 1.12.8(d) contains permits limits but ch 64 does not have a requirement for a permit.

Submitter Information Verification

Submitter Full Name: Steven Sawyer
Organization: [Not Specified]
Street Address:
City:
State:
Zip:
Submittal Date: Thu Dec 31 08:11:36 EST 2020
Committee: FCC-HAZ

Committee Statement

Resolution: FR-41-NFPA 1-2021
Statement: Table 1.12.8(d) contains permits limits but chapter 64 does not have a requirement to allow for a permit.

Public Input No. 22-NFPA 1-2020 [New Section after 67.1.2]

67.1.3 Permits. Permits where required, shall comply with 1.12.

Statement of Problem and Substantiation for Public Input

Table 1.12.8(d) contains permits limits but ch 67 does not have a requirement for a permit.

Submitter Information Verification

Submitter Full Name: Steven Sawyer
Organization: [Not Specified]
Street Address:
City:
State:
Zip:
Submittal Date: Thu Dec 31 08:15:39 EST 2020
Committee: FCC-HAZ

Committee Statement

Resolution: FR-42-NFPA 1-2021
Statement: Table 1.12.8(d) contains permits limits but chapter 67 does not have a requirement to allow for a permit.

Public Input No. 23-NFPA 1-2020 [New Section after 68.1.2]

68.1.3 **Permits. Permits where required, shall comply with 1.12.**

Statement of Problem and Substantiation for Public Input

Table 1.12.8(d) contains permits limits but ch 68 does not have a requirement for a permit.

Submitter Information Verification

Submitter Full Name: Steven Sawyer
Organization: [Not Specified]
Street Address:
City:
State:
Zip:
Submittal Date: Thu Dec 31 08:17:42 EST 2020
Committee: FCC-HAZ

Committee Statement

Resolution: FR-43-NFPA 1-2021
Statement: Table 1.12.8(d) contains permits limits but chapter 68 does not have a requirement for allowing a permit.

Public Input No. 24-NFPA 1-2020 [New Section after 70.1.3]

70.1.4 **Permits. Permits where required, shall comply with 1.12.**

Statement of Problem and Substantiation for Public Input

Table 1.12.8(d) contains permits limits but ch 70 does not have a requirement for a permit.

Submitter Information Verification

Submitter Full Name: Steven Sawyer
Organization: [Not Specified]
Street Address:
City:
State:
Zip:
Submittal Date: Thu Dec 31 08:19:48 EST 2020
Committee: FCC-HAZ

Committee Statement

Resolution: FR-44-NFPA 1-2021
Statement: Table 1.12.8(d) contains permits limits but chapter 70 does not have a requirement to allow for a permit.

Public Input No. 25-NFPA 1-2020 [New Section after 71.1.2]

71.1.3 **Permits. Permits where required, shall comply with 1.12.**

Statement of Problem and Substantiation for Public Input

Table 1.12.8(d) contains permits limits but ch 71 does not have a requirement for a permit.

Submitter Information Verification

Submitter Full Name: Steven Sawyer
Organization: [Not Specified]
Street Address:
City:
State:
Zip:
Submittal Date: Thu Dec 31 08:20:45 EST 2020
Committee: FCC-HAZ

Committee Statement

Resolution: FR-45-NFPA 1-2021
Statement: Table 1.12.8(d) contains permits limits but chapter 71 does not have a requirement to allow for a permit.

Public Input No. 26-NFPA 1-2020 [New Section after 72.1.2]

72.1.3 Permits. Permits where required, shall comply with 1.12.

Statement of Problem and Substantiation for Public Input

Table 1.12.8(d) contains permits limits but ch 72 does not have a requirement for a permit.

Submitter Information Verification

Submitter Full Name: Steven Sawyer
Organization: [Not Specified]
Street Address:
City:
State:
Zip:
Submittal Date: Thu Dec 31 08:21:38 EST 2020
Committee: FCC-HAZ

Committee Statement

Resolution: FR-46-NFPA 1-2021
Statement: Table 1.12.8(d) contains permits limits but chapter 72 does not have a requirement to allow for a permit.

Public Input No. 27-NFPA 1-2020 [New Section after 73.1.2]

73.1.3 **Permits. Permits where required, shall comply with 1.12.**

Statement of Problem and Substantiation for Public Input

Table 1.12.8(d) contains permits limits but ch 73 does not have a requirement for a permit.

Submitter Information Verification

Submitter Full Name: Steven Sawyer
Organization: [Not Specified]
Street Address:
City:
State:
Zip:
Submittal Date: Thu Dec 31 08:22:28 EST 2020
Committee: FCC-HAZ

Committee Statement

Resolution: FR-47-NFPA 1-2021
Statement: Table 1.12.8(d) contains permits limits but chapter 73 does not have a requirement to allow for a permit.

Public Input No. 29-NFPA 1-2020 [New Section after 74.1.2]

74.1.3 **Permits. Permits where required, shall comply with 1.12.**

Statement of Problem and Substantiation for Public Input

Table 1.12.8(a) contains permits limits but ch 74 does not have a requirement for a permit.

Submitter Information Verification

Submitter Full Name: Steven Sawyer
Organization: [Not Specified]
Street Address:
City:
State:
Zip:
Submittal Date: Thu Dec 31 08:30:51 EST 2020
Committee: FCC-HAZ

Committee Statement

Resolution: FR-48-NFPA 1-2021
Statement: Table 1.12.8(a) contains permits limits but chapter 74 does not have a requirement to allow for a permit.

Public Input No. 28-NFPA 1-2020 [New Section after 75.1.2]

75.1.3 **Permits. Permits where required, shall comply with 1.12.**

Statement of Problem and Substantiation for Public Input

Table 1.12.8(d) contains permits limits but ch 75 does not have a requirement for a permit.

Submitter Information Verification

Submitter Full Name: Steven Sawyer
Organization: [Not Specified]
Street Address:
City:
State:
Zip:
Submittal Date: Thu Dec 31 08:29:18 EST 2020
Committee: FCC-HAZ

Committee Statement

Resolution: FR-49-NFPA 1-2021
Statement: Table 1.12.8(d) contains permits limits but chapter 75 does not have a requirement to allow for a permit.