
**Supplemental Information**

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**Submitter Information Verification**

- **Submitter Full Name:** Kristin Bigda
- **Organization:** National Fire Protection Assoc
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- **City:**
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- **Zip:**
- **Submittal Date:** Wed Oct 12 11:09:36 EDT 2016

**Committee Statement**

- **Committee Statement:** Extract update.
- **Response Message:**
NFPA 14:

3.3.258.13* Standpipe System.
An arrangement of piping, valves, hose connections, and associated equipment installed in a building or structure, with the hose connections located in such a manner that water can be discharged in streams or spray patterns through attached hose and nozzles, for the purpose of extinguishing a fire, thereby protecting a building or structure and its contents in addition to protecting the occupants. [14, 2016]

13.2.3.4.1
Where an existing standpipe system, including yard piping and fire department connection, is modified, the new piping shall be independently tested in accordance with 11.4.1 of NFPA 14. [14:11.4.7.1]

13.2.3.4.2
Modifications that cannot be isolated, such as new valves or the point of connection for new piping, shall not require testing in excess of system static pressure. [14:11.4.7.2]

A.3.3.258.13 Standpipe System.
This arrangement is accomplished by means of connections to water supply systems or by means of pumps, tanks, and other equipment necessary to provide an adequate supply of water to the hose connections. [14:A.3.3.1517]
Second Revision No. 33-NFPA 1-2016 [ Global Comment ]


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- **Submitter Full Name:** Kristin Bigda
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- **Submittal Date:** Wed Oct 12 11:10:48 EDT 2016

Committee Statement

- **Committee Statement:** Extract update.
- **Response Message:**
**NFPA 31:**

11.5.1.2
Section 11.5 shall also apply to all accessories and control systems, whether electric, thermostatic, or mechanical, and all electrical wiring connected to liquid fuel–burning appliances. [31:1.1.2]

11.5.1.3
Section 11.5 shall also apply to the installation of liquid fuel storage and supply systems connected to liquid fuel–burning appliances. [31:1.1.3]

11.5.1.4
Section 11.5 shall also apply to those multifueled appliances in which a liquid fuel is one of the standard or optional fuels. [31:1.1.4]

11.5.1.5*
Section 11.5 shall not apply to internal combustion engines, oil lamps, or portable devices not specifically covered in NFPA 31. (See Chapter 11 of NFPA 31 for portable devices that are covered in NFPA 31.) [31:1.1.5]

11.5.1.9
Electrical wiring and utilization equipment used in connection with oil-burning appliances or equipment shall be installed in accordance with Section 11.1. [31:4.4.1]

11.5.1.10.1*
The type and grade of liquid fuel used in a liquid fuel–burning appliance shall be that liquid fuel for which the appliance is listed and approved or is stipulated by the manufacturer. Liquid fuels shall meet one of the following specifications and shall not contain gasoline or any other flammable liquid:

2. ASTM D3699, Standard Specification for Kerosene
3. ASTM D6448, Industrial Burner Fuels from Used Lube Oils
4. ASTM D6751, Standard Specification for Biodiesel Fuel Blend Stock (B100) for Middle Distillate Fuel
5. ASTM D6823, Commercial Burner Fuels from Used Lube Oils

5. [31:4.5.1]

11.5.1.10.2
Appliances that burn crankcase oil or used oil shall not be used in a residential occupancy. Such appliances shall only be used if all of the following conditions are met:

1. The installation is in a commercial or industrial occupancy.
2. The oil-burning appliance is designed to burn crankcase oil or used oil and is listed for such use.
3. The appliance is installed in accordance with the manufacturer's instructions and with the terms of its listing.
4. The installation meets the applicable requirements of Section 4.6 and Chapter 12 of NFPA 31.

11.5.1.10.3*

Where heavy oils are used, the following shall be required:

1. The oil-burning appliance shall be designed to burn such fuels.
2. Means shall be provided to maintain the oil at its proper atomizing temperature.
3. Automatically operated burners that require preheating of oil shall be arranged so that no oil can be delivered for combustion until the oil is at the proper atomizing temperature.
4. *Use of an oil-fired appliance that is listed in accordance with ANSI/UL 296A, Standard for Waste Oil-Burning Air-Heating Appliances, shall be deemed as meeting the intent of 11.5.1.10.3(1) through 11.5.1.10.3(3).

11.5.1.10.4

A properly sized and rated oil filter or strainer shall be installed in the oil supply line to an oil burner. [31:4.5.4]
Second Revision No. 34-NFPA 1-2016 [ Global Comment ]


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Submitter Information Verification

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Submittal Date: Wed Oct 12 11:11:44 EDT 2016

Committee Statement

Committee Statement: Extract update.  
Response Message:   
NFPA 52:

42.11.1.1
Section 42.11 shall apply to the design, installation, operation, and maintenance of compressed natural gas (CNG) and liquefied natural gas (LNG) engine fuel systems on vehicles of all types and for fueling vehicle (dispensing) systems and associated storage, including the following:

1. Original equipment manufacturers (OEMs)
2. Final-stage vehicle integrator/manufacturer (FSVIM)
3. Vehicle fueling (dispensing) systems

42.11.1.2
Section 42.11 shall apply to the design, installation, operation, and maintenance of liquefied natural gas (LNG) engine fuel systems on vehicles of all types, to their associated fueling (dispensing) facilities, and to LNG to CNG facilities with LNG storage in ASME containers of 70,000 gal (265 m³) or less.

42.11.1.3*
Vehicles and fuel supply containers complying with the standards of federal motor vehicle safety standards (FMVSSs) covering the installation of CNG fuel systems on vehicles and certified by the respective manufacturer as meeting these standards shall not be required to comply with Sections 4.4, 4.8, 4.9, and 4.10, and Chapter 6 of NFPA 52 (except Sections 6.9, 6.11, 6.12, 6.13, and 6.14 of NFPA 52).

42.11.1.4
Section 42.11 shall include marine, highway, rail, off-road, and industrial vehicles.

42.11.1.5
Vehicles that are required to comply with applicable federal motor vehicle safety standards covering the installation of LNG fuel systems on vehicles and that are certified by the manufacturer as meeting these standards shall not be required to comply with Chapter 9 of NFPA 52, except 9.12 of NFPA 52.

A.42.11.1.1
Natural gas is a flammable gas. It is colorless, tasteless, and nontoxic. It is a light gas, weighing about two-thirds as much as air. As used in the systems covered by this standard, it tends to rise and diffuse rapidly in air when it escapes from the system.

Natural gas burns in air with a luminous flame. At atmospheric pressure, the ignition temperature of natural gas–air mixtures has been reported to be as low as 900°F (482°C). The flammable limits of natural gas–air mixtures at atmospheric pressure are about 5 percent to 15 percent by volume natural gas.

Natural gas is nontoxic but can cause anoxia (asphyxiation) when it displaces the normal 21 percent oxygen in air in a confined area without adequate ventilation.
The concentrations at which flammable or explosive mixtures form are much lower than the concentration at which asphyxiation risk is significant. [52:A.1.1]

NFPA 704 rating is as follows:

1. Health — 0
2. Flammability — 4
3. Reactivity — 0
4. Special — None

Cryogenic fluids are gases that have been liquefied by having their temperature brought below –130°F (–90°C). They are typically stored at low pressures in vacuum jacketed containers. Some of the potential hazards of cryogenic fluids are the following:

1. Extreme cold that freezes or damages human skin on contact and can embrittle metals
2. Extreme pressure resulting from rapid vaporization of the fluid during a leak or release of the cryogenic fluid
3. Asphyxiation resulting from a release of the cryogenic fluid that vaporizes and displaces air

Current DOT and TC specifications, exemptions, and specified permits do not address the use of cylinders that are approved for the transportation of natural gas to be used in CNG service.

The following Compressed Gas Association publications are relevant cylinder inspection standards:

1. CGA C-6, Standards for Visual Inspection of Steel Compressed Gas Cylinders
2. CGA C-6.1, Standards for Visual Inspection of High Pressure Aluminum Compressed Gas Cylinders
3. CGA C-6.2, Guidelines for Visual Inspection and Requalification of Fiber Reinforced High Pressure Cylinders
4. CGA C-10, Recommended Procedures for Changes of Gas Service for Compressed Gas Cylinders

The following Compressed Gas Association publication is specified in ANSI/ISA NGV2, Compressed Natural Gas Vehicle (NGV) Fuel Containers, as appropriate for CNG container inspection:

CGA C-6.4, Methods of External Visual Inspection of Natural Gas Vehicle (NGV) Fuel Containers and Their Installations
Second Revision No. 36-NFPA 1-2016 [ Global Comment ]


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- **Submitter Full Name**: Kristin Bigda
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- **Submittal Date**: Wed Oct 12 11:15:15 EDT 2016

Committee Statement

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- **Response Message**: 
NFPA 418:

21.3.3.1.1 The design drawings for the construction and protection of the heliport shall be approved by the AHJ. [418:4.2.1]

21.3.3.1.2 The design of the heliport, including all the aeronautical components, shall be in accordance with FAA AC 150/5390-2B2C, Heliport Design Advisory Circular. [418:4.2.2]

21.3.3.1.3 The final approach and takeoff (FATO) area, the approach/departure path, and the touchdown and liftoff (TLOF) area shall be designated on the design drawings. [418:4.2.3]

21.3.3.2.1 Storage, handling, and use of flammable and combustible liquids shall be in accordance with Chapter 66. [418:4.3.1]

21.3.3.2.2 Oxygen and other medical gases shall be stored and used in accordance with Section 9.4 of NFPA 99. [418:4.3.2]

21.3.3.2.3 Aboveground flammable liquid storage tanks, compressed gas storage tanks, fuel storage tanks, and liquefied gas storage tanks shall be laterally located at least 50 ft (15.2 m) from the edge of the final approach and takeoff (FATO) area as defined in FAA AC 150/5390-2B2C, Heliport Design Advisory Circular. [418:4.3.3]

21.3.3.3 Fire-Fighting Access.

21.3.3.3.1 The heliport shall have at least two access points for fire-fighting/rescue personnel. The access points shall be located at least 90 degrees from each other as measured from the center of the landing pad (TLOF). [418:4.4.1]

21.3.3.3.2 Fences shall not prevent access by fire-fighting/rescue personnel. [418:4.4.2]

21.3.3.4 Fuel Spill Control.
The landing pad shall be designed so that fuel spills are directed away from access/egress points and passenger holding areas. [418:4.5]

21.3.3.5 No Smoking.

21.3.3.5.1 No smoking shall be permitted within 50 ft (15.2 m) of the landing pad edge. [418:4.6.1]
21.3.3.5.2
NO SMOKING signs shall be erected at access/egress points to the heliport. [418:4.6.2]

21.3.3.6  Fueling System.
Fueling systems shall be designed in accordance with Section 42.10. [418:4.7]

21.3.3.6.1
Fueling equipment shall not hinder or obstruct access to exits or fire-fighting equipment. [418:4.7.1]

21.3.3.6.2
Fueling equipment shall be located a minimum of 25 ft (7.6 m) from hangars and fixed fire protection equipment. [418:4.7.2]

21.3.3.6.3
Fuel servicing equipment shall be designed to not penetrate the FATO and safety area obstruction clearance requirements in FAA AC 150/5390-2B2C, Heliport Design Advisory Circular. [418:4.7.3]

21.3.3.7*  Means of Egress.
At least two means of egress that lead to a public way shall be provided from the landing pad. [418:4.8]

21.3.3.7.1*
The egress points shall be located at least 90 degrees from each other as measured from the center of the landing pad (TLOF). [418:4.8.1]

21.3.3.7.2
The egress points shall be located remotely from each other, not less than 30 ft (9.1 m) apart. [418:4.8.2]

21.3.3.7.3
No two egress points shall be located on the same side of the landing pad. [418:4.8.3]

21.3.4  Rooftop Landing Facilities.
21.3.4.1* Structural Support.
Main structural support members that could be exposed to a fuel spill shall be made fire resistant using listed materials and methods to provide a fire-resistance rating of not less than 2 hours. [418:5.2]

21.3.4.2  Landing Pad Pitch.
The rooftop landing pad shall be pitched to provide drainage at a slope of 0.5 percent to 2 percent. [418:5.3]
21.3.4.2.1
The pitch of the pad shall be designed to protect, at a minimum, the primary egress path, passenger holding area, rooftop hangar, and fire protection activation systems. [418:5.3.1]

21.3.4.2.2
Drainage flow shall not penetrate alternate egress points, stairways, ramps, hatches, and other openings not designed for drainage. [418:5.3.2]

21.3.4.2.3
The pitch of the pad shall not be required where the pad consists of a passive fire protection grid surface designed and listed for fuel catchment and containment. [418:5.3.3]

21.3.4.3  Landing Pad Construction Materials.
21.3.4.3.1
The rooftop landing pad surface shall be constructed of approved noncombustible, nonporous materials. [418:5.4.1]

21.3.4.3.2
The contiguous building roof covering within 50 ft (15.2 m) of the landing pad edge shall have a Class A fire resistance rating for exterior fire exposure, and shall be tested according to FM 4470, Approval for Class 1 Roof Covers; ANSI/UL 790, Standard Test Methods for Fire Tests of Roof Covering; or ASTM E108, Standard Test Methods for Fire Tests of Roof Coverings. [418:5.4.2]

21.3.4.4*  Means of Egress.
Two means of egress from the rooftop landing pad to the building's egress system shall be provided. [418:5.5]

21.3.4.4.1*
The egress points shall be located at least 90 degrees from each other as measured from the center of the landing pad (TLOF). [418:5.5.1]

21.3.4.4.2
The egress points shall be remotely located from each other, not less than 30 ft (9.1 m) apart. [418:5.5.2]

21.3.4.4.3
No two egress points shall be located on the same side of the rooftop landing pad. [418:5.5.3]

21.3.4.4.4*
Means of egress from the landing pad shall not obstruct flight operations. [418:5.5.4]

21.3.4.5  Fire-Fighting Access. (Reserved)

21.3.4.6 Fire Protection. [418:5.7]
21.3.4.6.1 **General.** A foam fire-extinguishing system with either a fixed discharge outlet(s) in accordance with 21.3.4.6.3.1 or a hose line(s) in accordance with 21.3.4.6.4.1 shall be designed and installed to protect the rooftop landing pad, unless otherwise permitted by the following:

1. A foam fire-extinguishing system shall not be required for heliports located on open parking structures or buildings that are not normally occupied.
2. For H-1 heliports, two portable foam extinguishers, each having a rating of 20-A:160-B, shall be permitted to be used to satisfy the requirement of 21.3.4.6.

21.3.4.6.1.1 Where trained personnel are not available, fixed fire protection outlet(s) shall be provided.

21.3.4.6.2* The foam discharge rate for the fire-extinguishing system shall be 0.10 gpm/ft² (4.1 L/min·m²) for aqueous film forming foam (AFFF).

21.3.4.6.1.3 Where freezing is possible, freeze protection shall be provided.

21.3.4.6.1.4 The foam components shall be installed in an area of the heliport and shall not penetrate the approach takeoff surface, transitional surfaces, and safety area as defined in FAA AC 150/5390-2C, *Heliport Design Advisory Circular.*

21.3.4.6.3 *Fixed Foam Fire-Extinguishing Systems.*

21.3.4.6.3.1 Fixed foam fire-extinguishing systems shall be designed and installed in accordance with NFPA 11, NFPA 16, or an equivalent standard, as appropriate, except as modified by Chapter 5 of NFPA 418.

21.3.4.6.3.2 The area of application of foam discharge for fixed discharge outlet systems shall be the entire rooftop landing pad.

21.3.4.6.3.2.1 The duration of foam discharge for the fixed discharge outlet system shall be 5-10 minutes.
The supply calculation method shall be performed in accordance with Chapter 6 of NFPA 408. [418: 5.7.3.2.1]

21.3.4.6.2.4
A fixed nozzle discharge outlet system shall be one of the following: fixed stationary nozzles around the perimeter, two or more oscillating monitors/nozzles, or in-deck nozzles within the perimeter of the deck. [418: 5.7.2.4]

21.3.4.6.2.5
Where fixed foam systems utilizing fixed deck nozzles or oscillating foam turrets, or both, are installed, system components shall be listed or approved.[418: 5.7.2.5]

21.3.4.6.2.6 Activation of Systems.
21.3.4.6.2.6.1 *
The fixed discharge outlet system shall be activated manually.[418: 5.7.2.6.1]

21.3.4.6.2.6.2 *
Manual actuation stations shall be located at each egress point from the rooftop landing pad and at an approved location inside the building from which the rooftop landing pad can be viewed.[418: 5.7.2.6.2]

21.3.4.6.2.6.3
Manual foam activation stations shall be clearly labeled or identified as to the purpose and hazard protected.[418: 5.7.2.6.3]

21.3.4.6.2.4
Where buildings are provided with a fire alarm system, the activation of the foam system shall be monitored by the building fire alarm system in accordance with NFPA 72.[418: 5.7.2.6.4]

21.3.4.6.2.5
An approved manual control for foam system shutdown shall be accessible at all times, including the time of fire and system operation.[418: 5.7.2.6.5]

21.3.4.6.4 Manual Fire-Fighting Equipment.
21.3.4.6.4.1* The area of application of foam discharge for hose line systems shall be the practical critical fire area for the category of the helicopter landing facility in accordance with Table 21.3.4.6.4.1. [418: 5.7.43.1]

Table 21.3.4.6.4.1 Practical Critical Fire Areas for Hose Line Systems Only

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<th>Helicopter Overall Length*</th>
<th>Practical Critical Fire Area</th>
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<td>ft²</td>
<td>m²</td>
</tr>
<tr>
<td>H-1</td>
<td>Less than 50 ft (15.2 m)</td>
<td>375</td>
</tr>
<tr>
<td>H-2</td>
<td>50 ft (15.2 m) up to but not including 80 ft (24.4 m)</td>
<td>840</td>
</tr>
<tr>
<td>Heliport Category</td>
<td>Helicopter Overall Length*</td>
<td>Practical Critical Fire Area</td>
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<tr>
<td>------------------</td>
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<td>----------------------------</td>
</tr>
<tr>
<td>H-3</td>
<td>80 ft (24.4 m) up to but not including 120 ft (36.6 m)</td>
<td>1440 ft² 133.8 m²</td>
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*Helicopter length, including the tail boom and the rotors.

[418: Table 5.7.43.1]

21.3.4.6.6.2
The duration of foam discharge for the hose line systems shall be 2 minutes. [418:5.7.43.2]

21.3.4.6.4.3 -
The supply calculation method shall be performed in accordance with Chapter 6 of NFPA 409. [418:5.7.4.3]

21.3.4.6.4 Supplementary Protection
Standpipes and hose stations, if used, shall be installed in accordance with Section 13.4. [418:5.7.4.4]

A fixed nozzle discharge outlet system shall be one of the following: fixed stationary nozzles around the perimeter, two or more oscillating monitors/nozzles, or in-deck nozzles within the perimeter of the deck. [418:5.7.4.4.1]

21.3.4.6.5 Water Supply

The water supply for the foam system shall be from a source approved by the AHJ. [418:5.7.5.1]

21.3.4.6.5.1 Fire pumps, if used, shall be installed in accordance with Section 13.4. [418:5.7.5.42]

21.3.4.6.5.2 -
Standpipes and hose stations, if used, shall be installed in accordance with Section 13.2. [418:5.7.5.24]

21.3.4.6.5.3 Where freezing is possible, freeze protection shall be provided. [418:5.7.51.2]
The foam components shall be installed in an area of the heliport and shall not penetrate the approach takeoff surface, transitional surfaces, and safety area as defined in FAA AC 150/5390-2B2C, Heliport Design Advisory Circular. [418:5.7.61.1]

21.3.4.6.7
At facilities where there is more than one rooftop landing pad, the supply of foam available shall be sufficient to cover an incident on at least one of the pads. [418:5.7.7]

21.3.4.6.8
Where fixed foam systems utilizing fixed deck nozzles or oscillating foam turrets, or both, are installed, system components shall be listed or approved. [418:5.7.8]

21.3.4.6.6 Foam Concentrate Supply. [418:5.7.6]

21.3.4.6.6.1 The supply of foam concentrate shall be sufficient to supply the largest system. [418:5.7.6.1]

21.3.4.6.9 Fire Alarm.
A means of communication shall be provided from the roof area to notify the fire department of emergencies. [418:5.9.7.7.1]

21.3.4.6.10 Where buildings are provided with a fire alarm system, a manual pull station shall be provided for each designated means of egress from the roof. (See 21.3.4.4.) [418:5.9.7.7.2]
21.3.4.8 Acceptance Testing.

21.3.4.8.1 Fixed Foam Fire-Extinguishing Systems.

The fixed foam discharge outlet system shall be tested with foam to determine the coverage of the rooftop landing pad. [418: 5.7.8.1]

21.3.4.6.8.1.1
The system shall cover 95 percent of the rooftop landing pad during the test. [418: 5.7.8.1.1]

21.3.4.6.8.1.2
The access points for firefighting and for egress shall be covered. [418: 5.7.8.1.2]

21.3.4.8.2 Manual Fire-Fighting Equipment.

The hose hand-lines shall be flow tested to demonstrate that the design objectives are met. [418: 5.7.8.2]

21.3.4.6.9 Inspection, Testing, and Maintenance.

21.3.4.6.9.1
Fire protection systems installed in accordance with NFPA 14 or NFPA 16 shall be inspected, tested, and maintained in accordance with NFPA 25. [418: 5.7.9.1]

21.3.4.6.9.2
Foam systems installed in accordance with NFPA 11 shall be maintained in accordance with NFPA 11. [418: 5.7.9.2]

21.3.5 Portable Fire Extinguishers.

21.3.5.1 Minimum Requirement.
At least one portable fire extinguisher as specified in Table 21.3.5.1 shall be provided for each takeoff and landing area, parking area, and fuel storage area. [418: 9.2]

Table 21.3.5.1 Minimum Ratings of Portable Fire Extinguishers for Heliport Categories

21.3.5.2 Extinguishers Subject to Damage, Theft, or Tampering.
Where the portable extinguisher cannot be maintained and safeguarded against damage, theft, or tampering, the portable fire extinguisher shall be omitted with the approval of the AHJ. [418: 9.3]

A.21.3.3.1
FAA AC 150/5390-2B2C, *Heliport Design Advisory Circular*, contains design and construction information on heliports. This advisory circular provides for adequate clearance between operating aircraft and buildings or structures located at the heliport. The FAA advisory circular should be consulted to ensure that adequate safe practice and facilities are maintained. [418:A.4.2]
A.21.3.3.7
The two means of egress can also be used for access to the landing pad for fire-fighting and/or rescue operations. Where doors accessing the interior of the building are locked, an approved means should be provided for entry of emergency responders. [418:A.4.8]

A.21.3.3.7.1
Figure A.21.3.3.7.1(a) and Figure A.21.3.3.7.1(b) are examples of acceptable configurations of egress points on landing pads. The geometry of the landing pad in Figure A.21.3.3.7.1(b) is such that it has no sides and does not comply with 21.3.3.7.3; however, it does comply with the 90-degree rule in 21.3.3.7.1. Figure A.21.3.3.7.1(c) is an example of an unacceptable configuration, due to both egress points being on the same side of the landing pad. [418:A.4.8.1]

A.21.3.4.1
Where the landing pad is nonporous, fuel-tight, and provided with a proper drainage system, and where fuel cannot flow to support members, the main structural support members would not need to be fire rated. [418:A.5.2]

A.21.3.4.4
Design of the means of egress from a rooftop landing pad might involve a compromise among several different code requirements. Rooftop landing pads bring with them an inherent risk. The means of egress must be provided for safety to human life. Strict compliance with a code’s requirement for rated stairways off the landing pad is not the intent of this standard. The intent of this standard is to provide a minimum safeguard to provide a reasonable degree of safety to all persons on the roof. The building’s egress system is dictated by the adopted building code. Once those persons enter the building’s egress system, they are away from the FATO area. [418:A.5.5]

A.21.3.4.4.1
See Figure A.21.3.3.7.1(a) through Figure A.21.3.3.7.1(c) for examples of acceptable configurations of egress points on landing pads. The geometry of the landing pad in Figure A.21.3.3.7.1(b) is such that it has no sides and cannot comply with 21.3.4.4.3; however, it does comply with the 90-degree rule in 21.3.4.4.1. Figure A.21.3.3.7.1(c) is not an acceptable configuration due to both egress points being on the same side of the landing pad. [418:A.5.5.1]

A.21.3.4.4.4
When considering the means of egress from the landing pad and for the rooftop, obstructions to the FATO need to be avoided since they can create unsafe flight conditions that have been shown to cause aircraft accidents. Exterior, open stairways leading to the building’s egress system should not encroach into the FATO. [418:A.5.5.4]

A.21.3.4.6.1.2
Currently, the qualified products listed for MIL-F-24385 do not contain any fluoroprotein or protein foam products. [418:A.5.7.1.2]
Consideration should be given to the environmental conditions of the rooftop landing pad in the design of the system, including wind, exhaust fans, and other factors that affect the distribution of the foam on the rooftop landing pad. [418:A.5.7.2.12.2]

A.21.3.4.6.2.6.1
Training on the operation of the fire protection system should be in accordance with Annex B of NFPA 418. [418:A.5.7.2.6.1]

A.21.3.4.6.2.6.2
It is acceptable for the rooftop landing pad to be viewed using video or other acceptable means. [418:A.5.7.2.6.2]

A.21.3.4.6.4.1
The area of application and the duration where using a hose line system is reduced because foam is applied efficiently and directly on the fire by trained personnel. [418:A.5.7.4.1]

A.21.3.4.7.2.6.1
Training on the operation of the fire protection system should be in accordance with Annex B of NFPA 418. [418:A.5.8.17.2.6.1]

A.21.3.4.7.2.6.2
It is acceptable for the rooftop landing pad to be viewed using video or other acceptable means. [418:A.5.8.27.2.6.2]
Second Revision No. 39-NFPA 1-2016 [ Global Comment ]


**Supplemental Information**

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**Submitter Information Verification**

- **Submitter Full Name:** Kristin Bigda
- **Organization:** National Fire Protection Assoc
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- **City:**
- **State:**
- **Zip:**
- **Submittal Date:** Wed Oct 12 11:20:08 EDT 2016

**Committee Statement**

- **Committee Statement:** Extract update.
- **Response Message:**

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National Fire Protection Association Report http://submittals.nfpa.org/TerraViewWeb/ContentFetcher?commentPara...
NFPA 25:

13.3.3.4 General Requirements.
13.3.3.4.1 Responsibility of the Property Owner or Designated Representative.

13.3.3.4.1.1* Responsibility for Inspection, Testing, Maintenance, and Impairment.
The property owner or designated representative shall be responsible for properly maintaining a water-based fire protection system. [25:4.1.1]

(A)* Inspection, testing, maintenance, and impairment procedures shall be implemented in accordance with those established in this document and in accordance with the manufacturer’s instructions. [25:4.1.1.1]

(B) Inspection, testing, and maintenance shall be performed by qualified personnel. [25:4.1.1.2]

(1)* The owner shall coordinate with the entity conducting the inspection, testing, and maintenance activities to minimize any water damage caused by the discharge of water. [25:4.1.1.2.1]

(C)* Where the property owner or designated representative is not the occupant, the property owner or designated representative shall be permitted to delegate the authority for inspecting, testing, maintenance, and the managing of impairments of the fire protection system to a designated representative. [25:4.1.1.3]

(D) Where a designated representative has received the authority for inspecting, testing, maintenance, and the managing of impairments, the designated representative shall comply with the requirements identified for the property owner or designated representative throughout this Code. [25:4.1.1.4]

13.3.3.4.1.2* Freeze Protection.
The property owner or designated representative shall ensure that water-filled piping is maintained at a minimum temperature of 40°F (4.4°C) unless an approved anti-freeze solution is utilized. [25:4.1.2]

13.3.3.4.1.2.1 All areas of the building containing water-filled piping that does not have another means of freeze protection shall be maintained at a minimum temperature of 40°F (4.4°C). [25:4.1.2.1]

13.3.3.4.1.2.2 Aboveground water-filled pipes that pass through open areas, cold rooms, passageways, or other areas exposed to temperatures below 40°F (4.4°C), protected against freezing by insulating
coverings, frostproof casings, listed heat tracing systems, or other reliable means shall be maintained at temperatures between 40°F (4°C) and 120°F (48.9°C). [25:4.1.2.2]

13.3.3.4.1.2.3
Where other approved means of freeze protection for water-filled piping as described in 13.3.3.4.1.2.2 are utilized they shall be inspected, tested, and maintained in accordance with NFPA 25. [25:4.1.2.3]

13.3.3.4.1.3* Accessibility.
The property owner or designated representative shall provide ready accessibility to components of water-based fire protection systems that require inspection, testing, and maintenance. [25:4.1.3]

13.3.3.4.1.4 Notification of System Shutdown or Testing.
The property owner or designated representative shall notify the AHJ, the fire department, if required, and the alarm-receiving facility before testing or shutting down a system or its supply. [25:4.1.4]

13.3.3.4.1.4.1
The notification of system shutdown or test shall include the purpose for the shutdown, the system or component involved, the estimated time of shutdown or test, and the expected duration of the shutdown or test. [25:4.1.4.1]

13.3.3.4.1.4.2
The AHJ, the fire department, and the alarm-receiving facility shall be notified when the system, supply, or component is returned to service or when the test is complete. [25:4.1.4.2]

13.3.3.4.1.5* Corrections and Repairs.
13.3.3.4.1.5.1*
The property owner or designated representative shall correct or repair deficiencies or impairments that are found during the inspection, test, and maintenance required by this Code. [25:4.1.5.1]

13.3.3.4.1.5.2
Corrections and repairs shall be performed by qualified maintenance personnel or a qualified contractor. [25:4.1.5.2]

13.3.3.4.1.6* Changes in Occupancy, Use, Process, or Materials.
The property owner or designated representative shall not make changes in the occupancy, the use or process, or the materials used or stored in the building without evaluation of the fire protection systems for their capability to protect the new occupancy, use, or materials. [25:4.1.6]

13.3.3.4.1.6.1
The evaluation required by 13.3.3.4.1.6 shall not be considered part of the normal inspection, testing, and maintenance required by this Code. [25:4.1.6.1]
13.3.4.1.6.1
The evaluation required by 4.1.6 shall not be considered part of the normal inspection, testing, and maintenance required by this standard. [25:4.1.6.1]

13.3.4.1.6.2*
The evaluation shall consider factors that include, but are not limited to, the following:

1. Occupancy changes such as converting office or production space into warehousing
2. Process or material changes such as metal stamping to molded plastics
3. Building revisions such as relocated walls, added mezzanines, and ceilings added below sprinklers
4. Removal of heating systems in spaces with piping subject to freezing
5. Changes to the storage method, arrangement, height or commodities.
6. Changes in water supplies

13.3.4.1.7* Addressing Changes in Hazards.
13.3.4.1.7.1 Where changes in the occupancy, hazard, water supply, storage commodity, storage arrangement, building modification, or other condition that affects the installation criteria of the system are identified, the property owner or designated representative shall promptly take steps to evaluate the adequacy of the installed system in order to protect the building or hazard in question. [25:4.1.7.1]

13.3.4.1.7.2 Where the evaluation reveals that the installed system is inadequate to protect the building or hazard in question, the property owner or designated representative shall make the required corrections. [25:4.1.7.2]

13.3.4.1.7.3 Corrections shall be approved. [25:4.1.7.3]

13.3.4.1.8 Valve Location.
The location of shutoff valves shall be identified at the system riser or other approved locations. [25:4.1.8]

13.3.4.1.9 Information Sign.
13.3.4.1.9.1 A permanently marked metal or rigid plastic information sign shall be placed at the system control riser supplying an antifreeze loop, dry system, preaction system, or auxiliary system control valve. [25:4.1.9.1]

13.3.4.1.9.2
Each sign shall be secured with a corrosion-resistant wire, chain, or other approved means and shall indicate at least the following information:

1. Location of the design area or areas
2. Discharge densities over the design area or areas
3. Required flow and residual pressure demand at the base of riser
4. Occupancy classification or commodity classification and maximum permitted storage height and configuration
5. Hose stream allowance included in addition to the sprinkler demand
6. The name of the installing contractor or person providing the information

[25:4.1.9.2]

13.3.3.4.1.10 Antifreeze Information Sign
An antifreeze information sign shall be placed on the antifreeze system main valve, which indicates the manufacture type and brand of the antifreeze solution, the concentration by volume of the antifreeze solution used, and the volume of the antifreeze solution used in the system.

[25:4.1.10]

13.3.3.4.1.10.1 Impairments.
Where an impairment to a water-based fire protection system occurs or is identified during inspection, testing, or maintenance activities, the procedures outlined in Chapter 15 of NFPA 25 shall be followed, including the attachment of a tag to the impaired system.

[25:4.1.10.11.1]

13.3.3.4.1.10.2 Where a water-based fire protection system is returned to service following an impairment, the system shall be verified to be working properly by means of an appropriate inspection or test as described in the table, “Summary of Component Replacement [Action] Requirements” in the applicable chapters of NFPA 25.

[25:4.1.10.11.2]

13.3.3.4.2 Manufacturer’s Corrective Action.
Manufacturers shall be permitted to make modifications to their own listed product in the field with listed devices that restore the original performance as intended by the listing, where acceptable to the AHJ.

[25:4.2]

13.3.3.4.3 Records.
13.3.3.4.3.1* Records shall be made for all inspections, tests, and maintenance of the system and its components and shall be made available to the AHJ upon request.

[25:4.3.1]

13.3.3.4.3.1.1* Records shall be permitted to be stored and accessed electronically.

[25:4.3.1.1]

13.3.3.4.3.2
Records shall indicate the following:

1. The procedure/activity performed (e.g., inspection, test, or maintenance)
2. The organization that performed the activity
3. The required frequency of the activity
4. The results and date of the activity
5. The name and contact information of the qualified contractor or owner, including lead person for activity [25:4.3.2]

13.3.3.4.3.*
Records shall be maintained by the property owner. [25:4.3.3]

13.3.3.4.4 As-built system installation drawings, hydraulic calculations, original acceptance test records, and device manufacturer’s data sheets shall be retained for the life of the system. [25:4.3.4]

13.3.3.4.5 Subsequent records shall be retained for a period of 1 year after the next inspection, test, or maintenance of that type required by the Code. [25:4.3.5]

13.3.3.5 Sprinkler Systems.
13.3.3.5.1 Maintenance — Sprinklers.
13.3.3.5.1.1 Where a sprinkler has been removed for any reason, it shall not be reinstalled. [25:5.4.1.1]*

13.3.3.5.1.2.* Replacement sprinklers shall have the proper characteristics for the application intended, which include the following:

1. Style
2. Orifice size and K-factor
3. Temperature rating
4. Coating, if any
5. Deflector type (e.g., upright, pendent, sidewall)
6. Design requirements [25:5.4.1.2]*

13.3.3.5.1.2.1.* Spray sprinklers shall be permitted to replace old-style sprinklers. [25:5.4.1.2.1]

13.3.3.5.1.2.2.* Where replacing residential sprinklers manufactured prior to 2003 that are no longer available from the manufacturer and are installed using a design density less than 0.05 gpm/ft² (204 mm/min), a residential sprinkler with an equivalent K-factor (± 5 percent) shall be permitted to be used provided the currently listed coverage area for the replacement sprinkler is not exceeded. [25:5.4.1.2.2]
13.3.3.5.1.2 Replacement sprinklers for piers and wharves shall comply with NFPA 307, *Standard for the Construction and Fire Protection of Marine Terminals, Piers, and Wharves.* [25:5.4.1.2.23]

13.3.3.5.1.3 Only new, listed sprinklers shall be used to replace existing sprinklers. [25:5.4.1.3]

13.3.3.5.1.4 Special and quick-response sprinklers as defined by NFPA 13, *Standard for the Installation of Sprinkler Systems,* shall be replaced with sprinklers of the same orifice, size, temperature range and thermal response characteristics, and K-factor. [25:5.4.1.4]

13.3.3.5.1.5 Stock of Spare Sprinklers.
A supply of at least six spare sprinklers shall be maintained on the premises so that any sprinklers that have operated or been damaged in any way can be promptly replaced. [25:5.4.1.5]

13.3.3.5.1.5.1 The sprinklers shall correspond to the types and temperature ratings of the sprinklers in the property. [25:5.4.1.5.1]

13.3.3.5.1.5.2 The sprinklers shall be kept in a cabinet located where the temperature in which they are subjected will at no time exceed 100°F (38°C). [25:5.4.1.5.2]

13.3.3.5.1.5.3 Where dry sprinklers of different lengths are installed, spare dry sprinklers shall not be required, provided that a means of returning the system to service is furnished. [25:5.4.1.5.3]

13.3.3.5.1.5.4 The stock of spare sprinklers shall include all types and ratings installed and shall be as follows:

1. For protected facilities having under 300 sprinklers — no fewer than 6 sprinklers
2. For protected facilities having 300 to 1000 sprinklers — no fewer than 12 sprinklers
3. For protected facilities having over 1000 sprinklers — no fewer than 24 sprinklers

13.3.3.5.1.5.5 One sprinkler wrench as specified by the sprinkler manufacturer shall be provided in the cabinet for each type of sprinkler installed to be used for the removal and installation of sprinklers in the system. [25:5.4.1.5.5]

13.3.3.5.1.5.6 A list of the sprinklers installed in the property shall be posted in the sprinkler cabinet. [25:5.4.1.5.6]
13.3.3.5.1.5.6.1*
The list shall include the following:

1. Sprinkler Identification Number (SIN) if equipped; or the manufacturer, model, orifice, deflector type, thermal sensitivity, and pressure rating
2. General description
3. Quantity of each type to be contained in the cabinet
4. Issue or revision date of the list

[25:5.4.1.5.6.1]

13.3.3.5.1.6*
Sprinklers shall not be altered in any respect or have any type of ornamentation, paint, or coatings applied after shipment from the place of manufacture. [25:5.4.1.6]

13.3.3.5.1.7
Sprinklers and automatic spray nozzles used for protecting commercial-type cooking equipment and ventilating systems shall be replaced annually. [25:5.4.1.7]

13.3.3.5.1.7.1
Where automatic bulb-type sprinklers or spray nozzles are used and annual examination shows no buildup of grease or other material on the sprinklers or spray nozzles, such sprinklers and spray nozzles shall not be required to be replaced. [25:5.4.1.7.1]

13.3.3.5.1.8  Protective Coverings.
13.3.3.5.1.8.1*
Sprinklers protecting spray areas and mixing rooms in resin application areas installed with protective coverings shall continue to be protected against overspray residue so that they will operate in the event of fire. [25:5.4.1.8.1]

13.3.3.5.1.8.2
Sprinklers installed as described in 13.3.3.5.1.8.1 shall be protected using cellophane bags having a thickness of 0.003 in. (0.076 mm) or less or thin paper bags. [25:5.4.1.8.2]

13.3.3.5.1.8.3
Coverings shall be replaced periodically so that heavy deposits of residue do not accumulate. [25:5.4.1.8.3]

13.3.3.5.2* Dry Pipe Systems.
Dry pipe systems shall be kept dry at all times. [25:5.4.2]

13.3.3.5.2.1
During nonfreezing weather, a dry pipe system shall be permitted to be left wet if the only other option is to remove the system from service while waiting for parts or during repair activities. [25:5.4.2.1]

13.3.3.5.2.2
Refrigerated spaces or other areas within the building interior where temperatures are maintained at or below 40°F (4.4°C) shall not be permitted to be left wet. [25:5.4.2.2]

13.3.3.5.2.3
Air driers shall be maintained in accordance with the manufacturer's instructions. [25:5.4.2.3]

13.3.3.5.2.4
Compressors used in conjunction with dry-pipe sprinkler systems shall be maintained in accordance with the manufacturer's instructions. [25:5.4.2.4]

13.3.3.6 Impairments.

13.3.3.6.1 General.
13.3.3.6.1.1 Minimum Requirements.
13.3.3.6.1.1.1 Subsection 13.3.3.6 shall provide the minimum requirements for a water-based fire protection system impairment program. [25:15.1.1.1]

13.3.3.6.1.1.2 Measures shall be taken during the impairment to ensure that increased risks are minimized and the duration of the impairment is limited. [25:15.1.1.2]

13.3.3.6.2 Impairment Coordinator.
13.3.3.6.2.1 The property owner or designated representative shall assign an impairment coordinator to comply with the requirements of 13.3.3.6. [25:15.2.1]

13.3.3.6.2.2 In the absence of a specific designee, the property owner or designated representative shall be considered the impairment coordinator. [25:15.2.2]

13.3.3.6.2.3 Where the lease, written use agreement, or management contract specifically grants the authority for inspection, testing, and maintenance of the fire protection system(s) to the tenant, management firm, or managing individual, the tenant, management firm, or managing individual shall assign a person as impairment coordinator. [25:15.2.3]

13.3.3.6.3 Tag Impairment System.
13.3.3.6.3.1 A tag shall be used to indicate that a system, or part thereof, has been removed from service. [25:15.3.1]

13.3.3.6.3.2 The tag shall be posted at each fire department connection and the system control valve, and other locations required by the AHJ indicating which system, or part thereof, has been removed from service. [25:15.3.2]
13.3.3.6.4 Impaired Equipment.

13.3.3.6.4.1
The impaired equipment shall be considered to be the water-based fire protection system, or part thereof, that is removed from service. [25:15.4.1]

13.3.3.6.4.2
The impaired equipment shall include, but shall not be limited to, the following:

1. Sprinkler systems
2. Standpipe systems
3. Fire hose systems
4. Underground fire service mains
5. Fire pumps
6. Water storage tanks
7. Water spray fixed systems
8. Foam-water sprinkler systems
9. Water mist systems
10. Fire service control valves
11. Water supply

[25:15.4.2]

13.3.3.6.5 Preplanned Impairment Programs.

13.3.3.6.5.1
All preplanned impairments shall be authorized by the impairment coordinator. [25:15.5.1]

13.3.3.6.5.2
Before authorization is given, the impairment coordinator shall be responsible for verifying that the following procedures have been implemented:

1. The extent and expected duration of the impairment have been determined.
2. The areas or buildings involved have been inspected and the increased risks determined.
3. Recommendations to mitigate any increased risks have been submitted to management or the property owner or designated representative.
4. Where a fire protection system is out of service for more than 10 hours in a 24-hour period, the impairment coordinator shall arrange for one of the following:
   1. Evacuation of the building or portion of the building affected by the system out of service
   2. *An approved fire watch
   3. *Establishment of a temporary water supply
   4. * Establishment and implementation of an approved program to eliminate potential ignition sources and limit the amount of fuel available to the fire
5. The fire department has been notified.
6. The insurance carrier, the alarm company, property owner or designated representative, and other AHJs have been notified.

* Formatted: Indent: Left: 0.25", No bullets or numbering, Tab stops: Not at 0.5"
7. The supervisors in the areas to be affected have been notified.
8. A tag impairment system has been implemented. (See 13.3.3.6.3.)
9. All necessary tools and materials have been assembled on the impairment site.
   [25:15.5.2]

13.3.3.6.6* Emergency Impairments.
13.3.3.6.6.1 Emergency impairments shall include, but are not limited to, interruption of water supply, frozen or ruptured piping, and equipment failure, and includes impairments found during inspection, testing, or maintenance activities.
   [25:15.6.1]

13.3.3.6.6.2* The coordinator shall implement the steps outlined in 13.3.3.6.5. [25:15.6.2]

13.3.3.6.7* Restoring Systems to Service.
When all impaired equipment is restored to normal working order, the impairment coordinator shall verify that the following procedures have been implemented:

1. Any necessary inspections and tests have been conducted to verify that affected systems are operational. The appropriate chapter of NFPA 25 shall be consulted for guidance on the type of inspection and test required.
2. Supervisors have been advised that protection is restored.
3. The fire department has been advised that protection is restored.
4. The property owner or designated representative, insurance carrier, alarm company, and other AHJs have been advised that protection is restored.
5. The impairment tag has been removed. [25:15.7]

A.3.3.122 Fire Hydrant.
See Figure A.3.3.122(a) and Figure A.3.3.122(b). [25:A.3.3.12]

A.13.3.3.4.1.1 Any portion or all of the inspection, testing, and maintenance can be permitted to be contracted with an inspection, testing, and maintenance service. When an inspection, testing, and maintenance service company agrees to perform inspections and tests at a specific frequency required by this standard, the inspection, testing, and maintenance service company should perform all inspections and tests that are required more frequently than the specified frequency. For example, the ITM service provider agrees to perform required inspections and tests on an annual basis. Those inspections and tests required on a daily, weekly, quarterly, and semi-annual frequency should also be performed during the annual inspections and tests. [25:A.4.1.1]

A.13.3.3.4.1.1(A) In order to ensure compliance, the owner should verify that windows, skylights, doors, ventilators, other openings and closures, concealed spaces, unused attics, stair towers, roof
houses, and low spaces under buildings do not expose water-filled piping to freezing. This should occur prior to the onset of cold weather and periodically thereafter. [25:A.4.1.1.1]

A.13.3.4.1.1(B)(1)
Water-based systems rely on the adequacy and ongoing maintenance of drainage systems such as roof drains, storm drains, and floor drains, during flowing water as part of testing systems. These systems are often used for other purposes than fire system testing and are not part of the fire protection system. They are often designed and maintained as part of building plumbing systems. [25:A.4.1.1.2.1]

A.13.3.4.1.1(C)
Examples of designated representatives can include the occupant, management firm, or managing individual through specific provisions in the lease, written use agreement, or management contract. [25:A.4.1.1.3]

A.13.3.4.1.2
Other means of freeze protection for water-filled piping include heated valve enclosures, heat tracing, insulation, antifreeze solutions, In areas that have the potential for freezing temperatures below the level that can be adequately protected by an allowable antifreeze solution, supplemental heat can be provided when temperatures fall below the level of the antifreeze solution. Other means of freeze protection for water-filled piping, including heated valve enclosures, heat tracing, insulation, or other methods are allowed by the applicable installation standard. Installation standards require heat tracing protecting fire protection piping against freezing to be supervised. [25:A.4.1.2]

A.13.3.4.1.3
The components are not required to be open or exposed. Doors, removable panels, or valve pits can be permitted to satisfy the need for accessibility. Such equipment should not be obstructed by features such as walls, ducts, columns, direct burial, or stock storage. [25:A.4.1.3]

A.13.3.4.1.5
Recalled products should be replaced or remedied. Remedies include entrance into a program for scheduled replacement. Such replacement or remedial product should be installed in accordance with the manufacturer's instructions and the appropriate NFPA installation standards. A recalled product is a product subject to a statute or administrative regulation specifically requiring the manufacturer, importer, distributor, wholesaler, or retailer of a product, or any combination of such entities, to recall the product, or a product voluntarily recalled by a combination of such entities. [25:A.4.1.5]

Needed corrections and repairs should be classified as an impairment, critical deficiency, or noncritical deficiency according to the effect on the fire protection system and the nature of the hazard protected. [25:A.4.1.5]

Impairments are the highest priority problem found during inspection, testing, and maintenance and should be corrected as soon as possible. The fire protection system cannot provide an adequate response to a fire, and implementation of impairment procedures outlined in 13.3.3.6 is required until the impairment is corrected. [25:A.4.1.5]
Critical deficiencies need to be corrected in a timely fashion. The fire protection system is still capable of performing, but its performance can be impacted and the implementation of impairment procedures might not be needed. However, special consideration must be given to the hazard in the determination of the classification. A deficiency that is critical for one hazard might be an impairment in another. [25:A.4.1.5]

Noncritical deficiencies do not affect the performance of the fire protection system but should be corrected in a reasonable time period so that the system can be properly inspected, tested, and maintained. [25:A.4.1.5]

Assembly occupancies, health care facilities, prisons, high-rise buildings, other occupancies where the life safety exposure is significant, or facilities that cannot be evacuated in a timely manner require special consideration. As an example, a nonfunctioning waterflow alarm might be considered a critical deficiency in a storage warehouse but an impairment in a hospital. [25:A.4.1.5]

High hazard occupancies where early response to a fire is critical also require special consideration. A small number of painted sprinklers could be considered an impairment for a system protecting a high hazard occupancy but might be considered a critical deficiency in a metal working shop. [25:A.4.1.5]

Classifications of needed corrections and repairs are shown in Table A.3.3.7 of NFPA 25. [25:A.4.1.5]

A.13.3.4.1.5.1
System deficiencies not explained by normal wear and tear, such as hydraulic shock, can often be indicators of system problems and should be investigated and evaluated by a qualified person or engineer. Failure to address these issues could lead to catastrophic failure. Examples of deficiencies that can be caused by issues beyond normal wear and tear are as follows:

1. Pressure gauge deficiencies as follows:
   1. Gauge not returning to zero
   2. Gauge off scale
   3. Gauge with bent needle
2. Support devices deficiencies as follows:
   1. Bent hangers and/or rods
   2. Hangers pulled out/off structure
   3. Indication of pipe or hanger movement such as the following:
      1. Hanger scrape marks on pipe, exposed pipe surface where pipe and hangers are painted
      2. Firestop material damaged at pipe penetration of fire-rated assembly
3. Unexplained system damage as follows:
   1. Unexplained system damage beyond normal wear and tear
   2. Bent or broken shafts on valves
   3. Bent or broken valve clappers
   4. Unexplained leakage at branch lines, cross main, or feed main piping
   5. Unexplained leakage at closed nipples
   6. Loose bolts on flanges and couplings
4. Fire pump deficiencies as follows:
   ...
1. Fire pump driver out of alignment
2. Vibration of fire pump and/or driver
3. Unusual sprinkler system piping noises (sharp report, loud bang)

[25:A.4.1.5.1]

A.13.3.4.1.6
The inspections and tests specified in this Code do not address the adequacy of design criteria or the capability of the fire protection system to protect the building or its contents. It is assumed that the original system design and installation were appropriate for the occupancy and use of the building and were approved by all applicable AHJs. If no changes to the water supply or to the building or its use have transpired since it was originally occupied, no evaluation is required. If changes are contemplated, it is the owner’s responsibility to arrange for the evaluation of the fire protection system(s). Where the inspections and tests specified in the Code have been contracted to a qualified inspection provider or contractor, it is not the role of the inspector or contractor to determine if any changes have been made or the subsequent evaluation of the fire protection system. The evaluation of any building changes should be conducted before any proposed change is incorporated and should utilize the appropriate installation standard and input from applicable AHJs. [25:A.4.1.6]

Fire protection systems should not be removed from service when the building is not in use; however, where a system that has been out of service for a prolonged period (such as in the case of idle or vacant properties) is returned to service, it is recommended that a responsible and experienced contractor be retained to perform all inspections and tests. [25:A.4.1.6]

A.13.3.4.1.6.2
Fire protection systems are designed and installed based on a specific set of circumstances and building uses. For example, the volume of water needed for a sprinkler system to control a fire in the built environment is based upon the intended use of the facility known at the time the sprinkler system was designed and installed. Revisions to properties used for storage represent one of the most common scenarios that impact the ability of systems to provide adequate protection. Some of the most common changes include raising the storage height, changing the storage method arrangement such as adding racks, installing solid shelves in rack structures or decreasing the aisle widths between racks. Changes in product packaging with the use of foam inserts, bubble wrap, or other plastics or encapsulated storage can significantly increase the fire hazard. Changing from wood pallets to plastic pallets, converting to the use of plastic bin boxes, or revising or adding material handling systems such as conveyors could severely impact the effectiveness of the fire protection systems. [25:A.4.1.6.2]

A.13.3.4.1.7
See Annex E of NFPA 25 for an example of a hazard evaluation form. A hazard evaluation is not part of a system inspection. [25:A.4.1.7]
A.13.3.3.4.3.1
Inspection reports used for system inspections should contain an “Owner’s Section” as shown in Figure A.13.3.3.4.3.1 that the property owner or designated representative should complete. Typical records include, but are not limited to, valve inspections; flow, drain, and pump tests; and trip tests of dry pipe, deluge, and preaction valves. [25:A.4.3.1]
Acceptance test records should be retained for the life of the system or its special components. Subsequent test records should be retained for a period of 1 year after the next test. The comparison determines deterioration of system performance or condition and the need for further testing or maintenance. [25:A.4.3.1.1](update Figure A.13.3.3.4.3.1)

A.13.3.3.4.3.1.1
Computer programs that file inspection and test results should provide a means of comparing current and past results and should indicate the need for corrective maintenance or further testing. [25:A.4.3.1.1]

A.13.3.3.4.3.3
See Section B.2 of NFPA 25 for information regarding sample forms. [25:A.4.3.3]

A.13.3.3.5.1.2
To help in the replacement of like sprinklers, unique sprinkler identification numbers (SINs) are provided on all sprinklers manufactured after January 1, 2001. The SIN accounts for differences in orifice size, deflector characteristics, pressure rating, and thermal sensitivity. [25:A.5.4.1.2]

A.13.3.3.5.1.2.2
It is recognized that the flow and pressure available to the replacement sprinkler might be less than its current flow and pressure requirement. [25:A.5.4.1.1.2]

A.13.3.3.5.1.2.1
Old-style sprinklers are permitted to replace existing old-style sprinklers. Old-style sprinklers should not be used to replace standard sprinklers without a complete engineering review of the system. The old-style sprinkler is the type manufactured before 1953. It discharges approximately 40 percent of the water upward to the ceiling, and it can be installed in either the upright or pendent position. [25:A.5.4.1.2.1]

A.13.3.3.5.1.4
It is imperative that any replacement sprinkler have the same characteristics as the sprinkler being replaced. If the same temperature range, response characteristics, spacing requirements, flow rates, and K-factors cannot be obtained, a sprinkler with similar characteristics should be used, and the system should be evaluated to verify the sprinkler is appropriate for the intended use. With regard to response characteristics, matching identical Response Time Index (RTI) and conductivity factors is not necessary unless special design considerations are given for those specific values. [25:A.5.4.1.4]

A.13.3.3.5.1.5
A minimum of two sprinklers of each type and temperature rating installed should be provided. [25:A.5.4.1.5]
A.13.3.5.1.5.5
One sprinkler wrench design can be appropriate for many types of sprinklers, and multiple wrenches of the same design should not be required. [25:A.5.4.1.5.5]

A.13.3.5.1.5.6.1
The minimum information in the list contained in the spare sprinkler cabinet should be marked with the following:

1. General description of the sprinkler, including upright, pendent, residential, ESFR, and so forth
2. Quantity of sprinklers that is to be maintained in the spare sprinkler cabinet.

An example of the list is shown in Figure A.13.3.5.1.5.6.1. Figure A.13.3.5.1.5.6.1 Sample List. [25:Figure A.5.4.1.5.6.1]

<table>
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<tr>
<th>Sprinkler Identification, SIN</th>
<th>General Description</th>
<th>Temperature Rating, °F</th>
<th>Sprinkler Quantity Maintained</th>
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<tr>
<td>TY9128</td>
<td>Extended Coverage K-25, upright</td>
<td>155</td>
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</tr>
<tr>
<td>VK425</td>
<td>Concealed pendant residential</td>
<td>145</td>
<td>6</td>
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</table>

Issued: 10/3/05 Revised:

[25:A.5.4.1.5.6.1]

A.13.3.5.1.6
Corrosion-resistant or specially coated sprinklers should be installed in locations where chemicals, moisture, or other corrosive vapors exist. [25:A.5.4.1.6]

A.13.3.5.1.8.1
Typical sandwich bags purchased in a grocery store are generally plastic, not cellophane. Plastic bags have a tendency to shrink and adhere to the sprinkler prior to sprinkler activation, creating the potential for disruption of sprinkler spray patterns. Bags placed over sprinklers need to be true cellophane or paper. [25:A.5.4.1.8.1]

A.13.3.5.2
Conversion of dry pipe systems to wet pipe systems on a seasonal basis causes corrosion and accumulation of foreign matter in the pipe system and loss of alarm service. [25:A.5.4.2]

A.13.3.6.3.1
A clearly visible tag alerts building occupants and the fire department that all or part of the water-based fire protection system is out of service. The tag should be weather resistant, plainly visible, and of sufficient size [typically 4 in. × 6 in. (100 mm × 150 mm)]. The tag should identify which system is impaired, the date and time impairment began, and the person responsible. Figure A.13.3.6.3.1 illustrates a typical impairment tag. [25:A.15.3.1]

A.13.3.6.3.2
An impairment tag should be placed on the fire department connection to alert responding fire fighters of an abnormal condition. An impairment tag that is located on the system riser only could go unnoticed for an extended period if fire fighters encounter difficulty in gaining access to the building or sprinkler control room. [25:A.15.3.2]

A.13.3.6.5
The need for temporary fire protection, termination of all hazardous operations, and frequency of inspections in the areas involved should be determined. All work possible should be done in advance to minimize the length of the impairment. Where possible, temporary feedlines should be used to maintain portions of systems while work is completed. [25:A.15.5] Water-based fire protection systems should not be removed from service when the building is not in use. Where a system that has been out of service for a prolonged period, such as in the case of idle or vacant properties, is returned to service, qualified personnel should be retained to inspect and test the systems. [25:A.15.5]

A.13.3.6.5.2(4)(b)
A fire watch should consist of trained personnel who continuously patrol the affected area. Ready access to fire extinguishers and the ability to promptly notify the fire department are important items to consider. During the patrol of the area, the person should not only be looking for fire, but making sure that the other fire protection features of the building such as egress routes and alarm systems are available and functioning properly. [25:A.15.5.2(4)(b)]

A.13.3.6.5.2(4)(c)
Temporary water supplies are possible from a number of sources, including use of a large-diameter hose from a fire hydrant to a fire department connection, use of a portable tank and a portable pump, or use of a standby fire department pumper and/or tanker. [25:A.15.5.2(4)(c)]

A.13.3.6.5.2(4)(d)
Depending on the use and occupancy of the building, it could be enough in some circumstances to stop certain processes in the building or to cut off the flow of fuel to some machines. It is also helpful to implement “No Smoking” and “No Hot Work” (cutting, grinding, or welding) policies while the system is out of service because these activities are responsible for many fire ignitions. [25:A.15.5.2(4)(d)]

A.13.3.6.6
Emergency impairments include, but are not limited to, system leakage, interruption of water supply, frozen or ruptured piping, equipment failure, or other impairments found during inspection, testing, or maintenance activities. [25:A.15.6]
A.13.3.6.6.2
When one or more impairments are discovered during inspection, testing, and maintenance activities the owner or owner’s authorized representative should be notified in writing. See Figure A.13.3.6.6.2 for an example of written notification. [25:A.15.6.2]

A.13.3.6.7
Occasionally, fire protection systems in idle or vacant buildings are shut off and drained. When the equipment is eventually restored to service after a long period of not being maintained, it is recommended that a qualified person perform the work. The following is an example of a procedure:

1. All piping should be traced from the extremities of the system to the main connections with a careful check for blank gaskets in flanges, closed valves, corroded or damaged sprinklers, nozzles or piping, insecure or missing hangers and insufficient support. Proper repairs or adjustments should be made and needed extensions or alterations for the equipment should be completed.
2. An air test at low pressure (40 psi) should be conducted prior to allowing water to fill the system. When the piping has been proven tight by passing the air test, water can be introduced slowly into the system with proper precautions against damage by escape of water from previously undiscovered defects. When the system has been filled under normal service pressure, drain valve tests should be made to detect any closed valve that possible could have been overlooked. All available pipes should be flushed and an obstruction investigation completed to make sure that the system is clear of debris.
3. Where the system was known to have been damaged by freezing or where other extensive damage may have occurred, a full hydrostatic test can be performed in accordance with NFPA 13 to determine whether the system integrity has been maintained.
4. Dry-pipe valves, quick opening devices, alarm valves and all alarm connections should be examined, put in proper condition and tested.
5. Fire pumps, pressure and gravity tanks, reservoirs and other water supply equipment should receive proper attention before being placed in service. Each supply should be tested separately; and then together if they are designed to work together.
6. All control valves should be operated from the closed to fully open position and should be left sealed, locked or equipped with a tamper switch.

[25:A.15.7]

### Supplemental Information

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<th>File Name</th>
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<tr>
<td>Extract_updates_NFPA_58_Annex.docx</td>
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</table>

### Submitter Information Verification

- **Submitter Full Name**: Kristin Bigda
- **Organization**: National Fire Protection Assoc
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- **City**: 
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- **Zip**: 
- **Submittal Date**: Wed Oct 12 11:22:22 EDT 2016

### Committee Statement

- **Committee Statement**: Extract update.
- **Response Message**: 
NFPA 58

3.3.15 ASME. American Society of Mechanical Engineers. [58, 2014]

3.3.69.1 ASME Container. A container constructed in accordance with the ASME Code. [58, 2014]

3.3.69.7 [LP-Gas] Container. Any vessel, including cylinders, tanks, portable tanks, and cargo tanks, used for the transporting or storing of LP-Gases. [58, 2014]

3.3.133 Gallon, U.S. Standard. 1 U.S. gal = 0.833 Imperial gal = 231 in.3 = 3.785 L. [58, 2014]

3.3.135.10* Liquefied Petroleum Gas (LP-Gas). Any material having a vapor pressure not exceeding that allowed for commercial propane that is composed predominantly of the following hydrocarbons, either by themselves (except propylene) or as mixtures: propane, propylene, butane (normal butane or isobutane), and butylenes. [58, 2014]

3.3.273 Water Capacity. The amount of water at 60°F (16°C) required to fill a container. [58, 2014]

Chapter 42
42.11.2.2 Scope.
42.11.2.2.1* Chapter 11 of NFPA 58 applies to engine fuel systems installed on mobile and nonstationary engines and off-road on vehicles using LP-Gas in internal combustion engines, including containers, container appurtenances, carburetion equipment, piping, hose and fittings, and their installation. Refer to Chapter 12 for on-road LP-Gas vehicle installations. [58:11.1.1]

42.11.2.2.2* Chapter 11 of NFPA 58 applies to the installation of fuel systems supplying engines used to propel all motorized vehicles as defined in 42.11.2.2.1. [58:11.1.2]

42.11.2.2.3 Chapter 11 of NFPA 58 applies to garaging of vehicles where such systems are installed. [58:11.1.3]

42.11.2.2.4 Permits. Permits, where required, shall comply with Section 1.12.

42.11.2.3 Training. Each person engaged in installing, repairing, filling, or otherwise servicing an LP-Gas engine fuel system shall be trained. [58:11.2]

42.11.2.4 Label Requirements. 42.11.2.4.1 Each over-the-road general-purpose vehicle powered by LP-Gas shall be identified with a weather-resistant, diamond-shaped label. [58:11.12.1.1]

42.11.2.4.2 The label shall be located on an exterior vertical or near vertical surface on the lower right rear of the vehicle (on the trunk lid of a vehicle so equipped but not on the bumper of any vehicle) inboard from any other markings. [58:11.12.1.2]

42.11.2.4.3 The label shall be a minimum of 43/4 in. (120 mm) long by 31/4 in. (83 mm) high. [58:11.12.1.3]

42.11.2.4.4 The marking shall consist of a border and the word PROPANE [1 in. (25 mm) minimum height centered in the diamond] in silver or white reflective luminous material on a black background. [58:11.12.1.4]

42.11.2.5 Industrial (and Forklift) Trucks Powered by LP-Gas.
42.11.2.5.1 Scope. Paragraph 42.11.2.5 applies to LP-Gas installation on industrial trucks (including forklift trucks), both to propel them and to provide the energy for their materials-handling attachments. [58:11.13.1]

42.11.2.5.2 Operations. The operation of industrial trucks (including forklift trucks) powered by LP-Gas engine fuel systems shall comply with 42.11.2.5.2.1 through 42.11.2.5.2.3. [58:11.13.4]
42.11.2.5.2.1 Industrial trucks shall be refueled outdoors. [58:11.13.4.1]

42.11.2.5.2.2 Where cylinders are exchanged indoors, the fuel piping system shall be equipped to minimize the release of fuel when cylinders are exchanged, in accordance with either of the following:

1. Using an approved quick-closing coupling in the fuel line
2. Closing the shutoff valve at the fuel cylinder and allowing the engine to run until the fuel in the line is exhausted [58:11.13.4.2]

42.11.2.5.2.3 Where LP-Gas–fueled industrial trucks are used in buildings or structures, the following shall apply:

1. The number of fuel cylinders on such a truck shall not exceed two.
2. The use of industrial trucks in buildings frequented by the public, including those times when such buildings are occupied by the public, shall require the approval of the AHJ.
3. The total water capacity of the fuel cylinders on an individual truck shall not exceed 105 lb (48 kg) [nominal 45 lb (20 kg) propane capacity].
4. Trucks shall not be parked and left unattended in areas occupied by or frequented by the public without the approval of the AHJ. If left unattended with approval, the cylinder shutoff valve shall be closed.
5. In no case shall trucks be parked and left unattended in areas of excessive heat or near sources of ignition. [58:11.13.4.3]

42.11.2.6 General Provisions for Vehicles Having Engines Mounted on Them (Including Floor Maintenance Machines).

42.11.2.6.1 Scope.

42.11.2.6.1.1 Paragraph 42.11.2.6 applies to the installation of equipment on vehicles that supply LP-Gas as a fuel for engines installed on these vehicles. [58:11.14.1.1]

42.11.2.6.1.2 Vehicles include floor maintenance and any other portable mobile unit, whether the engine is used to propel the vehicle or is mounted on it for other purposes. [58:11.14.1.2]

42.11.2.6.2 General Requirements.

42.11.2.6.2.1 Industrial trucks (including forklift trucks) and other engines on vehicles operating in buildings other than those used exclusively to house engines shall have an approved automatic shutoff valve installed in the fuel system. [58:11.14.2.1]

42.11.2.6.2.2 The source of air for combustion shall be isolated from the driver and passenger compartment, ventilating system, or air-conditioning system on the vehicle. [58:11.14.2.2]

42.11.2.6.2.3 Non–self-propelled floor maintenance machinery (floor polishers, scrubbers, buffers) and other similar portable equipment shall be listed. [58:11.14.2.3]

42.11.2.6.2.3.1 A label shall be affixed to the machinery or equipment, with the label facing the operator, with the text denoting that the cylinder or portion of the machinery or equipment containing the cylinder shall be stored in accordance with Chapter 8 of NFPA 58. [58:11.14.2.3(A)]

42.11.2.6.2.3.2 The use of floor maintenance machines in buildings frequented by the public, including the times when such buildings are occupied by the public, shall require the approval of the AHJ. [58:11.14.2.3(B)]

42.11.2.7 Garaging of Vehicles.

Where vehicles with LP-Gas engine fuel systems mounted on them, and general-purpose vehicles propelled by LP-Gas engines, are stored or serviced inside garages, the following conditions shall apply:
1. The fuel system shall be leak-free.
2. The container shall not be filled beyond the limits specified in Chapter 7 of NFPA 58.
3. The container shutoff valve shall be closed when the vehicle or the engine is being repaired, except when the engine is required to operate. Containers equipped with an automatic shutoff valve as specified in 11.4.1.8 of NFPA 58 satisfy this requirement.
4. The vehicle shall not be parked near sources of heat, open flames, or similar sources of ignition or near inadequately ventilated pits. [58:11.16]

Chapter 69 Liquefied Petroleum Gases and Liquefied Natural Gases

69.1.3 Stationary Installations.
Plans for stationary installations utilizing storage containers with aggregate water capacity exceeding 4000 gal (15.2 m³), and all rooftop installations of ASME containers shall be submitted to the AHJ before the installation is started by the person or company that either installs or contracts to have the containers installed. [See also 6.2021.11.1(F) of NFPA 58.] [58:4.3.1]

69.2.1 Containers.
69.2.1.1 General.
69.2.1.1.1* 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]

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

69.2.1.1.2 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)]

69.2.1.1.3 Where containers fabricated to earlier editions of regulations, rules, or codes listed in 69.2.1.1.1, 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 of NFPA 58 shall apply. [58:5.2.1.1(C)]

69.2.1.2 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]

69.2.1.2.1 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)]

69.2.1.2.2 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)]

69.2.1.2.3 All container appurtenances shall be replaced. [58:5.2.1.2(C)]

69.2.1.2.4
DOT 4E specification (aluminum) cylinders and composite cylinders involved in a fire shall be permanently removed from service. [58:5.2.1.2(D)]

69.2.1.3
ASME paragraph U-68 or U-69 containers shall be permitted to be continued in use, installed, reinstalled, or placed back into service. Installation of containers shall be in accordance with all provisions listed in NFPA 58. (See Section 5.2, Table 5.2.4.2 and Table 5.7.2.6(A), and Annex D of NFPA 58.) [58:5.2.1.3]

69.2.1.4
Containers that show excessive denting, bulging, gouging, or corrosion shall be removed from service. [58:5.2.1.4]

69.2.1.5
Except for containers used in cargo tank vehicle service, ASME containers of 3000 gal (11.4 m³) water capacity or less used to store anhydrous ammonia shall not be converted to LP-Gas fuel service. [58:5.2.1.5]

69.2.1.6
Repairs or alteration of a container shall comply with the regulations, rules, or code under which the container was fabricated. Repairs or alteration to ASME containers shall be in accordance with the ANSI/NB23 National Board Inspection Code. [58:5.2.1.6]

69.2.1.7
Field welding shall be permitted only on saddle plates, lugs, pads, or brackets that are attached to the container by the container manufacturer. [58:5.2.1.7]

69.2.1.8
Containers for general use shall not have individual water capacities greater than 120,000 gal (454 m³). [58:5.2.1.8]

Containers in dispensing stations:Dispensing systems not located in LP-Gas bulk plants, industrial plants, or industrial applications shall have an aggregate water capacity not greater than 30,000 gal (114 m³). [58:5.2.1.9]

69.2.1.10
Heating or cooling coils shall not be installed inside storage containers. [58:5.2.1.10]

69.2.1.11
ASME containers installed underground, partially underground, or as mounded installations shall incorporate provisions for cathodic protection and shall be coated with a material recommended for the service that is applied in accordance with the coating manufacturer’s instructions. [58:5.2.1.11]

69.2.1.2
Portable Container Appurtenance Physical Damage Protection.

69.2.1.2.1
Cylinders shall incorporate protection against physical damage to cylinder appurtenances and immediate connections to such appurtenances when not in use 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) [58:5.2.6.1]

69.2.1.2.2
Protection of appurtenances of portable containers, skid tanks, and tanks for use as cargo tanks of more than 1000 lb (454 kg) water capacity [nominal 420 lb (191 kg) propane capacity] shall comply with 69.2.1.2.2.1 through 69.2.1.2.2.3. [58:5.2.6.2]
69.2.1.2.2.1 Appurtenance protection from physical damage shall be provided by recessing, by protective housings, or by location on the vehicle. [58:5.2.6.2(A)]

69.2.1.2.2 Appurtenance protection shall comply with the provisions under which the containers are fabricated. [58:5.2.6.2(B)]

69.2.1.2.2.3 Appurtenance protection shall be secured to the container in accordance with the ASME code under which the container was designed and built. [58:5.2.6.2(C)]

69.2.1.3 Portable Storage Containers.

69.2.1.3.1 The legs or supports, or the lugs for the attachment of legs or supports, shall be secured to the container in accordance with the ASME code under which the container was designed and built. [58:5.2.7.1]

69.2.1.3.2 The attachment of a container to either a trailer or semitrailer running gear, or the attachments to the container to make it a vehicle, so that the unit can be moved by a conventional over-the-road tractor, shall comply with the DOT requirements for cargo tank service. [58:5.2.7.2]

69.2.1.3.3 Portable tank design and construction of a full framework, skids, or lugs for the attachment of skids, and protection of fittings shall be in accordance with DOT portable tank specifications. The bottom of the skids shall be not less than 2 in. (51 mm) or more than 12 in. (300 mm) below the outside bottom of the tank shell. [58:5.2.7.3]

69.2.1.3 Containers with Attached Supports.

69.2.1.3.1 Vertical ASME containers of over 125 gal (0.5 m³) water capacity for use in permanent installations in stationary service shall be designed with steel supports that allow the container to be mounted on and fastened to concrete foundations or supports. [58:5.2.7.1]

69.2.1.3.1.1 Steel supports shall be designed to make the container self-supporting without guy wires and to withstand the wind and seismic (earthquake) forces anticipated at the site. [58:5.2.7.1(A)]

69.2.1.3.1.2 Steel supports shall be protected against fire exposure with a material having a fire resistance rating of at least 2 hours. [58:5.2.7.1(B)]

69.2.1.3.1.3 Continuous steel skirts having only one opening of 18 in. (460 mm) or less in diameter shall have 2-hour fire protection applied to the outside of the skirt. [58:5.2.7.1(C)]

69.2.1.3.2 ASME containers to be used as portable storage containers, including movable fuel storage tenders and farm carts for temporary stationary service (normally not more than 12 months duration at any location), shall comply with 69.2.1.3.2.1 through 69.2.1.3.2.4. [58:5.2.7.2]

69.2.1.3.2.1 The legs or supports, or the lugs for the attachment of legs or supports, shall be secured to the container in accordance with the ASME code under which the container was designed and built. [58:5.2.7.2(A)]
The attachment of a container to either a trailer or semi-trailer running gear, or the attachments to the container to make it a vehicle, so that the unit can be moved by a conventional over-the-road tractor, shall comply with the DOT requirements for cargo tank service. [58:5.2.7.2(B)]

69.2.1.3.2.3
The unit specified in 69.2.1.3.2.2 shall be approved for stationary use. [58:5.2.7.2(C)]

69.2.1.3.2.4
Movable fuel storage tenders, including farm carts, shall be secured to the trailer support structure for the service involved. [58:5.2.7.2(D)]

69.2.1.3.3
Portable tank design and construction of a full framework, skids, or lugs for the attachment of skids, and protection of fittings shall be in accordance with DOT portable tank specifications. The bottom of the skids shall be not less than 2 in. (50 mm) or more than 12 in. (300 mm) below the outside bottom of the tank. [58:5.2.7.3]

69.2.1.4 Container Marking,

69.2.1.4.1
Cylinders shall be marked as provided in the regulations, rules, or code under which they are fabricated. [58:5.2.8.1]

69.2.1.4.1.1
Where LP-Gas and one or more other compressed gases are to be stored or used in the same area, the cylinders shall be marked “Flammable” and either “LP-Gas,” “Propane,” or “Butane,” or shall be marked in accordance with the requirements of 49 CFR, “Transportation.” [58:5.2.8.1(A)]

69.2.1.4.1.2
When being transported, cylinders shall be marked and labeled in accordance with 49 CFR, “Transportation.” [58:5.2.8.1(B)]

69.2.1.4.2
Cylinders shall be marked with the following information:
(1) Water capacity of the cylinder in pounds
(2) Tare weight of the cylinder in pounds, fitted for service [58:5.2.8.2]

69.2.1.4.3
The markings specified for ASME containers shall be on a stainless steel metal nameplate attached to the container, located to remain visible after the container is installed. [58:5.2.8.3]

69.2.1.4.3.1
The nameplate shall be attached in such a way as to minimize corrosion of the nameplate or its fastening means and not contribute to corrosion of the container. [58:5.2.8.3(A)]

69.2.1.4.3.2
Where the container is buried, mounded, insulated, or otherwise covered so the nameplate is obscured, the information contained on the nameplate shall be duplicated and installed on adjacent piping or on a structure in a clearly visible location. [58:5.2.8.3(B)]

69.2.1.4.3.3
Stationary ASME containers shall be marked with the following information:
(1) Service for which the container is designed (e.g., underground, aboveground, or both)
(2) Name and address of container supplier or trade name of container
(3) Water capacity of container in pounds or U.S. gallons
(4) MAWP in pounds per square inch
(5) Wording that reads “This container shall not contain a product that has a vapor pressure in excess of ___ psig at 100°F” (see Table 5.2.4.2 of NFPA 58)

(6) Outside surface area in square feet

(7) Year of manufacture

(8) Shell thickness and head thickness

(9) OL (overall length), OD (outside diameter), and HD (head design)

(10) Manufacturer’s serial number

(11) ASME Code symbol

(12) Minimum design metal temperature ___°F at MAWP ____ psi

(13) Type of construction “W”

(14) Degree of radiography “RT-___”

69.2.1.4.3.4

In addition to the markings required by this Code, nameplates on cargo tanks shall include the markings required by the ASME Boiler and Pressure Vessel Code and the DOT. [58:5.2.8.3(D)]

69.2.1.4.4

Warning labels shall meet the following requirements:

(1) Warning labels shall be applied to all cylinders of 100 lb (45.4 kg) propane capacity or less that are not filled on site.

(2) Warning labels shall include information on the potential hazards of LP-Gas. [58:5.2.8.4]

69.2.1.4.5

All containers that contain unodorized LP-Gas products shall be marked “NOT ODORIZED.” [58:5.2.8.5].

69.2.1.4.5.1

The marking shall have a contrasting background surrounded by a rectangular red border in and with red letters and red border in the sizes shown in Table 69.2.1.4.5.1. [58:5.2.8.5(A)]

Table 69.2.1.4.5.1 “NOT ODORIZED” Label Size

<table>
<thead>
<tr>
<th>Water Capacity</th>
<th>Letter Height</th>
<th>Border Width</th>
</tr>
</thead>
<tbody>
<tr>
<td>gal</td>
<td>in.</td>
<td>cm</td>
</tr>
<tr>
<td>499–498</td>
<td>1.89</td>
<td>4.0</td>
</tr>
<tr>
<td>49–498</td>
<td>1.88</td>
<td>3.7</td>
</tr>
<tr>
<td>2.6–48</td>
<td>1.8</td>
<td>1.8</td>
</tr>
<tr>
<td>1–2.5</td>
<td>0.9</td>
<td>1.0</td>
</tr>
</tbody>
</table>

[58: Table 5.2.8.5(A)]

69.2.1.4.5.2

The markings shall be on both ends or on both sides of a container or on both sides and the rear of cargo tanks. [58:5.2.8.5(B)]

69.2.2 Reserved. [58:5.3]

69.2.3 Reserved. [58:5.4]

69.2.4 Reserved. [58:5.5]

69.2.5 Containers with Attached Supports
69.2.5.1 Vertical ASME Containers
Vertical ASME containers of over 125 gal (0.5 m³) water capacity for use in permanent installations in stationary service shall be designed with steel supports that allow the container to be mounted on and fastened to concrete foundations or supports. [58:5.6.1]

69.2.5.1.1 Steel supports shall be designed to make the container self-supporting without guy wires and to withstand the wind and seismic (earthquake) forces anticipated at the site. [58:5.6.1.1]

69.2.5.1.2 Steel supports shall be protected against fire exposure with a material having a fire resistance rating of at least 2 hours. [58:5.6.1.2]

69.2.5 Continuous steel skirts having only one opening of 18 in. (460 mm) or less in diameter shall have 2-hour fire protection applied to the outside of the skirt. [58:5.6.1.3]

69.2.5.2 Skid Tanks
Skid tanks shall have a secure steel frame to allow transportation of the skid tank when not filled with LP-Gas. [58:5.6.2]

69.2.5.3 Porta-Pacs
69.2.5.3.1 The legs or supports, or the lugs for the attachment of legs or supports, shall be secured to the container in accordance with the ASME code under which the container was designed and built. [58:5.6.3.1]

69.2.5.3.2 The ASME container shall be attached to either:

1. A trailer or semitrailer running gear, or the attachments to the container to make it a vehicle, so that the unit can be moved by a conventional over-the-road tractor.
2. A metal frame such that the container can be moved as a trailer if wheels are added, which shall be approved for stationary use, or on a flat rail car.
3. Protection of appurtenances shall be in accordance with 5.2.6.
4. Movable fuel storage tenders shall be secured to the trailer support structure for the service involved.

[58:5.6.3.2]

69.2.6 Reserved.

69.2.7 Reserved.

69.2.8 Container Appurtenances and Regulators
69.2.8.1 Materials
69.2.8.1.1 Container appurtenances and regulators shall be fabricated of materials that are compatible with LP-Gas, shall be resistant to the action of LP-Gas under service conditions, and shall comply with Sections 5.7 and 5.8 of NFPA 58.
The following materials shall not be used:

1. Gray cast iron
2. Nonmetallic materials for bonnets or bodies of valves or regulators

Pressure-containing metal parts of appurtenances shall have a minimum melting point of 1500°F (816°C), except for the following:

1. Fusible elements
2. Approved or listed variable liquid level gauges used in containers of 3500 gal (13.2 m³) water capacity or less

Container appurtenances shall have a service pressure of at least 250 psig (1.7 MPag).

Gaskets used to retain LP-Gas in containers shall be resistant to the action of LP-Gas.

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

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

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

Gaskets for use with approved or listed liquid level gauges for installation on a container of 3500 gal (13.2 m³) water capacity or less shall be exempt from the minimum melting point requirement.

Piping (including hose), fittings, and valves shall comply with Section 5.9 of NFPA 58.

Installation of LP-Gas Systems.

Application.

Section 69.3 shall apply to the following:

1. Location and field installation of LP-Gas systems that use components, subassemblies, container assemblies, and container systems that are fabricated in accordance with Chapter 5 of NFPA 58
2. Location of containers and liquid transfer systems
3. Installation of container appurtenances and regulators
4. Installation of piping (including flexible connectors and hose), hydrostatic relief valves, and piping service limitations
69.3.1 Nonapplication.
This chapter does not apply to the following:
(1) Refrigerated containers
(2) Installation of systems used in the highway transportation of LP-Gas

69.3.2 Location of Containers.

69.3.2.1 LP-Gas containers shall be located outside of buildings unless they are specifically allowed to be located inside of buildings. [58:6.2.1]

69.3.2.2 LP-Gas containers shall be allowed in buildings only for the following applications:

1. Cylinders as specifically provided for in Section 6.22 of NFPA 58
2. Containers of less than 125 gal (0.5 m³) water capacity for the purposes of being filled in buildings or structures complying with Chapter 10 of NFPA 58
3. Containers on LP-Gas vehicles complying with, and parked or garaged in accordance with, Chapter 9 of NFPA 58
4. Containers used with LP-Gas portable engine fuel systems complying with 11.15.1 of NFPA 58
5. Containers used with LP-Gas stationary engine fuel systems complying with Section 6.28 of NFPA 58
6. Containers used with LP-Gas–fueled industrial trucks complying with 11.13.4 of NFPA 58
7. Containers on LP-Gas–fueled vehicles garaged in accordance with Section 11.16 of NFPA 58

69.3.3 Location of Containers Not Connected for Use.

69.3.3.1 Cylinders awaiting use, resale, or exchange shall be stored in accordance with Chapter 8. [58:6.3.1]

69.3.3.2 ASME containers of 4,000 gal (15.2 m³) or less that have been removed from service but that contain LP-Gas shall be stored outside of buildings in accordance with either (1) or (2):

1. Containers shall be located either at a bulk plant or in an approved area.
2. Containers not complying with (1) shall comply with the following:
   1. Containers shall be located in a manner that will minimize exposure to physical damage.
   2. Containers shall be oriented so that the pressure relief valve remains in communication with the vapor space.
   3. Containers shall not be located on roofs of buildings.
   4. Valve outlets on ASME containers shall be plugged or capped.
5. Where screw-on-type caps or collars are utilized on ASME containers, they shall be in place whenever this type of container is stored regardless of the fill level of the container.

6. The location of ASME containers shall comply with the “Aboveground Containers” column and the “Between Containers” column of Table 6.4.1.1 with respect to important buildings and lines of adjoining property that can be built upon.

7. Where the provisions of (f) are impractical, alternative storage locations for containers shall be approved by the authority having jurisdiction.

[58:6.3.2]

6.3.2 Container Separation Distances.

6.3.3 Aboveground Containers.

6.3.3.1* Containers installed outside of buildings, whether of the portable type replaced on a cylinder exchange basis or permanently installed and refilled at the installation, shall be located with respect to the adjacent containers, important building, group of buildings, or line of adjoining property that can be built upon, in accordance with Table 69.3.34.1.1, Table 69.3.45.1.2, 69.3.46.1 through 69.3.46.4.1.1, [58:6.3.4.1]

Table 69.3.34.1.1 Separation Distances Between Containers, Important Buildings, and Line of Adjoining Property That Can Be Built Upon

<table>
<thead>
<tr>
<th>Water Capacity per Container</th>
<th>Mounded or Underground Containers</th>
<th>Aboveground Containers</th>
<th>Between Containers</th>
</tr>
</thead>
<tbody>
<tr>
<td>gal</td>
<td>m³</td>
<td>ft m</td>
<td>ft m</td>
</tr>
<tr>
<td>&lt;125</td>
<td>&lt;0.5</td>
<td>10 3</td>
<td>0 0</td>
</tr>
<tr>
<td>125–250</td>
<td>0.5–1.0</td>
<td>10 3</td>
<td>10 3</td>
</tr>
<tr>
<td>251–500</td>
<td>&gt;1.0–1.9</td>
<td>10 3</td>
<td>10 3</td>
</tr>
<tr>
<td>501–2,000</td>
<td>&gt;1.9–7.6</td>
<td>10 3</td>
<td>25 7.6</td>
</tr>
<tr>
<td>2,001–30,000</td>
<td>&gt;7.6–114</td>
<td>50 15</td>
<td>50 15</td>
</tr>
<tr>
<td>30,001–70,000</td>
<td>&gt;114–265</td>
<td>50 15</td>
<td>75 23</td>
</tr>
<tr>
<td>70,001–90,000</td>
<td>&gt;265–341</td>
<td>50 15</td>
<td>100 30</td>
</tr>
</tbody>
</table>

*¼ of sum of diameters of adjacent containers.
### Minimum Distances

<table>
<thead>
<tr>
<th>Water Capacity per Container</th>
<th>Mounded or Underground Containers&lt;sup&gt;a&lt;/sup&gt;</th>
<th>Aboveground Containers</th>
<th>Between Containers&lt;sup&gt;b&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>gal</td>
<td>ft</td>
<td>m</td>
<td>ft</td>
</tr>
<tr>
<td>90,001–120,000</td>
<td>50</td>
<td>15</td>
<td>125</td>
</tr>
<tr>
<td></td>
<td>&gt;341–454</td>
<td></td>
<td></td>
</tr>
<tr>
<td>120,001–200,000</td>
<td>50</td>
<td>15</td>
<td>200</td>
</tr>
<tr>
<td></td>
<td>&gt;454–757</td>
<td></td>
<td></td>
</tr>
<tr>
<td>200,001–1,000,000</td>
<td>50</td>
<td>15</td>
<td>300</td>
</tr>
<tr>
<td></td>
<td>&gt;757–3785</td>
<td></td>
<td></td>
</tr>
<tr>
<td>&gt;1,000,000</td>
<td>50</td>
<td>15</td>
<td>400</td>
</tr>
<tr>
<td></td>
<td>&gt;3785</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<sup>a</sup> See 69.3.3.2.1.
<sup>b</sup> See 69.3.3.4.1, 69.3.3.4.2, 69.3.3.4.3, and 69.3.3.4.4.

When the provisions of 6.28.3 through 6.28.5 of NFPA 58 are met, the minimum distance from an ASME container to a building shall be reduced by one-half for ASME containers of 2001 gal through 30,000 gal (7.6 m³ through 114 m³) water capacity. [58: 6.34.1.2]

The 25 ft (7.6 m) minimum distance from aboveground ASME containers of 501 gal through 2000 gal (1.9 m³ through 7.6 m³) water capacity to buildings, a group of buildings, or the line of adjoining property that can be built upon shall be reduced to 10 ft (3 m) for a single ASME container of 1200 gal (4.5 m³) or less water capacity where such container is at least 25 ft (7.6 m) from any other LP-Gas container of more than 125 gal (0.5 m³) water capacity. [58: 6.34.1.3]

Underground or Mounded ASME Containers.

Minimum distances for underground or mounded ASME containers of 2001 gal through 30,000 gal (7.6 m³ through 114 m³) water capacity, incorporating all the provisions of Section 6.28.30 of NFPA 58, shall be reduced to 10 ft (3 m). [58: 6.34.2.1]

Distances for all underground and mounded ASME containers shall be measured from the container surface. [58: 6.34.2.2]

No part of an underground or mounded ASME container shall be less than 10 ft (3 m) from a building or line of adjoining property that can be built upon. [58: 6.34.2.3]

Minimum Separation Distances for ASME Containers.
The minimum separation distances specified in Table 69.3.34.1.1 between containers and buildings of other than wood-framed noncombustible construction devoted exclusively to gas manufacturing and distribution operations shall be reduced to 10 ft (3 m). [58:6.34.3.1]

69.3.34.3.2

If the aggregate water capacity of a multicontainer installation is 501 gal (1.9 m³) or more and the installation is comprised of individual containers, each with a water capacity of less than 125 gal (0.5 m³), the minimum distance shall comply with Table 69.3.34.1.1 and 69.3.34.3.2.1 through 69.3.34.3.2.3. [58:6.34.3.2]

69.3.34.3.2.1

The aggregate capacity shall be used rather than the capacity per container. [58:6.34.3.2(A)]

69.3.34.3.2.2

If more than one such installation is made, each installation shall be separated from any other installation by at least 25 ft (7.6 m). [58:6.34.3.2(B)]

69.3.34.3.2.3

The minimum distances between containers shall not be applied to installations covered by 69.3.34.3.2. [58:6.34.3.2(C)]

69.3.34.4 Separation Distance Between Container Pressure Relief Valve and Building Openings.

69.3.34.4.1

Cylinders shall not be located and installed underneath any building unless the space is open to the atmosphere for 50 percent of its perimeter or more. [58:6.34.4.1]

69.3.34.4.2

ASME containers of less than 125 gal (0.5 m³) water capacity shall be located and installed so that the discharge from pressure relief devices shall not terminate in or beneath any building. [58:6.34.4.2]

69.3.34.4.3

The distance measured horizontally from the point of discharge of a container pressure relief valve to any building opening below the level of such discharge shall be in accordance with Table 69.3.34.4.3. [58:6.34.4.3]

Table 69.3.34.4.3 Separation Distance Between Container Pressure Relief Valve and Building Openings

<table>
<thead>
<tr>
<th>Container Type</th>
<th>Exchange or Filled on Site at the Point of Use</th>
<th>Distance Horizontally from Relief Valve Discharge to Opening Below Discharge</th>
<th>Discharge from Relief Valve, Vent Discharge, and Filling Connection to Exterior Source of Ignition, Openings into Direct-Vent Appliances, and Mechanical Ventilation Air Intakes</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>ft</td>
<td>m</td>
</tr>
<tr>
<td>Cylinder</td>
<td>Exchange</td>
<td>3</td>
<td>0.9</td>
</tr>
<tr>
<td>Cylinder</td>
<td>Filled on site at the point of use</td>
<td>3</td>
<td>0.9</td>
</tr>
<tr>
<td>ASME</td>
<td>Filled on site at the point of use</td>
<td>5</td>
<td>1.5</td>
</tr>
</tbody>
</table>

[58: Table 6.3.4.3]

69.3.34.4.4
The distance measured in any direction from the point of discharge of a container pressure relief valve, vent of a fixed maximum liquid level gauge on a container, and the container filling connection to exterior sources of ignition, openings into direct-vent (sealed combustion system) appliances, and mechanical ventilation air intakes shall be in accordance with Table 69.3.34.4.3. [58:6.34.4.4]

69.3.34.4.5
Access at the ends or sides of individual underground containers having a water capacity of 125 gal (0.5 m³) or more shall be provided in multicontainer installations to facilitate working with cranes or hoists. [58:6.34.4.5]

69.3.45.1 ASME Multi-Container Requirements.

69.3.45.1.1
Where storage containers having an aggregate water capacity of more than 4000 gal (15.2 m³) are located in heavily populated or congested areas, the siting provisions of 69.3.34.1.1 and Table 69.3.34.1.1 shall be permitted to be modified as indicated by the fire safety analysis described in 6.2729.3 of NFPA 58. [58:6.4.1.1]

69.3.45.1.2
Aboveground multicontainer installations comprised of ASME containers having an individual water capacity of 12,000 gal (45 m³) or more and installed for use in a single location shall be limited to the number of containers in one group, with each group separated from the next group in accordance with the degree of fire protection provided in Table 69.3.45.1.2. [58:6.45.1.2]

Table 69.3.45.1.2 Maximum Number of Containers in a Group and Their Separation Distances

<table>
<thead>
<tr>
<th>Fire Protection Provided by</th>
<th>Maximum Number of Containers in One Group</th>
<th>Minimum Separation Between Groups</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>ft</td>
<td>m</td>
</tr>
<tr>
<td>Hose streams only (see 6.4.1.2 and 6.27.3.1 of NFPA 58)</td>
<td>6</td>
<td>50</td>
</tr>
<tr>
<td>Fixed monitor nozzles per 6.27.6.3 of NFPA 58</td>
<td>6</td>
<td>25</td>
</tr>
<tr>
<td>Fixed water spray per 6.27.6.1 of NFPA 58</td>
<td>9</td>
<td>25</td>
</tr>
<tr>
<td>Insulation per 6.27.5.1 of NFPA 58</td>
<td>9</td>
<td>25</td>
</tr>
</tbody>
</table>

[58: Table 6.45.1.2]

69.3.45.1.3
Where the provisions of 6.2830.3 and 6.2830.4 of NFPA 58 are met, the minimum separation distance between groups of ASME containers protected by hose stream only shall be one-half the distances required in Table 69.3.4.1.2. [58:6.45.1.3]

69.3.45.2 Underground and Mounded ASME Containers.

69.3.4.2.1
Underground or mounded ASME containers shall be located in accordance with 69.3.45.2.2 and 69.3.45.2.3. [58:6.4.2.1]

69.3.45.2.2
Underground or mounded containers shall be located outside of any buildings. [58:6.45.2.2]
69.3.4.2.3
Buildings shall not be constructed over any underground or mounded containers. [58:6.45.2.3]

69.3.4.2.4
The sides of adjacent containers shall be separated in accordance with Table 6.4.1.1 but shall not be separated by less than 3 ft (1 m). [58:6.4.2.4]

69.3.4.2.5
Where containers are installed parallel with ends in line, the number of containers in one group shall not be limited. [58:6.4.2.5]

69.3.4.2.6
Where more than one row of containers is installed, the adjacent ends of the containers in each row shall be separated by not less than 10 ft (3 m). [58:6.4.2.6]

69.3.4.3  General Requirements.

69.3.4.3.1
The sides of adjacent containers shall be separated in accordance with Table 69.3.3.1.1 but shall not be separated by less than 3 ft (1 m). [58:6.4.3.1]

69.3.4.3.2
Where containers are installed parallel with ends in line, the number of containers in one group shall not be limited. [58:6.4.3.2]

69.3.4.3.3
Where more than one row of containers is installed, the adjacent ends of the containers in each row shall be separated by not less than 10 ft (3 m). [58:6.4.3.3]

69.3.4.4  Additional Container Installation Requirements.

69.3.4.4.1
Additional container installation requirements shall comply with 69.3.4.4.2 through 69.3.4.4.14 and 69.3.4.5. [58:6.4.4.16.5.3.1]

69.3.4.4.2
Containers shall not be stacked one above the other. [58:6.4.4.6.5.3.22]

69.3.4.4.3*
Combustible materials shall not accumulate or be stored within 10 ft (3 m) of a container. [58:6.4.4.6.5.3.3]

69.3.4.4.4*
The area under containers shall be graded or shall have dikes or curbs installed so that the flow or accumulation of flammable liquids with flash points below 200° F (93.4°C) is prevented. [58:6.4.4.6.5.3.4]

69.3.4.4.5
LP-Gas containers shall be located at least 10 ft (3 m) from the centerline of the wall of diked areas containing flammable or Class II combustible liquids. [58:6.4.4.6.5.3.5]

69.3.4.4.6
The minimum horizontal separation between aboveground LP-Gas containers and aboveground tanks containing liquids having flash points below 200°F (93.4°C) shall be 20 ft (6 m). [58:6.4.4.6.5.3.6]

69.3.4.4.7
The requirements of 69.3.4.4.6 shall not apply where LP-Gas containers of 125 gal (0.5 m³) or less water capacity are installed adjacent to fuel oil supply tanks of 660 gal (2.5 m³) or less capacity. [58:6.4.4.6.5.3.7]

69.3.4.4.8
Buildings shall not be constructed over any underground or mounded containers. [58:6.45.2.3]
No horizontal separation shall be required between aboveground LP-Gas containers and underground tanks containing flammable or combustible liquids installed in accordance with NFPA 30. [58:6.45.43.8]

The minimum separation between LP-Gas containers and oxygen or gaseous hydrogen containers shall be in accordance with NFPA 55. [58:6.45.43.9]

Where protective structures having a minimum fire resistance rating of 2 hours interrupt the line of sight between uninsulated portions of the oxygen or hydrogen containers and the LP-Gas containers, no minimum distance shall apply. [58:6.45.43.10]

The minimum separation between LP-Gas containers and liquefied hydrogen containers shall be in accordance with NFPA 55. [58:6.45.43.11]

Where LP-Gas cylinders are to be stored or used in the same area with other compressed gases, the cylinders shall be marked to identify their content in accordance with ANSI/CGA C-7, Guide to the Preparation of Precautionary Labeling and Marking of Compressed Gas Containers. [58:6.45.43.12]

An aboveground LP-Gas container and any of its parts shall not be located within 6 ft (1.8 m) of a vertical plane beneath overhead electric power lines that are over 600 volts, nominal. [58:6.45.43.13]

Refrigerated LP-Gas containers shall be located within an impoundment in accordance with Section 12.5 of NFPA 58. [58:6.45.43.14]

Structure Requirements.

Structures such as fire walls, fences, earth or concrete barriers, and other similar structures shall not be permitted around or over installed nonrefrigerated containers unless specifically allowed. [58:6.45.54.1]

Structures partially enclosing containers shall be permitted if designed in accordance with a sound fire protection analysis. [58:6.45.54.2]

Structures used to prevent flammable or combustible liquid accumulation or flow shall be permitted in accordance with 69.3.4.4.4. [58:6.45.54.3]

Structures between LP-Gas containers and gaseous hydrogen containers shall be permitted in accordance with 69.3.4.4.10. [58:6.45.54.4]

Structures such as fences shall be permitted in accordance with 6.19.4 of NFPA 58. [58:6.45.54.5]

Location of Transfer Operations.

Transfer of Liquids.

Liquid shall be transferred into containers, including containers mounted on vehicles, only outdoors or in structures specially designed for such purpose. [58:6.57.1.1]

The transfer of liquid into containers mounted on vehicles shall not take place within a building but shall be permitted to take place under a weather shelter or canopy. (See 6.2527.3.3 of NFPA 58.) [58:6.57.1.2]
Structures housing transfer operations or converted for such use after December 31, 1972, shall comply with Chapter 10 of NFPA 58. [58:6.57.1.3]

The transfer of liquid into containers on the roofs of structures shall be permitted, provided that the installation conforms to the requirements specified in 6.68.7 and 6.2022.11 of NFPA 58. [58:6.57.1.4]

The transfer hose shall not be routed in or through any building except those specified in 69.3.57.1.3. [58:6.57.1.5]

Filling of containers located outdoors in stationary installations in accordance with 69.3.57.1.4 shall be permitted to be filled at that location. [58:6.57.1.6]

Container Point of Transfer Location Requirements.

If the point of transfer of containers located outdoors in stationary installations is not located at the container, it shall be located in accordance with Table 69.3.57.2.1. [58:6.57.2.1]

Table 69.3.57.2.1 Distance Between Point of Transfer and Exposures

<table>
<thead>
<tr>
<th>Part</th>
<th>Exposure</th>
<th>Minimum Horizontal Distance</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Buildings, a mobile homes, recreational vehicles, and modular homes with at least 1-hour fire-rated walls b</td>
<td>10 ft 3.1 m</td>
</tr>
<tr>
<td>B</td>
<td>Buildings with other than at least 1-hour fire-rated walls</td>
<td>25 ft 7.6 m</td>
</tr>
<tr>
<td>C</td>
<td>Building wall openings or pits at or below the level of the point of transfer</td>
<td>25 ft 7.6 m</td>
</tr>
<tr>
<td>D</td>
<td>Line of adjoining property that can be built upon</td>
<td>25 ft 7.6 m</td>
</tr>
<tr>
<td>E</td>
<td>Outdoor places of public assembly, including schoolyards, athletic fields, and playgrounds</td>
<td>50 ft 15 m</td>
</tr>
<tr>
<td>F</td>
<td>Public ways, including public streets, highways, thoroughfares, and sidewalks</td>
<td>10 ft 3.1 m</td>
</tr>
<tr>
<td>(1)</td>
<td>From points of transfer in for LP-Gas dispensing stations and at vehicle fuel dispensers systems</td>
<td>10 ft 3.1 m</td>
</tr>
<tr>
<td>(2)</td>
<td>From other points of transfer</td>
<td>25 ft 7.6 m</td>
</tr>
<tr>
<td>G</td>
<td>Driveways d</td>
<td>5 ft 1.5 m</td>
</tr>
<tr>
<td>H</td>
<td>Mainline railroad track centerlines</td>
<td>25 ft 7.6 m</td>
</tr>
<tr>
<td>I</td>
<td>Containers other than those being filled</td>
<td>10 ft 3.1 m</td>
</tr>
<tr>
<td>J</td>
<td>Flammable and Class II combustible liquid dispensers and the fill connections of containers</td>
<td>10 ft 3.1 m</td>
</tr>
</tbody>
</table>
Minimum Horizontal Distance

<table>
<thead>
<tr>
<th>Part</th>
<th>Exposure</th>
<th>ft</th>
<th>m</th>
</tr>
</thead>
<tbody>
<tr>
<td>K</td>
<td>Flammable and Class II combustible liquid aboveground containers, and filling connections of underground containers</td>
<td>20</td>
<td>6.1</td>
</tr>
<tr>
<td>L</td>
<td>Stored or accumulated combustible materials</td>
<td>10</td>
<td>3.1</td>
</tr>
</tbody>
</table>

4For the purpose of the table, buildings also include structures such as tents and box trailers at construction sites.
6See 69.3.5.3.4.
7Not applicable to driveways and points of transfer at vehicle fuel dispensers.
8Not applicable to filling connections at the storage container or to dispensing vehicle fuel dispenser units of 4000 gal (15.2 m³) water capacity or less when used for filling containers not mounted on vehicles.
9NFPA 30 defines these as follows: Class I Flammable liquids include those having a flash point below 100°F (37.8°C) and having a vapor pressure not exceeding 40 psia (276 kPa) at 100°F (37.8°C). Class II combustible liquids include those having a flash point at or above 100°F (37.8°C) and below 140°F (60°C).
[58: Table 6.57.2.1]
69.3.57.2.2
Containers not located in stationary installations shall be filled at a location determined by the point of transfer in accordance with Table 69.3.57.2.1. [58:6.57.2.2]
69.3.57.3 Separation Distance from Point of Transfer.
69.3.57.3.1
If the point of transfer is a component of a system covered by Section 6.24 or Chapter 11 of NFPA 58, the requirements of parts A, B, and C of Table 69.3.5.2.1 shall not apply to the structure containing the point of transfer. [58:6.57.3.1]
69.3.57.3.2
If LP-Gas is vented to the atmosphere under the conditions stipulated in 7.3.1(5) of NFPA 58, the distances in Table 69.3.57.2.1 shall be doubled. [58:6.57.3.2]
69.3.57.3.3
If the point of transfer is housed in a structure complying with Chapter 10 of NFPA 58, and the common walls comply with 10.2.1 of NFPA 58, separation distances in Table 69.3.57.2.1 shall not be required where the common walls comply with 10.3.1.3 of NFPA 58. [58:6.57.3.3]
69.3.57.3.4
The distances in Table 69.3.57.2.1, parts B, C, D, E, F(2), and J, shall be reduced by one-half where the system incorporates the provisions of low emission transfer as provided in 6.28.30.5 of NFPA 58. [58:6.5.3.4]
69.3.6 Installation of Containers.
69.3.6.1 General Requirements.
69.3.6.1.1
Containers shall be positioned so that the pressure relief valve is in direct communication with the vapor space of the container. [58:6.68.1.1]
69.3.68.1.2
LP-Gas containers or systems of which they are a part that are installed within 10 ft (3m) of public vehicular thoroughfares shall be provided with a means of vehicular barrier protection. [58:6.68.1.2]

69.3.68.1.3
Field welding on containers shall be limited to nonpressure parts such as saddle plates, wear plates, or brackets installed by the container manufacturer. [58:6.68.1.3]

69.3.68.1.4*
Aboveground containers shall be painted. [58:6.68.1.4]

69.3.68.1.5
Containers shall be installed so that all container operating appurtenances are accessible. [58:6.68.1.5]

69.3.68.1.6
Where necessary to prevent flotation due to possible high flood waters around aboveground or mounded containers, or high water table for those underground and partially underground, containers shall be securely anchored. [58:6.68.1.6]

69.3.68.2
Installation of Cylinders.

69.3.68.2.1
Cylinders shall be installed only aboveground and shall be set upon a firm foundation or otherwise be firmly secured. (See 69.3.6.2.2.) [58:6.68.2.1]

69.3.68.2.2
The cylinder shall not be in contact with the soil. [58:6.68.2.2]

69.3.68.2.3
Flexibility shall be provided in the connecting piping. (See 69.3.6.2.4.) [58:6.68.2.3]

69.3.68.2.4
Where flexible connectors are used, they shall comply with 6.911.6 of NFPA 58. [58:6.68.2.4]

69.3.7
Internal Valves.

69.3.79.1
The requirements of 69.3.79.2 through 69.3.79.5 shall be required for internal valves in liquid service that are installed in containers of over 4000 gal (15.2 m³) water capacity by July 1, 2003. [58:6.11.1]

69.3.79.2
Internal valves shall be installed in accordance with 5.78.4.2 and Table 5.78.4.2 of NFPA 58 on containers of over 4000 gal (15.2 m³) water capacity. [58:6.11.2]

69.3.79.3
Thermal Activation.

69.3.79.3.1
Automatic shutdown of internal valves in liquid service shall be provided using thermal (fire) actuation. [58:6.11.3.1]

69.3.79.3.2
The thermal sensing element of the internal valve shall be within 5 ft (1.5 m) of the internal valve. [58:6.11.3.2]

69.3.79.4
Remote Shutdown Station.

69.3.79.4.1
At least one remote shutdown station for internal valves in liquid service shall be installed not less than 25 ft (7.6 m) or more than 100 ft (30 m) from the liquid transfer point in accordance with the following:

1. Not less than 25 ft (7.6 m) or more than 100 ft (30 m) from the liquid transfer point
2. Not less than 25 ft (7.6 m) from the internal valves that are being controlled
3. Along a path of egress from the liquid transfer point

[58:6.113.4.1] 69.3.79.4.2
This requirement shall be retroactive to all internal valves required by NFPA 58. [58:6.113.4.2] 69.3.79.5
Emergency remote shutdown stations shall be identified by a sign, visible from the point of transfer, incorporating the words "Propane — Container Liquid Valve Emergency Shutoff" in block letters of not less than 2 in. (51 mm) in height on a background of contrasting colors to the letters. [58:6.113.5] 69.3.8-10 Emergency Shutoff Valves.
69.3.810.1
On new installations and on existing installations, stationary container storage systems with an aggregate water capacity of more than 4000 gal (15.2 m³) utilizing a liquid transfer line that is 1½ in. (38 mm) or larger, and a pressure equalizing vapor line that is 1¼ in. (32 mm) or larger, shall be equipped with emergency shutoff valves. [58:6.1214.1]
69.3.810.2
An emergency shutoff valve shall be installed in the transfer lines of the fixed piping transfer system within 20 ft (6 m) of lineal pipe from the nearest end of the hose or swivel-type piping connections. [58:6.1214.2]
69.3.810.3
When the flow is only into the container, a backflow check valve shall be permitted to be used in lieu of an emergency shutoff valve if installed in the piping transfer system downstream of the hose or swivel-type piping connections. [58:6.1214.3]
69.3.810.4
The backflow check valve shall have a metal-to-metal seat or a primary resilient seat with metal back-up, not hinged with combustible material, and shall be designed for this specific application. [58:6.1214.4]
69.3.810.5
Where there are two or more liquid or vapor lines with hoses or swivel-type piping connected of the sizes designated, an emergency shutoff valve or a backflow check valve, where allowed, shall be installed in each leg of the piping. [58:6.1214.5]
69.3.810.6
Emergency shutoff valves shall be installed so that the temperature-sensitive element in the valve, or a supplemental temperature-sensitive element that operates at a maximum temperature of 250°F (121°C) that is connected to actuate the valve, is not more than 5 ft (1.5 m) from the nearest end of the hose or swivel-type piping connected to the line in which the valve is installed. [58:6.1214.6]
69.3.810.7
Temperature-sensitive elements of emergency shutoff valves shall not be painted, nor shall they have any ornamental finishes applied after manufacture. [58:6.1214.7]
69.3.810.8*
The emergency shutoff valves or backflow check valves shall be installed in the fixed piping so that any break resulting from a pull will occur on the hose or swivel-type piping side of the connection while retaining intact the valves and piping on the plant side of the connection. [58:6.1214.8]
Where emergency shutoff valves are required to be installed in accordance with 69.3.810.2, a means shall be incorporated to actuate the emergency shutoff valves in the event of a break of the fixed piping resulting from a pull on the hose. [58:6.1214.9]

69.3.810.10
Emergency shutoff valves required by NFPA 58 shall be tested annually for the functions required by 5.4213.2.3(2) and (3) of NFPA 58, and the results of the test shall be documented. [58:6.4214.10]

69.3.810.11
Backflow check valves installed in lieu of emergency shutoff valves shall be checked annually for proper operation, and the results of the test shall be documented. [58:6.4214.11]

69.3.810.12
All new and existing emergency shutoff valves shall comply with 69.3.108.12.1 through 69.3.810.12.3.

69.3.810.12.1
Each emergency shutoff valve shall have at least one clearly identified and easily accessible manually operated remote emergency shutoff device. [58:6.4214.12.1]

69.3.810.12.2
The shutoff device shall be located not less than 25 ft (7.6 m) or more than 100 ft (30 m) in the path of egress from the emergency shutoff valve. [58:6.4214.12.2]

69.3.810.12.3
Where an emergency shutoff valve is used in lieu of an internal valve in compliance with 5.7.8.4.2(D)(2) of NFPA 58, the remote shutoff device shall be installed in accordance with 69.3.29.4 and 69.3.29.5. [58:6.4214.12.3]

69.3.810.13
Emergency shutoff valves for railroad tank car transfer systems shall be in accordance with 6.19.2.6, 6.28.4, 7.2.3.7, and 7.2.3.8 of NFPA 58. [58:6.4214.13]

69.3.911*
Installation in Areas of Heavy Snowfall.

69.3.11.1 In areas where the ground snow load is equal to or exceeds 175 100 psf (855 488 kg/m²), piping, regulators, meters, and other equipment installed in the piping system shall be protected from the forces of accumulated snow. [58:6.4618.1]

69.3.1012 LP-Gas Systems in Buildings or on Building Roofs or Exterior Balconies.

69.3.1012.1 Application.

69.3.1012.1.1 Subsection 69.3.1012 shall apply to the installation of the following LP-Gas systems in buildings or structures:
(1) Cylinders inside of buildings or on the roofs or exterior balconies of buildings
(2) Systems in which the liquid is piped from outside containers into buildings or onto the roof

69.3.1012.1.2 The phrase cylinders in use shall mean connected for use. [58:6.2022.1.2]

69.3.1012.1.2.1 The use of cylinders indoors shall be only for the purposes specified in 6.2022.4 through 6.2022.10 of NFPA 58. [58:6.2022.1.2(A)]

69.3.1012.1.2.2 The use of cylinders indoors shall be limited to those conditions where operational requirements make the indoor use of cylinders necessary and location outside is impractical. [58:6.2022.1.2(B)]
69.3.1012.1.3

The use of cylinders on roofs shall be limited to those conditions where operational requirements make the use of cylinders necessary and location other than on roofs of buildings or structures is impractical. [58:6.2022.1.2(C)]

69.3.1012.1.2.4

Liquid LP-Gas shall be piped into buildings or structures only for the purposes specified in 6.911.1.1(D) of NFPA 58. [58:6.2022.1.2(D)]

69.3.1012.1.3

Storage of cylinders awaiting use shall be in accordance with Chapter 8 of NFPA 58. [58:6.2022.1.3]

69.3.1012.1.4

Transportation of cylinders within a building shall be in accordance with 6.2022.3.6 of NFPA 58. [58:6.2022.1.4]

69.3.1012.1.5

The following provisions shall be required in addition to those specified in Sections 6.2 and 6.3.4 of NFPA 58:

1. Liquid transfer systems shall be in accordance with Chapter 7 of NFPA 58.
2. Engine fuel systems used inside buildings shall be in accordance with Chapter 11 of NFPA 58.
3. LP-Gas transport or cargo tank vehicles stored, serviced, or repaired in buildings shall be in accordance with Chapter 9 of NFPA 58. [58:6.2022.1.5]

69.3.1012.2

Additional Equipment Requirements for Cylinders, Equipment, Piping, and Appliances Used in Buildings, Building Roofs, and Exterior Balconies.

69.3.1012.2.1

Cylinders shall be in accordance with the following:

1. Cylinders shall not exceed 245 lb (111 kg) water capacity [nominal 100 lb (45 kg) propane capacity] each.
2. Cylinders shall comply with other applicable provisions of Section 5.2 of NFPA 58, and they shall be equipped as provided in Section 5.2.8 of NFPA 58.
3. Cylinders shall be marked in accordance with 5.2.8.1 and 5.2.8.2 of NFPA 58.
4. Cylinders with propane capacities greater than 2 lb (0.9 kg) shall be equipped as provided in Table 5.2.8.4.1(D) of NFPA 58, and an excess-flow valve shall be provided for vapor service when used indoors.
5. Cylinder valves shall be protected in accordance with 5.2.6.1 of NFPA 58.
6. Cylinders having water capacities greater than 2.7 lb (1.2 kg) and connected for use shall stand on a firm and substantially level surface.
7. Cylinders shall be secured in an upright position if necessary.
8. Cylinders and the valve-protecting devices used with them shall be oriented to minimize the possibility of impingement of the pressure relief device discharge on the cylinder and adjacent cylinders. [58:6.2022.2.1]

69.3.1012.2.2

Manifolds and fittings connecting cylinders to pressure regulator inlets shall be designed for at least 250 psig (1.7 MPag) service pressure. [58:6.2022.2.2]

69.3.1012.2.3

Piping shall comply with Section 5.10 of NFPA 58 and shall have a pressure rating of 250 psig (1.7 MPag). [58:6.2022.2.3]
Liquid piping and vapor piping at pressures above 125 psig (0.9 MPag) shall be installed in accordance with 6.911.3 of NFPA 58. [58:6.2022.2.4]

69.3.1012.2.5
Hose, hose connections, and flexible connectors shall comply with the following:
(1) Hose used at pressures above 5 psig (34 kPag) shall be designed for a pressure of at least 350 psig (2.4 MPag).
(2) Hose used at a pressure of 5 psig (34 kPag) or less and used in agricultural buildings not normally occupied by the public shall be designed for the operating pressure of the hose.
(3) Hose shall comply with 5.910.6 of NFPA 58.
(4) Hose shall be installed in accordance with 6.2123.3 of NFPA 58.
(5) Hose shall be as short as practical, without kinking or straining the hose or causing it to be close enough to a burner to be damaged by heat.
(6) Hoses greater than 10 ft (3 m) in length shall be protected from damage. [58:6.2022.2.5]

69.3.1012.2.6
Portable heaters, including salamanders, shall comply with the following:
(1) Portable heaters shall be equipped with an approved automatic device to shut off the flow of gas to the main burner and to the pilot, if used, in the event of flame extinguishment or combustion failure.
(2) Portable heaters shall be self-supporting unless designed for cylinder mounting.
(3) Portable heaters shall not be installed utilizing cylinder valves, connectors, regulators, manifolds, piping, or tubing as structural supports.
(4) Portable heaters having an input of more than 50,000 Btu/hr (53 MJ/hr) shall be equipped with either a pilot that must be lighted and proved before the main burner can be turned on or an approved electric ignition system. [58:6.2022.2.6]

69.3.1012.2.7
The provisions of 69.3.1012.2.6 shall not be applicable to the following:
(1) Tar kettle burners, hand torches, or melting pots
(2) Portable heaters with less than 7500 Btu/hr (8 MJ/hr) input if used with cylinders having a maximum water capacity of 2.7 lb (1.2 kg) and filled with not more than 16.8 oz (0.522 kg) of LP-Gas [58:6.2022.2.7]

69.3.1012.3 Buildings Under Construction or Undergoing Major Renovation.

69.3.1012.3.1
Where cylinders are used and transported in buildings or structures under construction or undergoing major renovation and such buildings are not occupied by the public, the requirements of 69.3.1012.3.2 through 69.3.1012.3.10 shall apply. [58:6.2022.4.1]

69.3.1012.3.2
The use and transportation of cylinders in the unoccupied portions of buildings or structures under construction or undergoing major renovation that are partially occupied by the public shall be approved by the AHJ. [58:6.2022.4.2]

69.3.1012.3.3
Cylinders, equipment, piping, and appliances shall comply with 69.3.1012.2. [58:6.2022.4.3]

69.3.1012.3.4
Heaters used for temporary heating shall be located at least 6 ft (1.8 m) from any cylinder. (See 69.3.1012.3.5 for an exception to this requirement.) [58:6.2022.4.4]

69.3.1012.3.5
Integral heater-cylinder units specifically designed for the attachment of the heater to the cylinder, and designed and installed to prevent direct or radiant heat application to the cylinder shall be exempt from the spacing requirement of 69.3.1012.3.4. [58:6.2022.4.5]

69.3.1012.3.6
Blower-type and radiant-type units shall not be directed toward any cylinder within 20 ft (6.1 m). [58:6.2022.4.6]

69.3.1012.3.7
If two or more heater-cylinder units of either the integral or nonintegral type are located in an unpartitioned area on the same floor, the cylinder(s) of each such unit shall be separated from the cylinder(s) of any other such unit by at least 20 ft (6.1 m). [58:6.2022.4.7]

69.3.1012.3.8
If heaters are connected to cylinders manifolded together for use in an unpartitioned area on the same floor, the total water capacity of cylinders manifolded together serving any one heater shall not be greater than 735 lb (333 kg) [nominal 300 lb (136 kg) propane capacity]. If there is more than one such manifold, it shall be separated from any other by at least 20 ft (6.1 m). [58:6.2022.4.8]

69.3.1012.3.9
Where cylinders are manifolded together for connection to a heater(s) on another floor, the following shall apply.
(1) Heaters shall not be installed on the same floors with manifolded cylinders.
(2) The total water capacity of the cylinders connected to any one manifold shall not be greater than 2450 lb (1111 kg) [nominal 1000 lb (454 kg) propane capacity]
(3) Manifolds of more than 735 lb (333 kg) water capacity [nominal 300 lb (136 kg) propane capacity], if located in the same unpartitioned area, shall be separated from each other by at least 50 ft (15 m). [58:6.2022.4.9]

69.3.1012.3.10
Where compliance with the provisions of 69.3.1012.3.6 through 69.3.1012.3.9 is impractical, alternate installation provisions shall be allowed with the approval of the AHJ. [58:6.2022.4.10]

69.3.1012.4 Buildings Undergoing Minor Renovation When Frequented by the Public.

69.3.1012.4.1
Cylinders used and transported for repair or minor renovation in buildings frequented by the public during the hours the public normally occupies the building shall comply with the following:
(1) The maximum water capacity of individual cylinders shall be 50 lb (23 kg) [nominal 20 lb (9.1 kg) propane capacity], and the number of cylinders in the building shall not exceed the number of workers assigned to the use of the propane.
(2) Cylinders having a water capacity greater than 2.7 lb (1.2 kg) shall not be left unattended. [58:6.2022.5.1]

69.3.1012.4.2
During the hours the building is not open to the public, cylinders used and transported within the building for repair or minor renovation and with a water capacity greater than 2.7 lb (1.2 kg) shall not be left unattended. [58:6.2022.5.2]

69.3.1012.5 Buildings Housing Industrial Occupancies.

69.3.1012.5.1
Cylinders used in buildings housing industrial occupancies for processing, research, or experimental purposes shall comply with 69.3.1012.5.1.1 and 69.3.1012.5.1.2. [58:6.2022.6.1]

69.3.1012.5.1.1
If cylinders are manifolded together, the total water capacity of the connected cylinders shall be not more than 735 lb (333 kg) [nominal 300 lb (136 kg) propane capacity]. If there is more than one such manifold in a room, it shall be separated from any other by at least 20 ft (6.1 m). [58:6.2022.6.1(A)]

69.3.1012.5.1.2
The amount of LP-Gas in cylinders for research and experimental use in the building shall be limited to the smallest practical quantity. [58:6.2022.6.1(B)]

69.3.1012.5.2
The use of cylinders to supply fuel for temporary heating in buildings housing industrial occupancies with essentially noncombustible contents shall comply with the requirements in 69.3.1012.3 for cylinders in buildings under construction. [58:6.2022.6.2]

69.3.1012.5.3
The use of fuel cylinders for temporary heating shall be permitted only where portable equipment for space heating is essential and a permanent heating installation is not practical. [58:6.2022.6.3]

69.3.1012.6 Buildings Housing Educational and Institutional Occupancies.

69.3.1012.6.1
The use of cylinders in classrooms shall be prohibited unless they are used temporarily for classroom demonstrations in accordance with 69.3.1012.8.1. [58:6.2022.7.1]

69.3.1012.6.2
Where cylinders are used in buildings housing educational and institutional laboratory occupancies for research and experimental purposes, the following shall apply:

(1) The maximum water capacity of individual cylinders used shall be 50 lb (23 kg) [nominal 20 lb (9.1 kg) propane capacity] if used in educational occupancies and 12 lb (5.4 kg) [nominal 5 lb (2 kg) propane capacity] if used in institutional occupancies.

(2) If more than one such cylinder is located in the same room, the cylinders shall be separated by at least 20 ft (6.1 m).

(3) Cylinders not connected for use shall be stored in accordance with Chapter 8 of NFPA 58.

(4) Cylinders shall not be stored in a laboratory room. [58:6.2022.7.2]

69.3.1012.7 Temporary Heating and Food Service Appliances in Buildings in Emergencies.

69.3.1012.7.1
Cylinders shall not be used in buildings for temporary emergency heating purposes except when all of the following conditions are met:

(1) The permanent heating system is temporarily out of service.

(2) Heat is necessary to prevent damage to the buildings or contents.

(3) The cylinders and heaters comply with, and are used and transported in accordance with, 69.3.1012.2 and 69.3.1012.3.

(4) The temporary heating equipment is not left unattended.

(5) Air for combustion and ventilation is provided in accordance with NFPA 54. [58:6.2022.8.1]

69.3.1012.7.2
When a public emergency has been declared and gas, fuel, or electrical service has been interrupted, portable listed LP-Gas commercial food service appliances meeting the requirements of 69.3.1012.8.4 shall be permitted to be temporarily used inside affected buildings. [58:6.2022.8.2]

69.3.1012.7.3
The portable appliances used shall be discontinued and removed from the building at the time the permanently installed appliances are placed back in operation. [58:6.2022.8.3]
69.3.1012.8 Use in Buildings for Demonstrations or Training, and Use of Small Cylinders for Self-Contained Torch Assemblies and Food Service Appliances.

69.3.1012.8.1 Cylinders used temporarily inside buildings for public exhibitions or demonstrations, including use in classroom demonstrations, shall be in accordance with the following:
(1) The maximum water capacity of a cylinder shall be 12 lb (5.4 kg) [nominal 5 lb (2 kg) propane capacity].
(2) If more than one such cylinder is located in a room, the cylinders shall be separated by at least 20 ft (6.1 m). [58:6.2022.9.1]

69.3.1012.8.2 Cylinders used temporarily in buildings for training purposes related to the installation and use of LP-Gas systems shall be in accordance with the following:
(1) The maximum water capacity of individual cylinders shall be 245 lb (111 kg) [nominal 100 lb (45 kg) propane capacity], but not more than 20 lb (9.1 kg) of propane shall be placed in a single cylinder.
(2) If more than one such cylinder is located in the same room, the cylinders shall be separated by at least 20 ft (6.1 m).
(3) The training location shall be acceptable to the AHJ.
(4) Cylinders shall be promptly removed from the building when the training class has terminated. [58:6.2022.9.2]

69.3.1012.8.3* Cylinders used in buildings as part of approved self-contained torch assemblies or similar appliances shall be in accordance with the following:
(1) Cylinders used in buildings shall comply with ANSI/UL 147A, Standard for Nonrefillable (Disposable) Type Fuel Gas Cylinder Assemblies.
(2) Cylinders shall have a maximum water capacity of 2.7 lb (1.2 kg). [58:6.2022.9.3]

69.3.1012.8.4 Cylinders used with commercial food service appliances shall be used inside restaurants and in attended commercial food catering operations in accordance with the following:
(1) Cylinders and appliances shall be listed.
(2) Commercial food service appliances shall not have more than two 10 oz (296 ml) nonrefillable butane gas cylinders, each having a maximum capacity of 1.08 lb (0.490 kg).
(3) Cylinders shall comply with ANSI/UL 147B, Standard for Nonrefillable (Disposable) Type Metal Container Assemblies for Butane.
(4) Cylinders shall be connected directly to the appliance and shall not be manifolded.
(5) Cylinders shall be an integral part of the listed, approved, commercial food service device and shall be connected without the use of a rubber hose.
(6) Storage of cylinders shall be in accordance with 8.3.1 of NFPA 58. [58:6.2022.9.4]

69.3.1012.9 Cylinders on Roofs or Exterior Balconies.

69.3.1012.9.1 Where cylinders are installed permanently on roofs of buildings, the buildings shall be of fire-resistant construction or noncombustible construction having essentially noncombustible contents, or of other construction or contents that are protected with automatic sprinklers. [58:6.2022.11.1]

69.3.1012.9.1.1
The total water capacity of cylinders connected to any one manifold shall be not greater than 980 lb (445 kg) [nominal 400 lb (181 kg) propane capacity]. If more than one manifold is located on the roof, it shall be separated from any other by at least 50 ft (15 m). [58:6.2022.11.1(A)]

69.3.10.12
Cylinders shall be located in areas where there is free air circulation, at least 10 ft (3 m) from building openings (such as windows and doors), and at least 20 ft (6.1 m) from air intakes of air-conditioning and ventilating systems. [58:6.2022.11.1(B)]

69.3.10.13
Cylinders shall not be located on roofs that are entirely enclosed by parapets more than 18 in. (460 mm) high unless the parapets are breached with low-level ventilation openings not more than 20 ft (6.1 m) apart, or unless all openings communicating with the interior of the building are at or above the top of the parapets. [58:6.2022.11.1(C)]

69.3.10.14
Piping shall be in accordance with 69.3.10.2.3 through 69.3.10.2.5. [58:6.2022.11.1(D)]

69.3.10.15
Hose shall not be used for connection to cylinders. [58:6.2022.11.1(E)]

69.3.10.16
The fire department shall be advised of each installation. [58:6.2022.11.1(F)]

69.3.10.1.6
Cylinders having water capacities greater than 2.7 lb (1 kg) [nominal 1 lb (0.5 kg) LP-Gas capacity] shall not be located on decks or balconies of dwellings of two or more living units above the first floor unless they are served by exterior stairways. [58:6.2022.11.2]

69.3.14-13 Installation of Appliances.

69.3.14.1 Installation of Patio Heaters.

69.3.14.1.1
Patio heaters utilizing an integral LP-Gas container greater than 1.08 lb (0.49 kg) propane capacity shall comply with 69.3.14.1.2 and 69.3.14.1.3. [58:6.2423.2.1]

69.3.14.1.2
Patio heaters shall be listed and used in accordance with their listing and the manufacturer’s instructions. [58:6.2423.2.2]

69.3.14.1.3
Patio heaters shall not be located within 5 ft (1.5 m) of exits from an assembly occupancy. [58:6.2423.2.3]

69.3.14.2.1 Hose for Portable Appliances.

69.3.14.2.1
The requirements of 69.3.14.13 shall apply to hoses used on the low-pressure side of regulators to connect portable appliances. [58:6.2423.3.1]

69.3.14.2.2
Where used inside buildings, the following shall apply:

1. The hose shall be the minimum practical length and shall be in accordance with 69.3.10.12.2.5.
2. The hose shall not extend from one room to another or pass through any partitions, walls, ceilings, or floors except as provided by 69.3.10.12.3.9.
3. The hose shall not be concealed from view or used in concealed locations. [58:6.2423.3.2]

69.3.14.2.3
Where installed outside of buildings, the hose length shall be permitted to exceed 10 ft (3.3 m) but shall be as short as practical. [58:6.2423.3.3]
69.3.1113.2.4
Hose shall be securely connected to the appliance. [58:6.2123.3.4]

69.3.1113.2.5
The use of rubber slip ends shall not be permitted. [58:6.2123.3.5]

69.3.1113.2.6
A shutoff valve shall be provided in the piping immediately upstream of the inlet connection of the hose. [58:6.2123.3.6]

69.3.1113.2.7
Where more than one such appliance shutoff is located near another, the valves shall be marked to indicate which appliance is connected to each valve. [58:6.2123.3.7]

69.3.1113.2.8
Hose shall be protected against physical damage. [58:6.2123.3.8]

69.3.12-14 LP-Gas Systems on Vehicles (Other Than Engine Fuel Systems).

69.3.1214 Application.
Subsection 69.3.12 14 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 [58:6.2426.1]

69.3.1214 Nonapplication.
Subsection 69.3.12 14 shall not apply to the following:
(1) Systems installed on mobile homes
(2) Systems installed on recreational vehicles
(3) Cargo tank vehicles, cargo tank vehicles (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

69.3.1214 Container Installation Requirements.

69.3.1214.3 Container Installation Requirements.

69.3.1214.3.1 Containers shall comply with 69.3.1214.3.1.1 through 69.3.1214.3.1.4. [58:6.2426.3.1]

69.3.1214.3.1.1 ASME mobile containers shall in accordance with one of the following:
(1) A MAWP of 312 psig (2.2 MPag) or higher where installed in enclosed spaces of vehicles
(2) A MAWP of 312 psig (2.2 MPag) or higher where installed on passenger vehicles
(3) A MAWP of 250 psig (1.7 MPag) or higher for containers where installed on the exterior of nonpassenger vehicles

69.3.1214.3.1.2 LP-Gas fuel containers used on passenger-carrying vehicles shall not exceed 200 gal (0.8 m³) aggregate water capacity. [58:6.2426.3.1(B)]

69.3.1214.3.1.3 The capacity of individual LP-Gas containers on highway nonpassenger vehicles shall be 1000 gal (3.8 m³) or in accordance with Table 69.3.12.3.1.1. U.S. Department of Transportation regulations.

69.3.1214.3.1.3.1 Maximum Capacities of Individual LP-Gas Containers Installed on LP-Gas Highway Vehicles
<table>
<thead>
<tr>
<th>Vehicle</th>
<th>Maximum Container Water Capacity</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>gal</td>
</tr>
<tr>
<td>Passenger vehicle</td>
<td>200</td>
</tr>
<tr>
<td>Nonpassenger vehicle</td>
<td>300</td>
</tr>
<tr>
<td>Road-surfacing vehicle</td>
<td>1000</td>
</tr>
<tr>
<td>Cargo tank vehicle</td>
<td>Not limited by NFPA 58</td>
</tr>
</tbody>
</table>

The capacity of cargo tank motor vehicles shall not be limited by this code. [58:6.26.3.1(D)]

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(DE)]

ASME containers and cylinders utilized for the purposes covered by 69.3.12.14 shall not be installed, transported, or stored (even temporarily) inside any vehicle covered by 69.3.12.14, except for ASME containers installed in accordance with 69.3.12.14.3.4.9, Chapter 9 of NFPA 58, or DOT regulations. [58:6.26.3.2]

The LP-Gas supply system, including the containers, shall be installed either on the outside of the vehicle or in a recess or cabinet vapor tight 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]

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

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

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)]

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)]

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)]
All container valves, appurtenances, and connections shall be protected to prevent damage from accidental contacts 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.  

Permanently mounted ASME containers shall be located on the vehicle to provide the protection specified in 69.3.1214.3.4.5.  

Cylinders shall have permanent protection for cylinder valves and connections.  

Where cylinders are located on the outside of a vehicle, weather protection shall be provided.  

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.  

Cylinders installed on portable kettles alongside the kettle, on the vehicle frame, or on road surface heating equipment shall be protected from radiant or convected heat from open flame or other burners by the use of a heat shield or by the location of the cylinder(s) on the vehicle. In addition, the following shall apply:

1. Cylinder valves shall be closed when burners are not in use.
2. Cylinders shall not be refilled while burners are in use as provided in 7.2.3.2(B) of NFPA 58.  

Installation of Container Appurtenances.  

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 69.3.1214.3.3.
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.  

Regulators shall be installed in accordance with 6.810.2 of NFPA 58 and 69.3.1214.4.2.1 through 69.3.1214.4.2.5.  

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.
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. [58:6.2426.4.2(B)]

69.3.1214.4.2.3
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. [58:6.2426.4.2(C)]

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 mm²) 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. [58:6.2426.4.2(D)]

69.3.1214.4.2.5
A regulator vent outlet shall be at least 2 in. (51 mm) above the compartment vent opening.

69.3.1214.5 Piping.
69.3.1214.5.1
Piping shall be installed in accordance with 6.911.3 of NFPA 58 and 69.3.1214.5.1.1 through 69.3.1214.5.1.13. [58:6.2426.5.1]

69.3.1214.5.1.1
Steel tubing shall have a minimum wall thickness of 0.049 in. (1.2 mm). [58:6.2426.5.1(A)]

69.3.1214.5.1.2
A flexible connector shall be installed between the regulator outlet and the fixed piping system to protect against expansion, contraction, jarring, and vibration strains. [58:6.2426.5.1(B)]

69.3.1214.5.1.3
Flexibility shall be provided in the piping between a cylinder and the gas piping system or regulator. [58:6.2426.5.1(C)]

69.3.1214.5.1.4
Flexible connectors shall be installed in accordance with 6.911.6 of NFPA 58. [58:6.2426.5.1(D)]

69.3.1214.5.1.5
Flexible connectors longer than the length allowed in the Code, or fuel lines that incorporate hose, shall be used only where approved. [58:6.2426.5.1(E)]

69.3.1214.5.1.6
The 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. [58:6.2426.5.1(F)]

69.3.1214.5.1.7
Piping shall be installed in a protected location. [58:6.2426.5.1(G)]

69.3.1214.5.1.8
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. [58:6.2426.5.1(H)]
Gas piping shall be installed to enter the vehicle through the floor directly beneath or adjacent to the appliance served. [58:6.2426.5.1(I)]

If a branch line is installed, the tee connection shall be located in the main gas line under the floor and outside the vehicle. [58:6.2426.5.1(J)]

Exposed parts of the fixed piping system either shall be of corrosion-resistant material or shall be coated or protected to minimize exterior corrosion. [58:6.2426.5.1(K)]

Hydrostatic relief valves shall be installed in isolated sections of liquid piping as provided in Section 6.13 of NFPA 58. [58:6.2426.5.1(L)]

Piping systems, including hose, shall be pressure tested and proven free of leaks in accordance with Section 6.14 of NFPA 58. [58:6.2426.5.1(M)]

There shall be no fuel connection between a tractor and trailer or other vehicle units. [58:6.2426.5.2]

Equipment shall be installed in accordance with the manufacturer’s recommendations and, in the case of approved equipment, as provided in the approval. [58:6.2426.6.1]

Installation shall be made in accordance with Section 6.18 of NFPA 58 and 69.3.1214.6.1 and 69.3.1214.6.2. [58:6.2426.6.2]

All appliances covered by 69.3.1214.7 installed on vehicles shall be approved. [58:6.2426.7.2]

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. [58:6.2426.7.3]

Gas-fired heating appliances shall be equipped with shutoffs in accordance with 5.2022.7(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. [58:6.2426.7.4]

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. [58:6.2426.7.5]
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. [58:6.2426.7.6]

69.3.1214.7.7
Appliances installed in the cargo space of a vehicle shall be readily accessible whether the vehicle is loaded or empty. [58:6.2426.7.7]

69.3.1214.7.8
Appliances shall be constructed or otherwise protected to minimize possible damage or impaired operation due to cargo shifting or handling. [58:6.2426.7.8]

69.3.1214.7.9
Appliances shall be located so that a fire at any appliance will not block egress of persons from the vehicle. [58:6.2426.7.9]

69.3.1214.7.10
A permanent caution plate shall be affixed to either the appliance or the vehicle outside of any enclosure, shall be adjacent to the container(s), and shall include the following instructions:

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. [58:6.2426.7.10]

69.3.1214.7.11
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. [58:6.2426.7.11]

69.3.1214.8-General Precautions.

69.3.1214.8.1
Mobile units including mobile kitchens and catering vehicles that contain hotplates and other cooking equipment shall be provided with at least one approved portable fire extinguisher rated in accordance with Section 13.6 and NFPA 10 at not less than 10-B:C. [58:6.2426.8.1]

69.3.1214.8.2
Where fire extinguishers have more than one letter classification, they can be considered as meeting the requirements of each letter class. [58:6.2426.8.2]

69.3.1214.9.1-Parking, Servicing, and Repair.

69.3.1214.9.1
Where vehicles with LP-Gas fuel systems used for purposes other than propulsion are parked, serviced, or repaired inside buildings, the requirements of 69.3.1214.9.2 through 69.3.1214.9.4 shall apply. [58:6.2426.9.1]

69.3.1214.9.2
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. [58:6.2426.9.2]

69.3.1214.9.3
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. [58:6.2426.9.3]

69.3.1214.9.4
The vehicle shall not be parked near sources of heat, open flames, or similar sources of ignition, or near unventilated pits. [58:6 2426.98.4]

69.3.13.15. Vehicle Fuel Dispenser and Dispensing Stations Systems

69.3.13.1 Application.

69.3.13.1.1 Subsection 69.3.13.15 includes the location, installation, and operation of vehicle fuel dispensers and dispensing stations systems. [58:6 2527.1.1]

69.3.13.1.2 The provisions of 69.3.2 and 69.3.34, as modified by 69.3.13.15, shall apply. [58:6 2527.1.2]

69.3.13.15. Location.

69.3.13.15.1 Location of vehicle fuel dispensers and dispensing stations systems shall be in accordance with Table 69.3.57.2.1. [58:6 2527.2.1]

69.3.13.15.2 Vehicle fuel dispensers and dispensing stations systems shall be located away from pits in accordance with Table 69.3.57.2.1, with no drains or blow-offs from the unit directed toward or within 15 ft (4.6 m) of a sewer system's opening. [58:6 2527.2.2]

69.3.13.15.3 General Installation Provisions.

69.3.13.15.3.1 Vehicle fuel dispensers and dispensing stations systems shall be installed in accordance with the manufacturer's installation instructions. [58:6 2527.3.1]

69.3.13.15.3.2 Vehicle fuel dispensers and dispensing stations systems shall not be located within a building or structure, unless they comply with Chapter 10 of NFPA 58. [58:6 2527.3.2]

69.3.13.15.3.3 Where a vehicle fuel dispenser or dispensing system is installed under a weather shelter or canopy, the area shall be ventilated and shall not be enclosed for more than 50 percent of its perimeter. [58:6 2527.3.3]

69.3.13.15.3.4 Control for the pump used to transfer LP-Gas through the unit into containers shall be provided at the device in order to minimize the possibility of leakage or accidental discharge. [58:6 2527.3.4]

69.3.13.15.3.5 A device that shuts off the flow of gas when flow exceeds the predetermined flow rate shall be installed as close as practical to the point where the dispenser hose connects. An excess-flow check valve or a differential back pressure valve shall be installed in or on the dispenser at the point at which the dispenser hose is connected to the liquid piping. [58:6 2527.3.5]

69.3.13.15.3.6 Piping and the dispensing hose shall be provided with hydrostatic relief valves in accordance with Section 6.13.19 of NFPA 58. [58:6 2527.3.6]

69.3.13.15.3.7 Protection against trespassing and tampering shall be in accordance with 6.19 of NFPA 58. [58:6 2527.3.7]
The container liquid withdrawal opening used with vehicle fuel dispensers and dispensing stations shall be equipped with one of the following:

1. An internal valve fitted for remote closure and automatic shutoff using thermal (fire) actuation
2. A positive shutoff valve that is located as close to the container as practical in combination with an excess-flow valve installed in the container, plus an emergency shutoff valve that is fitted for remote closure and installed downstream in the line as close as practical to the positive shutoff valve

An identified and accessible remote emergency shutoff device for either the internal valve or the emergency shutoff valve required by 69.3.1315.3.8(1) or (2) shall be installed not less than 3 ft (1 m) or more than 100 ft (30 m) from the liquid transfer point.

Emergency shutoff valves and internal valves that are fitted for remote closure as required in this section shall be tested annually for proper operation.

A manual shutoff valve and an excess-flow check valve shall be located in the liquid line between the pump and the dispenser inlet where the dispensing device is installed at a remote location and is not part of a complete storage and dispensing unit mounted on a common base.

Vehicle barrier protection (VBP) shall be provided for containers serving liquid dispensers where those containers are located within 10 ft of a vehicle thoroughfare or parking location. Such protection shall be either 69.3.1315.3.13.1 or 69.3.1315.3.13.2.

Concrete filled guard posts constructed of steel not less than 4 in. (102 mm) in diameter, with the following characteristics:

1. Spaced not more than 4 ft (1219 mm) between posts on center
2. Set not less than 3 ft (900 mm) deep in a concrete footing of not less than 15 in. (380 mm) diameter
3. Set with the top of the posts not less than 3 ft (900 mm) above ground
4. Located not less than 3 ft (900 mm) from the protected installation

Equivalent protection in lieu of guard posts shall be a minimum of 3 ft (900 mm) in height and shall resist a force of 42,000 lb (53,3759 N) applied 3 ft (900 mm) above the adjacent ground surface.

Where the dispenser is not mounted on a common base with its storage container and the dispensing unit is located within 10 ft of a vehicle thoroughfare, parking location, or a engine fuel filling station, the dispenser shall be provided with VBP.

Dispensers shall be protected from physical damage.
69.3.1315.3.16
A listed quick-acting shutoff valve shall be installed at the discharge end of the transfer hose. [58:6.2527.3.16]

69.3.1315.3.17
An identified and accessible switch or circuit breaker shall be installed outside at a location not less than 20 ft (6.1 m) or more than 100 ft (30.5 m) from the dispensing device(s) to shut off the power in the event of a fire, an accident, or other emergency. [58:6.2527.3.17]

69.3.1315.3.18
The markings for the switches or breakers shall be visible at the point of liquid transfer. [58:6.2527.3.18]

69.3.1315.4 Installation of Vehicle Fuel Dispensers.

69.3.1315.4.1
Hose shall comply with the following:
(1) Hose length shall not exceed 18 ft (5.5 m) unless approved by the AHJ.
(2) All hose shall be listed.
(3) When not in use, the hose shall be secured to protect the hose from damage. [58:6.2527.4.1]

69.3.1315.4.2
A listed emergency breakaway device shall be installed and shall comply with ANSI/UL 567, Standard for Emergency Breakaway Fittings, Swivel Connectors, and Pipe-Connection Fittings for Petroleum Products and LP-Gas, and be designed to retain liquid on both sides of the breakaway point, or other devices affording equivalent protection approved by the AHJ. [58:6.2527.4.2]

69.3.1315.4.3
Dispensing devices for LP-Gas Vehicle fuel dispensers shall be located as follows:
(1) Conventional systems shall be at least 10 ft (3.0 m) from any dispensing device for Class I or Class II liquids.
(2) Low-emission transfer systems in accordance with Section 6.2830.5 of NFPA 58 shall be at least 5 ft (2 m) from any dispensing device for Class I or Class II liquids. [58:6.2527.4.3]

69.4 LP-Gas Liquid Transfer.

69.4.1 Scope.

69.4.1.1
Section 69.4 applies to transfers of liquid LP-Gas from one container to another wherever this transfer involves connections and disconnections in the transfer system or the venting of LP-Gas to the atmosphere. [58:7.1.1]

69.4.1.2
Section 69.4 also applies to operational safety and methods for determining the quantity of LP-Gas permitted in containers. [58:7.1.2]

69.4.2 Operational Safety.

69.4.2.1 Transfer Personnel.

69.4.2.1.1
Transfer operations shall be conducted by qualified personnel meeting the provisions of Section 4.4 of NFPA 58. [58:7.2.1.1]

69.4.2.1.2
At least one qualified person shall remain in attendance at the transfer operation from the time connections are made until the transfer is completed, shutoff valves are closed, and lines are disconnected. [58:7.2.1.2]
69.4.2.1.3
Transfer personnel shall exercise caution to ensure that the LP-Gases transferred are those for which the transfer system and the containers to be filled are designed. [58:7.2.1.3]

69.4.2.2 Filling and Evacuating of Containers.
69.4.2.2.1
Transfer of LP-Gas to and from a container shall be accomplished only by qualified individuals trained in proper handling and operating procedures meeting the requirements of Section 4.4 of NFPA 58 and in emergency response procedures. [58:7.2.2.1]

69.4.2.2.2
When noncompliance with Section 5.2 and Section 5.7 of NFPA 58 is found, the container owner and user shall be notified in writing. [58:7.2.2.2]

69.4.2.2.3
Injection of compressed air, oxygen, or any oxidizing gas into containers to transfer LP-Gas liquid shall be prohibited. [58:7.2.2.3]

69.4.2.2.4
When evacuating a container owned by others, the qualified person(s) performing the transfer shall not inject any material other than LP-Gas into the container. [58:7.2.2.4]

69.4.2.2.5*
Valve outlets on refillable cylinders of 108 lb (49 kg) water capacity [nominal 45 lb (20 kg) propane capacity] or less shall be equipped with a redundant pressure-tight seal or one of the following listed connections: CGA 790, CGA 791, or CGA 810, as described in CGA V-1, Standard Compressed Gas Cylinder Valve Outlet and Inlet Connections. [58:7.2.2.5]

69.4.2.2.6
Where redundant pressure seals are used, they shall be in place whenever the cylinder is not connected for use. [58:7.2.2.6]

69.4.2.2.7
Nonrefillable (disposable) and new unused cylinders shall not be required to be equipped with valve outlet seals. [58:7.2.2.7]

69.4.2.2.8
Containers shall be filled only after determination that they comply with the design, fabrication, inspection, marking, and requalification provisions of NFPA 58. [58:7.2.2.8]

69.4.2.2.9
Prior to refilling a cylinder that has a cylinder sleeve, the cylinder sleeve shall be removed to facilitate the visual inspection of the cylinder. [58:7.2.2.9]

69.4.2.2.10 Reserved.

69.4.2.2.11 Reserved.

69.4.2.2.12 “Single trip,” “nonrefillable,” or “disposable” cylinders shall not be refilled with LP-Gas. [58:7.2.2.12]

69.4.2.2.13 Containers shall comply with the following with regard to service or design pressure requirements:
(1) The service pressure marked on the cylinder shall be not less than 80 percent of the vapor pressure of the LP-Gas for which the cylinder is designed at 130°F (54.4°C).
(2) The maximum allowable working pressure (MAWP) for ASME containers shall be in accordance with Table 5.2.4.2 of NFPA 58. [58:7.2.2.13]
Universal cylinders shall be permitted to be filled when in the vertical position or in the horizontal position when the positioning slot is in the correct orientation. [58:7.2.2.14]

69.4.2.2.12-15
Transfer of refrigerated product shall be made only into systems that are designed to accept refrigerated product. [58:7.2.2.1415]

69.4.2.2.13-16
A container shall not be filled if the container assembly does not meet the requirements for continued service. [58:7.2.2.1616]

69.4.2.2.14-17
Transfer hoses larger than \( \frac{1}{2} \) in. (12 mm) internal diameter shall not be used for making connections to individual cylinders being filled indoors. [58:7.2.2.1717]

69.4.2.3 Arrangement and Operation of Transfer Systems.

69.4.2.3.1
Public access to areas where LP-Gas is stored and transferred shall be prohibited, except where necessary for the conduct of normal business activities. [58:7.2.3.1]

69.4.2.3.2
Sources of ignition shall be turned off during transfer operations, while connections or disconnections are made, or while LP-Gas is being vented to the atmosphere. [58:7.2.3.2]

69.4.2.3.2.1
Internal combustion engines within 15 ft (4.6 m) of a point of transfer shall be shut down while such transfer operations are in progress, with the exception of the following:

1) Engines of LP-Gas cargo tank vehicles, constructed and operated in compliance with Chapter 9 of NFPA 58, while such engines are driving transfer pumps or compressors on these vehicles to load containers in accordance with 6.56.2.2 of NFPA 58

2) Portable engines with shielded ignition systems and exhaust system spark-arresters located at least 10 ft (3 m) from a point of transfer while such engines are driving transfer pumps or compressors

23) Engines for industrial (and forklift) trucks powered by LP-Gas used in buildings as provided in Section 11.13 of NFPA 58 [58:7.2.3.2(A)]

69.4.2.3.2.2
Smoking, open flame, portable electrical tools, and extension lights capable of igniting LP-Gas shall not be permitted within 25 ft (7.6 m) of a point of transfer while filling operations are in progress. [58:7.2.3.2(B)]

69.4.2.3.2.3
Metal cutting, grinding, oxygen–fuel gas cutting, brazing, soldering, or welding shall not be permitted within 35 ft (10.7 m) of a point of transfer while filling operations are in progress. [58:7.2.3.2(C)]

69.4.2.3.2.4
Materials that have been heated above the ignition temperature of LP-Gas shall be cooled before LP-Gas transfer is started. [58:7.2.3.2(D)]

69.4.2.3.2.5
Sources of ignition shall be turned off during the filling of any LP-Gas container on the vehicle. [58:7.2.3.2(E)]

69.4.2.3.3
Cargo tank vehicles unloading into storage containers shall be at least 10 ft (3.0 m) from the container and so positioned that the shutoff valves on both the truck and the container are readily accessible. [58:7.2.3.3]
69.4.2.3.4
The cargo tank vehicle shall not transfer LP-Gas into dispensing station storage system while parked on a public way. [58:7.2.3.4]

69.4.2.3.5
Transfers to containers serving agricultural or industrial equipment requiring refueling in the field shall comply with 69.4.2.3.5.1 and 69.4.2.3.5.2. [58:7.2.3.5]

69.4.2.3.5.1*
Where the intake of air-moving equipment is less than 50 ft (15 m) from a point of transfer, it shall be shut down while containers are being refilled. [58:7.2.3.5(A)]

69.4.2.3.5.2
Equipment employing open flames or equipment with integral containers shall be shut down while refueling. [58:7.2.3.5(B)]

69.4.2.3.6
During the time railroad tank cars are on sidings for loading or unloading, the following shall apply:
(1) A caution sign, with wording such as “STOP. TANK CAR CONNECTED,” shall be placed at the active end(s) of the siding while the car is connected, as required by DOT regulations.
(2) Wheel chocks shall be placed to prevent movement of the car in either direction. [58:7.2.3.6]

69.4.2.3.7
Where a hose or swivel-type piping is used for loading or unloading railroad tank cars, it shall be protected as follows:
(1) An emergency shutoff valve shall be installed at the railroad tank car end of the hose or swivel-type piping where flow into or out of the railroad tank car is possible.
(2) An emergency shutoff valve or a backflow check valve shall be installed on the railroad tank car end of the hose or swivel piping where flow is only into the railroad tank car. [58:7.2.3.7]

69.4.2.3.8
Where cargo tank vehicles are filled directly from railroad tank cars on a private track with nonstationary storage tanks involved, the following requirements shall be met:
(1) Transfer protection shall be provided in accordance with 69.3.8.10.
(2) Ignition source control shall be in accordance with Section 6.22.25 of NFPA 58.
(3) Control of ignition sources during transfer shall be provided in accordance with 69.4.2.3.2.
(4) Fire extinguishers shall be provided in accordance with 9.4.7 of NFPA 58.
(5) Transfer personnel shall meet the provisions of 69.4.2.1.
(6) Cargo tank vehicles shall meet the requirements of 69.4.2.3.
(7) The points of transfer shall be located in accordance with 69.3.57.2.1 with respect to exposures.
(8) Provision for anchorage and breakaway shall be provided on the cargo tank vehicle side for transfer from a railroad tank car directly into a cargo tank vehicle.
(9) The provisions of Chapter 14 of NFPA 58 shall apply to all LP-Gas transfers performed in accordance with 69.4.2.3.8. [58:7.2.3.8]

69.4.2.3.9
Where cargo tank vehicles are filled from other cargo tank vehicles or cargo tanks, the following requirements shall apply:
(1) Transfer between cargo tanks or cargo tank vehicles where one is used as a bulk plant shall be temporary installations that comply with 4.3.2, 6.42.1.1, 6.42.1.2, 6.42.4 through 6.42.6 of NFPA 58, and 69.4.2.3.1.
Arrangements and operations of the transfer system shall be in accordance with the following:
(a) The point of transfer shall be in accordance with Table 69.3.57.2.1.
(b) Sources of ignition within the transfer area shall be controlled during the transfer operation as specified in 69.4.2.3.2.
(c) Fire extinguishers shall be provided in accordance with 9.4.7 of NFPA 58.
(3) Cargo tanks shall comply with the requirements of 69.4.2.2.8.
(4) Provisions designed either to prevent a pull-away during a transfer operation or to stop the flow of products from both cargo tank vehicles or cargo tanks in the event of a pull-away shall be incorporated.
(5) Off-truck remote shutoff devices that meet 49 CFR 173.315(n) requirements and are installed on the cargo tank vehicle unloading the product shall satisfy the requirements of 69.4.2.3.9(4).
(6) Cargo tank vehicle LP-Gas transfers that are for the sole purpose of testing, maintaining, or repairing the cargo tank vehicle shall be exempt from the requirements of 69.4.2.3.9(1).

**69.4.2.4 Hose Inspection.**

69.4.2.4.1 Hose assemblies shall be observed for leakage or for damage that could impair their integrity before each use. [58:7.2.4.1]

69.4.2.4.2 The hose assemblies specified in 69.4.2.4.1 shall be inspected at least annually. [58:7.2.4.2]

69.4.2.4.3 Inspection of pressurized hose assemblies shall include inspection for the following:
(a) Damage to outer cover that exposes reinforcement
(b) Kinked or flattened hose
(c) Soft spots or bulges in hose
(d) Couplings that have slipped on the hose, are damaged, have missing parts, or have loose bolts
(e) Leakage other than permeability leakage [58:7.2.4.3]

69.4.2.4.4 Hose assemblies shall be replaced, repaired, or continued in service based on the results of the inspection. [58:7.2.4.4]

69.4.2.4.5 Leaking or damaged hose shall be immediately repaired or removed from service. [58:7.2.4.5]

**69.4.3 Venting LP-Gas to the Atmosphere.**

69.4.3.1 General.

LP-Gas in either liquid or vapor form shall not be vented to the atmosphere unless it is vented under the following conditions:
(a) Venting of LP-Gas shall be permitted where the maximum flow from fixed liquid level, rotary, or slip tube gauges does not exceed that from a No. 54 drill orifice.
(b) Venting of LP-Gas between shutoff valves before disconnecting the liquid transfer line from the container shall be permitted.
(c) Venting of LP-Gas, where necessary, shall be permitted to be performed by the use of bleeder valves.
(d) Venting of LP-Gas shall be permitted for the purposes described in 69.4.3.1(1) and 69.4.3.1(2) within structures designed for container filling in accordance with Chapter 10 of NFPA 58.
(e) Venting of LP-Gas listed liquid transfer pumps using such vapor as a source of energy shall be permitted where the rate of discharge does not exceed the discharge from a No. 31 drill size orifice.
(6) Venting of LP-Gas for purging in accordance with 7.3.2 of NFPA 58 shall be permitted.
(7) Venting of LP-Gas shall be permitted for emergencies.
(8) Venting of LP-Gas vapor utilized as the pressure source in remote shutdown systems for internal valves and emergency shutoff valves shall be permitted. [58:7.3.1]

69.5 Storage of Cylinders Awaiting Use, Resale, or Exchange.

69.5.1 Scope.

69.5.1.1 The provisions of Section 69.5 apply to the storage of cylinders of 1000 lb (454 kg) water capacity or less, whether filled, partially filled, or empty, as follows:

(1) At consumer sites or dispensing stations, where not connected for use
(2) In storage for resale or exchange by dealer or reseller [58:8.1.1]

69.5.1.2 Section 69.5 does not apply to new or unused cylinders. [58:8.1.2]

69.5.1.3 Section 69.5 does not apply to cylinders stored at bulk plants. [58:8.1.3]

69.5.2 General Provisions.

69.5.2.1 General Location of Cylinders.

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

69.5.2.1.2 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]

69.5.2.1.3 Cylinders stored in buildings in accordance with 69.5.3 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]

69.5.2.1.4 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 69.5.3.1, 69.5.3.2.1, and 69.5.3.3.1. [58:8.2.1.4]

69.5.2.1.5 Cylinders shall not be stored on roofs. [58:8.2.1.5]

69.5.2.2 Protection of Valves on Cylinders in Storage.

69.5.2.2.1 Cylinder valves shall be protected as required by 69.2.1.2.1 and 69.4.2.2.5. [58:8.2.2.1]

69.5.2.2.2 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]

69.5.2.2.3 Valve outlets on cylinders less than 108 lb (49 kg) water capacity [nominal 45 lb (20 kg) propane capacity] shall be plugged, capped, or seated in accordance with 69.4.2.2.5. [58:8.2.2.3]

69.5.3 Storage Within Buildings.

69.5.3.1 General.
Storage of cylinders in buildings shall be in accordance with Table 69.5.3.1(a) or Table 69.5.3.1(b) or the requirements of 69.5.3. [58:8.3.1]

**Table 69.5.3.1(a) Maximum Allowable Storage Quantities of LP-Gas in Other Than Industrial, Storage, and Mercantile Occupancies**

<table>
<thead>
<tr>
<th>Occupancy</th>
<th>Assembly</th>
<th>Educational</th>
<th>Day Care</th>
<th>Health Care</th>
<th>Ambulatory Health Care</th>
<th>Detention and Correctional</th>
<th>One- and Two-Family Dwellings</th>
<th>Lodging or Rooming House</th>
<th>Hotel and Dormitory</th>
<th>Apartment</th>
<th>Residential Board and Care</th>
<th>Business</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Maximum Allowable Quantity (MAQ):</strong></td>
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<tr>
<td>Storage (state units: lb, gal, etc.)</td>
<td>2 lb</td>
<td>2 lb</td>
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<tr>
<td><strong>MAQ increases for:</strong></td>
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<tr>
<td>Total (including cabinets)</td>
<td>2 lb</td>
<td>2 lb</td>
<td>2 lb</td>
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<td>Total for suppression</td>
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<tr>
<td>Total for both cabinets and suppression</td>
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<td>Attended catered</td>
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<tr>
<td>Occupancy</td>
<td>Assembly</td>
<td>Educational</td>
<td>Day Care</td>
<td>Health Care</td>
<td>Ambulatory Health Care</td>
<td>Detention and Correctional</td>
<td>One- and Two-Family Dwellings</td>
<td>Lodging or Rooming House</td>
<td>Hotel and Dormitory</td>
<td>Apartment</td>
<td>Residential Board and Care</td>
<td>Business</td>
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<tr>
<td>food service per NFPA 58 in 10 oz maximum cylinders</td>
<td>15 lb</td>
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<td>Additional 10 oz cylinders w/ 2-hr fire wall</td>
<td>15 lb</td>
<td>15 lb</td>
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<td>Other</td>
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<tr>
<td>Total (including threshold) for other</td>
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<td>20 lb</td>
<td>0</td>
<td>5 lb</td>
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<tr>
<td>Flame effects per NFPA 160. Additional 20 lb</td>
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<td>In labs, not in classrooms. Additional 20 lb units with</td>
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<tr>
<td>In labs only. Additional 5 lb units with</td>
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<td>Amounts per dwelling</td>
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</tr>
</tbody>
</table>
### Table 69.5.3.1(b) Maximum Allowable Storage Quantities of LP-Gas in Mercantile, Industrial, and Storage Occupancies

<table>
<thead>
<tr>
<th>Occupancy</th>
<th>Mercantile</th>
<th>Industrial</th>
<th>Storage</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Maximum Allowable Quantity (MAQ):</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Storage (state units: lb, gal, etc.)</td>
<td>200 lb (1 lb maximum/cylinder)</td>
<td>300 lb</td>
<td>300 lb</td>
</tr>
<tr>
<td><strong>MAQ increases for:</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total (including threshold) for cabinets</td>
<td>200 lb</td>
<td>300 lb</td>
<td>300 lb</td>
</tr>
<tr>
<td>Total (including threshold) for suppression</td>
<td>200 lb</td>
<td>300 lb</td>
<td>300 lb</td>
</tr>
<tr>
<td>Total (including threshold) for both cabinets and suppression</td>
<td>200 lb</td>
<td>300 lb</td>
<td>300 lb</td>
</tr>
<tr>
<td>Total (including threshold) for other (describe)</td>
<td>1000 lb</td>
<td>Additional 300 lb</td>
<td>10,000 lb</td>
</tr>
</tbody>
</table>

For SI units, 1 lb = 0.45 kg, 1 oz = 0.028 kg.

Separation of groups of 200 lb by 50 ft and a sprinkler density of 0.300 gpm (1.1 L/min) over 300 ft in special rooms or buildings per

[58: Table 8.3.1(a)]
### Occupancy

<table>
<thead>
<tr>
<th>Mercantile</th>
<th>Industrial</th>
<th>Storage</th>
</tr>
</thead>
<tbody>
<tr>
<td>the most remote 2000 ft² (18.6 m²) area and 250 gpm (946 L/min) hose stream allowance</td>
<td>Chapter 10 of NFPA 58</td>
<td></td>
</tr>
</tbody>
</table>

[58: Table 8.3.1(b)]

For SI units, 1 lb = 0.45 kg; 1 gpm = 3.8 L/min; 1 ft = 0.3 m; 1 ft² = 0.09 m².

### 69.5.3.2 Storage Within Buildings Frequent by the Public.

#### 69.5.3.2.1

The quantity of LP-Gas in cylinders stored or displayed shall not exceed 200 lb (91 kg) in one location, with additional storage separated by 50 ft (15 m). The maximum quantity to be stored in one building shall not exceed 1000 lb (454 kg). [58:8.3.2.1]

#### 69.5.3.2.1.1

Where the total quantity stored in a building exceeds 200 lb (91 kg), an approved sprinkler system that, at a minimum, meets the requirement of Section 13.3 and NFPA 13 for Ordinary Hazard (Group 2) shall be installed. [58:8.3.2.1(A)]

#### 69.5.3.2.2

The sprinkler density shall be 0.300 gpm (12.2 L/min) over the most remote 2000 ft² (18.6 m²) area, and the hose stream allowance shall be 250 gpm (946 L/min). [58:8.3.2.1(B)]

#### 69.5.3.2.3

In restaurants and at food service locations, storage of 10 oz (283 g) butane nonrefillable containers shall be limited to not more than 24 containers and 24 additional 10 oz (283 g) butane nonrefillable containers stored in another location within the building where constructed with at least 2-hour fire wall protection. [58:8.3.2.3]

### 69.5.3.3 Storage Within Buildings Not Frequent by the Public.

#### 69.5.3.3.1

The maximum quantity of LP-Gas allowed in one storage location shall not exceed 735 lb (334 kg) water capacity [nominal 300 lb (136 kg) propane capacity]. [58:8.3.3.1]

#### 69.5.3.3.2

Where additional storage locations are required on the same floor within the same building, they shall be separated by a minimum of 300 ft (91.4 m). [58:8.3.3.2]

#### 69.5.3.3.3

Storage beyond the limitations described in 69.5.3.3.2 shall comply with 69.5.3.4. [58:8.3.3.3]

#### 69.5.3.3.4

Cylinders carried as part of the service equipment on highway mobile vehicles shall not be part of the total storage capacity requirements of 69.5.3.3.1, where such vehicles are stored in private garages and carry no more than three cylinders with a total aggregate capacity per vehicle not exceeding 100 lb (45.4 kg) of propane. [58:8.3.3.4]

#### 69.5.3.3.5

Cylinder valves shall be closed when not in use. [58:8.3.3.5]

### 69.5.3.4 Storage Within Special Buildings or Rooms.

#### 69.5.3.4.1

---

For SI units, 1 lb = 0.45 kg; 1 gpm = 3.8 L/min; 1 ft = 0.3 m; 1 ft² = 0.09 m².
The maximum quantity of LP-Gas stored in special buildings or rooms shall be 10,000 lb (4540 kg). [58:8.3.4.1]

69.5.3.4.2
Special buildings or rooms for storing LP-Gas cylinders shall not be located where the buildings or rooms adjoin the line of property occupied by schools, churches, hospitals, athletic fields, or other points of public gathering. [58:8.3.4.2]

69.5.3.4.3
The construction of all special buildings and rooms specified in 69.5.3.4.2 shall comply with Chapter 10 of NFPA 58 and the following:

1. Vents to the outside only shall be provided at both the top and bottom of the building and shall be located at least 5 ft (1.5 m) from any building opening.
2. The entire area shall be classified for purposes of ignition source control in accordance with Section 6.22-25 of NFPA 58. [58:8.3.4.3]

69.5.3.5 Storage Within Residential Buildings.
Storage of cylinders within a residential building, including the basement or any storage area in a common basement of a multiple-family building and attached or detached garages, shall be limited to cylinders each with a maximum water capacity of 2.7 lb (1.2 kg) and shall not exceed 5.4 lb (2.4 kg) aggregate water capacity per each living space unit. [58:8.3.5]

69.5.4 Storage Outside of Buildings.
69.5.4.1* Location of Storage Outside of Buildings.
69.5.4.1.1 Storage outside of buildings for cylinders awaiting use or resale or that are part of a cylinder exchange point shall be located as follows:

1. At least 5 ft (1.5 m) from any doorway or opening in a building frequented by the public where occupants have at least two means of egress as defined by 3.3.177 and NFPA 101.
2. At least 10 ft (3 m) from any doorway or opening in a building or sections of a building that has only one means of egress.
3. At least 20 ft (6.1 m) from any automotive service station fuel dispenser. [58:8.4.1.1]

69.5.4.1.2 Distances from cylinders in storage outside of buildings shall be in accordance with Table 69.5.4.1.2 with respect to the following:

1. Nearest important building or group of buildings
2. Line of adjoining property that can be built upon
3. Busy thoroughfares or sidewalks on other than private property
4. Line of adjoining property occupied by schools, churches, hospitals, athletic fields, or other points of public gathering
5. Dispensing station system. [58:8.4.1.2]

Table 69.5.4.1.2 Distances from Cylinders in Storage and Exposures

<table>
<thead>
<tr>
<th>Quantity of LP-Gas Stored</th>
<th>(1) and (2)</th>
<th>(3) and (4)</th>
<th>(5)*</th>
</tr>
</thead>
<tbody>
<tr>
<td>lb</td>
<td>ft</td>
<td>m</td>
<td>ft</td>
</tr>
<tr>
<td>≤720</td>
<td>0</td>
<td>0</td>
<td>0</td>
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</tbody>
</table>
**Quantity of LP-Gas Stored**

<table>
<thead>
<tr>
<th></th>
<th>Horizontal Distance to ...</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>(1) and (2)</td>
</tr>
<tr>
<td><strong>lb</strong></td>
<td><strong>kg</strong></td>
</tr>
<tr>
<td>721–2,500</td>
<td>&gt;227–1,134</td>
</tr>
<tr>
<td>2,501–6,000</td>
<td>&gt;1,134–2,721</td>
</tr>
<tr>
<td>6,001–10,000</td>
<td>&gt;2,721–4,540</td>
</tr>
<tr>
<td>&gt;10,000</td>
<td>&gt;4,540</td>
</tr>
</tbody>
</table>

*The minimum distance from a point of transfer associated with a dispensing system must comply with Table 69.3.5.2.1.*

[58: Table 8.4.1.2]

**69.5.4.1.3 Fire-Resistive Protective Structure.**

(A) The distances in Table 69.5.4.1.2 shall be reduced to 0 where a 2-hour fire-resistive protective structure made of noncombustible materials is provided that breaks the line of sight of the storage and the building. [58:8.4.1.3(A)]

(B) For buildings with exterior walls rated 2-hour fire resistance and constructed of noncombustible materials not provided with eaves over the storage, the exterior wall shall be allowed in lieu of a protective structure to reduce the distance to 0. [58:8.4.1.3(B)]

**69.5.4.1.4**

Cylinders in the filling process shall not be considered to be in storage. [58:8.4.1.4]

**69.5.4.2 Protection of Cylinders.**

**69.5.4.2.1**

Cylinders at a location open to the public shall be protected by either of the following:

(1) An enclosure in accordance with 6.1921.4.2 of NFPA 58
(2) A lockable ventilated enclosure of metal exterior construction [58:8.4.2.1]

**69.5.4.2.2**

Vehicular barrier protection (VBP) shall be provided where vehicle traffic is expected at the location, except where cylinders are protected in accordance with 69.5.4.2.1(2). [58:8.4.2.2]

**69.5.4.3 Alternate Location and Protection of Storage.**

Where the provisions of 69.5.4.1 and 69.5.4.2.1 are impractical at construction sites or at buildings or structures undergoing major renovation or repairs, alternative storage of cylinders shall be acceptable to the AHJ. [58:8.4.3]

**69.5.5* Fire Protection and Electrical Area Classification.**

**69.5.5.1**

Retail cylinder exchange locations shall be provided with at least one approved portable fire extinguisher in accordance with Section 4.7 of NFPA 58, having a minimum capacity of 10 lb (4.5 kg) dry chemical with an A:B:C rating complying with 69.5.5.3, on the premises where retail cylinder exchange cabinets are storing more than 720 lb (327 kg) of propane. [58:8.5.1]

**69.5.5.2**
Storage locations, other than those complying with 69.5.5.1, where the aggregate quantity of propane stored is in excess of 720 lb (327 kg), shall be provided with at least one approved portable fire extinguisher in accordance with Section 4.7 of NFPA 58 having a 40-B:C or 80-B:C rating and a minimum capacity of 18 lb (8.2 kg) dry chemical.  

69.5.5.3
The required fire extinguisher shall be located within 50 ft (15 m) travel distance of the propane storage location in accordance with 69.5.5.3.1 and 69.5.5.3.2. [58:8.5.3]

69.5.5.3.1
A 40-B:C fire extinguisher shall be located not more than 30 ft (10 m) from the propane storage location. [58:8.5.3.1]

69.5.5.3.2
An 80-B:C fire extinguisher shall be located not more than 50 ft (15 m) from the propane storage location. [58:8.5.3.2]

69.5.4
Where fire extinguishers have more than one letter classification, they shall be considered to satisfy the requirements of each letter class.

69.5.5.5
The storage of cylinders awaiting resale shall be exempt from the electrical classification requirements of this Code. [58:8.5.4]

69.5.6
Automated Cylinder Exchange Stations.

69.5.6.1
Cylinder exchange cabinets that include an automated vending system for exchanging cylinders shall comply with the requirements in 69.5.6.2 through 69.5.6.6. [58:8.6.1]

69.5.6.2
Electrical equipment installed in cylinder storage compartments shall comply with the requirements for Class I, Division 2 equipment in accordance with NFPA 70. [58:8.6.2]

69.5.6.3
Cabinets shall be designed such that cylinders can be placed inside only in the upright position. [58:8.6.3]

69.5.6.4
Door releases for access to stored cylinders shall be permitted to be pneumatic, mechanical, or electrically powered. [58:8.6.4]

69.5.6.5
A manual override control shall be permitted for use by authorized personnel. [58:8.6.5]

69.5.6.6
The vending system shall not be capable of returning to automatic operation after a manual override until the system has been inspected and reset by authorized personnel. [58:8.6.6]

69.6
Vehicular Transportation of LP-Gas.

69.6.1
Transportation in Portable Containers.

69.6.1.1
Transportation of Cylinders.

69.6.1.1.1
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 69.6.1. [58:9.3.2.1]

69.6.1.1.2
Cylinders shall be constructed as provided in 69.2.1 and equipped in accordance with Section 5.7 of NFPA 58 for transportation as cylinders. [58:9.3.2.2]

69.6.1.1.3
The quantity of LP-Gas in cylinders shall be in accordance with Chapter 7 of NFPA 58. [58:9.3.2.3]

69.6.1.1.4
Cylinder valves shall comply with the following:
(1) Valves of cylinders shall be protected in accordance with 69.2.1.2.1.
(2) Screw-on-type protecting caps or collars shall be secured in place.
(3) The provisions of 69.4.2.2.5 shall apply. [58:9.3.2.4]

69.6.1.1.5
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]

69.6.1.1.5.1
Open-bodied vehicles shall be considered to be in compliance with 69.6.1.1.5.

69.6.1.1.5.2
Closed-bodied vehicles having separate cargo, driver, and engine compartments shall be considered to be in compliance with 69.6.1.1.5. [58:9.3.2.5(B)]

69.6.1.1.5.3
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)]

69.6.1.1.6
Cylinders and their appurtenances shall be determined to be leak-free before being loaded into vehicles. [58:9.3.2.6]

69.6.1.1.7
Cylinders shall be loaded into vehicles with flat floors or equipped with racks for holding cylinders. [58:9.3.2.7]

69.6.1.1.8
Cylinders shall be fastened in position to minimize the possibility of movement, tipping, and physical damage. [58:9.3.2.8]

69.6.1.1.9
Cylinders being transported by vehicles shall be positioned in accordance with Table 69.6.1.1.9. [58:9.3.2.9]

Table 69.6.1.1.9 Orientation of Cylinders on Vehicles

<table>
<thead>
<tr>
<th>Propane Capacity of Cylinder</th>
<th>Open Vehicles</th>
<th>Enclosed Spaces of Vehicles</th>
</tr>
</thead>
<tbody>
<tr>
<td>lb</td>
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<tr>
<td>≤45</td>
<td>≤20</td>
<td>Any position</td>
</tr>
<tr>
<td>&gt;45</td>
<td>&gt;20</td>
<td>Relief valve in communication with the vapor space</td>
</tr>
</tbody>
</table>
Propane Capacity of Cylinder

<table>
<thead>
<tr>
<th></th>
<th>Open Vehicles</th>
<th>Enclosed Spaces of Vehicles</th>
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<td>lb</td>
<td>kg</td>
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<td>≤1.9</td>
<td>Any position</td>
</tr>
<tr>
<td>&gt;4.2</td>
<td>&gt;1.9</td>
<td>Relief valve in communication with the vapor space</td>
</tr>
</tbody>
</table>

69.6.1.1.10 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]

69.6.1.2 Fire Extinguishers.

69.6.1.2.1 Each truck or trailer transporting portable containers in accordance with 69.6.1.1 or 9.3.369.6.1.2 of NFPA 58 shall be equipped with at least one approved portable fire extinguisher in accordance with Section 4.7 of NFPA 58 having a minimum capacity of 18 lb (8.2 kg) dry chemical with a B:C rating. [58:9.3.5.1]

69.6.1.2.2 Where fire extinguishers have more than one letter classification, they shall be considered to satisfy the requirements of each letter class. [58:9.3.5.2]

69.6.2 Parking and Garaging Vehicles Used to Carry LP-Gas Cargo.

69.6.2.1 Application.

Subsection 69.6.2 applies to the parking and garaging of vehicles used for the transportation of LP-Gas. [58:9.7.1]

69.6.2.2 Parking Outdoors.

69.6.2.2.1 Vehicles shall not be left unattended on any street, highway, avenue, or alley, except for necessary absences from the vehicle associated with drivers’ normal duties, including stops for meals and rest stops during the day or night, except as follows:

(1) This requirement shall not apply in an emergency.

(2) This requirement shall not apply to vehicles parked in accordance with 69.6.2.2.3 and 69.6.2.2.4. [58:9.7.2.1]

69.6.2.2.2* Vehicles shall not be parked in congested areas. [58:9.7.2.2]

69.6.2.2.3 Where vehicles are parked off the street in uncongested areas, they shall be at least 50 ft (15 m) from any building used for assembly, institutional, or multiple residential occupancy. [58:9.7.2.3]

69.6.2.2.4 Where vehicles carrying portable containers or cargo tank vehicles of 3500 gal (13 m³) water capacity or less are parked on streets adjacent to the driver's residence in uncongested residential areas, the parking locations shall be at least 50 ft (15 m) from a building used for assembly, institutional, or multiple residential occupancy. [58:9.7.2.4]

69.6.2.3 Parking Indoors.
69.6.2.3.1 Cargo tank vehicles parked in any public garage or building shall have LP-Gas liquid removed from the following:
(1) Cargo tank
(2) Piping
(3) Pump
(4) Meter
(5) Hose
(6) Related equipment [58:9.7.3.1]

69.6.2.3.2 Vehicles used to carry portable containers shall not be moved into any public garage or building for parking until all portable containers have been removed from the vehicle. [58:9.7.3.2]

69.6.2.3.3 The pressure in the delivery hose and related equipment shall be reduced to approximately atmospheric. [58:9.7.3.3]

69.6.2.3.4 All valves shall be closed before the vehicle is moved indoors. [58:9.7.3.4]

69.6.2.3.5 Delivery hose or valve outlets shall be plugged or capped before the vehicle is moved indoors. [58:9.7.3.5]

69.6.2.3.6 Vehicles carrying or containing LP-Gas shall only be parked in buildings complying with Chapter 10 of NFPA 58 and located on premises owned or under the control of the operator of such vehicles where the following provisions are met:
(1) The public shall be excluded from such buildings.
(2) Floor level ventilation shall be provided in all parts of the building where such vehicles are parked.
(3) Leaks in the vehicle LP-Gas systems shall be repaired before the vehicle is moved indoors.
(4) Primary shutoff valves on cargo tanks and other LP-Gas containers on the vehicle (except propulsion engine fuel containers) shall be closed and delivery hose outlets plugged or capped to contain system pressure before the vehicle is moved indoors.
(5) Primary shutoff valves on LP-Gas propulsion engine fuel containers shall be closed while the vehicle is parked.
(6) No LP-Gas container shall be located near a source of heat or within the direct path of hot air being blown from a blower-type heater.
(7) LP-Gas containers shall be gauged or weighed to determine that they are not filled beyond the maximum filling limit according to Section 7.4 of NFPA 58. [58:9.7.3.6]

69.6.2.3.7 Where vehicles are serviced or repaired indoors, the following shall apply:
(1) When it is necessary to move a vehicle into any building located on premises owned or operated by the operator of such vehicle for service on engine or chassis, the provisions of 69.6.2.3.6 shall apply.
(2) When it is necessary to move a vehicle carrying or containing LP-Gas into any public garage or repair facility for service on the engine or chassis, the provisions of 69.6.2.3.1 shall apply, or the driver or a qualified representative of an LP-Gas operator shall be in attendance at all times while the vehicle is indoors, and the following shall apply:
(a) Leaks in the vehicle LP-Gas systems shall be repaired before the vehicle is moved indoors.
(b) Primary shutoff valves on cargo tanks, portable containers, and other LP-Gas containers installed on
the vehicle (other than propulsion engine fuel containers) shall be closed.
(c) LP-Gas liquid shall be removed from the piping, pump, meter, delivery hose, and related equipment
and the pressure therein reduced to approximately atmospheric before the vehicle is moved inside.
(d) Delivery hose or valve outlets shall be plugged or capped before the vehicle is moved indoors.
(e) No container shall be located near a source of heat or within the direct path of hot air blown from a
blower or from a blower-type heater.
(f) LP-Gas containers shall be gauged or weighed to determine that they are not filled beyond the
maximum filling capacity in accordance with Section 7.4 of NFPA 58.

If repair work or servicing is to be performed on a cargo tank vehicle system, all LP-Gas shall be removed
from the cargo tank and piping, and the system shall be thoroughly purged before the vehicle is moved
indoors. [58:9.7.3.8]

69.7 LP-Gases at Utility Plants.
The design, construction, location, installation, and operation of refrigerated and nonrefrigerated liquefied
petroleum gas systems at utility gas plants shall be in accordance with NFPA 59.

69.8 Liquefied Natural Gas (LNG) Facilities.
The design, location, construction, and operation of liquified natural gas facilities shall be in accordance
with NFPA 59A.
A.3.3.43 Liquefied Petroleum Gas (LP-Gas).
In the pure state propylene (Chemical Abstract Service 105-07-01) has a vapor pressure of 132.8 psig (915.72 kPa) at 70°F (21.1°C). The vapor pressure of commercial propane (Chemical Abstract Service 74-98-6) at 70°F (21.1°C) is 124 psig (855 kPa). Although commercial propane may contain some propylene, as in impurity, propylene in the pure state does not meet the definition of LP-Gas. Propylene in the pure state is commonly found in use as an industrial fuel gas. (See NFPA 51.)

A.42.11.2.2.1
Chapter 11 covers engine fuel systems for engines installed on vehicles for any purpose, as well as fuel systems for portable engines. [58:A.11.1.1]

A.42.11.2.2.2
Containers for engine fuel systems can be of the permanently installed or exchange type. [58:A.11.1.2]

A.11.12.1.4
See Figure A.11.12.1.4.
Figure A.11.12.1.4 Example of Vehicle Identification Marking.

A.69.2.1.1.1
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.

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]

69.2.1.4.2
The tare weight is the cylinder weight plus the weight of all permanently attached valves and other fittings but does not include the weight of protecting devices that are removed in order to load the cylinder. [58:A.5.2.8.2]
A.69.2.1.4.3
Head design refers to the shape of the head. Shapes include hemispherical, semi-ellipsoidal, and others. (Refer to the API-ASME Code for Unfired Pressure Vessels for Petroleum Liquids and Gases for more information.) [58:A.5.2.8.3]

A.69.2.8.1.2
Materials with melting points exceeding 1500°F (816°C) include steel, ductile (nodular) iron, malleable iron, or brass, as follows:

2. Approved or listed variable liquid level gauges used in containers of 3500 gal (13.2 m³) water capacity or less are exempt from the minimum melting point requirement.
3. Cast-iron should not be used.
4. Nonmetallic materials should not be used for bonnets or bodies of valves or regulators.

[58:A.5.9.1.2]

A.69.3.1
Section 6.45 of NFPA 58 includes general provisions that are applicable to most stationary systems. Sections 6.57 through 6.1315 of NFPA 58 extend and modify Section 6.45 of NFPA 58 for systems installed for specific purposes. [58:A.6.1.1]

A.69.3.34.1.1
When applying Table 69.34.3.1.1 to cylinders, which have their capacities expressed in pounds, the first table entry, <125 gal (<0.5 m³), includes all cylinders. Cylinders have a maximum capacity of 1000 lb or 119 gal (454 kg or 3.8 m³) (water capacity). [58:A.6.34.1.1]

The “Line of Adjoining Property that can be built upon” refers to the property boundaries of the plot adjacent to the one upon which the tank is located. This is illustrated in Figure A.69.3.34.1.1 taking into consideration a condition that involves property on the other side of a street, highway, navigable waterway, or other right of way. The minimum distance limitation is from the tank to the property line where that property line is common to plots of ground of different ownership and would also apply between the tank and the property line of the far side of a street or other public right of way. [58:A.6.34.1.1]

Figure A.69.3.34.1.1 Illustration of Separation Distances from Containers to the Line of Adjoining Property that can be Built Upon. [58:Figure A.6.34.1.1]
A.69.3.34.4.3
Building openings in the context of 69.3.34.4.3 are any opening that communicates air from the exterior to the interior of the building, including windows, doors, or dryer vent terminations below the level of the relief valve discharge. [58:A.6.34.4.23]

A.69.3.45.43.3
Clearance is required between combustible materials and propane containers in order to minimize the effects of fires on the container. The requirement to maintain separation between the container and stored combustible materials is needed so that an accumulation of materials that may represent a hazard to the container does not occur. The term “stored” is intended to denote materials that are purposely placed. Vegetation of any type located near or under the container is not considered to be a hazard. [58:A.6.45.43.3]

A.69.3.4.4.469.3.5.3.4
For information on flash point see NFPA 30 [58:A.6.4.45.3.4]

A.69.3.4.569.3.5.4
Also see NFPA 51 for oxygen systems. [58:A.6.4.54.3.9]

A.69.3.4.4.14—
Because of the anticipated flash of some nonrefrigerated LP-Gases when released to the atmosphere, dikes normally serve no useful purpose for these nonrefrigerated installations. [58:A.6.4.4.14]

A.69.3.4.569.3.5.4.
The presence of such structures can create significant hazards, such as the following:

1. Pocketing of escaping gas
2. Interference with application of cooling water by fire departments
3. Redirection of flames against containers
4. Impeding the egress of personnel in an emergency

[58:A.6.4.54.4]
A.69.3.57.1.1
It is the intent to allow transfer of liquid into containers in open areas under canopies or roofs where 50 percent or more of the perimeter is not enclosed. [58:A.6.57.1.1]
Generally, a light-reflecting color paint is preferred unless the system is installed in an extremely cold climate. [58:A.6.68.1.4]

Anchorage can be accomplished by the use of concrete bulkheads or equivalent anchorage or by the use of a weakness or shear fitting. [58:A.6.1214.8]

Gas leaks have resulted from snow or ice accumulations on gas systems, and snow or ice shedding from roofs onto gas systems. In these incidents, external fires have occurred and in some cases gas has migrated into or under buildings, resulting in interior fires or explosions. Selection of appropriate methods of protection should be based upon the installation and anticipated snow and or ice loading. Possible methods of protection include the following:

1. Minimizing the extent of above-ground piping.
2. Locating above-ground piping, regulators, and meters above anticipated snow accumulations.
3. Locating above-ground piping, regulators and meters on the gable end of buildings, rather than under eaves, to prevent damage from snow or ice shedding off of roofs.
4. Protecting above-ground piping, regulators, and meters with extended roof overhangs or dedicated covers.
5. Adding additional support above-ground piping, regulators and meters to withstand anticipated snow or ice loading.

The requirement for a pilot or an electronic ignition system became effective for heaters with inputs over 50,000 Btu/hr manufactured on or after May 17, 1967. [58:A.6.2022.2.6]

The weight of the cylinders will be affected by the specific gravity of the LP-Gas. Weights varying from 16.0 oz to 16.8 oz (454 g to 476 g) are recognized as being within the range of what is nominal. [58:A.6.2022.9.3]

Typical non-engine fuel systems include those on commercial, industrial, construction, and public service vehicles such as trucks, semitrailers, trailers, portable tar kettles, road surface heating equipment, mobile laboratories, clinics, and mobile cooking units (such as catering and canteen vehicles). [58:A.6.2426.1]

Requirements for the design of containers are located in Section 5.2 of NFPA 58. Requirements for container appurtenances are located in Section 5.3 of NFPA 58. [58:A.6.2426.7.6]

Ignition source control at transfer locations is covered in Section 6.22-25 of NFPA 58. Fire protection is covered in Section 6.26-29 of NFPA 58. [58:A.7.1]
Examples of an effective seal are a POL plug or cap. Listed quick-closing couplings with CGA V-1 connection numbers 790 (fork lift ACME connection), 791 (portable cylinder ACME/POL connection), and 810 (socket/plug quick connection) have secondary seals. Therefore, plugs or caps for these connections are not required or recommended. [58:A.7.2.2.5]

Air-moving equipment includes large blowers on crop dryers, space heaters, and some central heating equipment. Equipment employing open flames includes flame cultivators, weed burners, and tar kettles. [58:A.7.2.3.5(A)]

The filling process in 69.5.4.1.4 refers to the time period beginning when a cylinder or cylinders are brought to a dispensing station to be filled and ending when the last cylinder is filled and all the cylinders are removed from the filling area. This is meant to define a continuous process, with the cylinders being unattended for only brief periods, such as operator breaks or lunch. [58:A.8.4.1]

The shelves should be made of any material with a flame spread index, in accordance with ASTM E84, Standard Test Method for Surface Burning Characteristics of Building Materials, or UL 723, Standard for Test for Surface Burning Characteristics of Building Materials, of less than 25 and should be of sufficient strength to support the cylinders. [58:A.8.4.2.1]

Only minimal VBP, such as either parking bumpers (minimum of 6 inches above grade) or sidewalks (minimum of 6 inches above grade), may be needed for cylinder exchange cabinets. The storage cabinets associated with cylinder exchange may provide limited protection against physical damage to the stored cylinders. Examples of such protection include, but are not limited to:

1. Guard rails
2. Steel bollards
3. Raised sidewalks (minimum of 6 in. in height)
4. Fencing
5. Ditches
6. Berms (not to exceed 50% of the container perimeter)
7. Jersey barriers
8. Parking bumpers (minimum of 6 in. in height)
9. Fencing/Gates

[58:A.8.4.2.2]

See 6.2629.4.4-3 of NFPA 58. [58:A.8.5]

The term "congested area" is intended to describe situations where access to the vehicle during an emergency would be impeded or where moving the vehicle away from an emergency would be prevented. [58:A.9.7.2.2]

Supplemental Information

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Submitter Information Verification

Submitter Full Name: Kristin Bigda
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Street Address:
City:
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Submittal Date: Wed Oct 12 11:23:08 EDT 2016

Committee Statement

Committee Statement: Extract update.
Response Message:
NFPA 61:

20.15.5.1* Application.
The requirements of 20.15.5 shall apply to all of the following:

1. All facilities that receive, handle, process, dry, blend, use, mill, package, store, or ship dry agricultural bulk materials, their by-products, or dusts that include grains, oilseeds, agricultural seeds, legumes, sugar, flour, spices, feeds, dry dairy/food powders, and other related materials
2. All facilities designed for manufacturing and handling starch, including drying, grinding, conveying, processing, packaging, and storing dry or modified starch, and dry products and dusts generated from these processes
3. Those seed preparation and meal-handling systems of oilseed processing plants not covered by NFPA 36

A.20.15.5.1
Examples of facilities covered by NFPA 61 include, but are not limited to, bakeries, grain elevators, feed mills, flour mills, milling, corn milling (dry and wet), rice milling, dry milk products, mix plants, soybean and other oilseed preparation operations, cereal processing, snack food processing, tortilla plants, chocolate processing, pet food processing, cake mix processing, sugar refining and processing, and seed plants.

### Supplemental Information

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### Submitter Information Verification

**Submitter Full Name:** Kristin Bigda  
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### Committee Statement

**Committee Statement:** Extract update.  
**Response Message:**
NFPA 407:

42.10.1.1  
Section 42.10 does not apply to any of the following:

1. In-flight fueling
2. Fuel servicing of flying boats or amphibious aircraft on water
3. Draining or filling of aircraft fuel tanks incidental to aircraft fuel system maintenance operations or manufacturing [407:1.1.1]

42.10.2.1.1 through 42.10.5.22 will get deleted and replaced with new Chapter 4 through 8 of NFPA 407.

42.10.2 Design and Construction.

42.10.2.1 General Requirements.

42.10.2.1.1 The requirements of Chapter 4 shall apply to all aviation fueling facilities, aircraft fueling vehicles, rooftop heliport fueling facilities, and self-service aviation fueling facilities. [407: 4.1.1.1]

42.10.2.1.2 Aviation fueling facilities shall also comply with the requirements of Chapter 5. [407: 4.1.1.2]

42.10.2.1.3 Aircraft fueling vehicles and carts shall also comply with the requirements of Chapter 6. [407: 4.1.1.3]

42.10.2.1.4 Rooftop heliport fueling facilities shall also comply with the requirements of Chapter 5 and Chapter 7. [407: 4.1.1.4]

42.10.2.1.5 Self-service aviation fueling facilities shall also comply with the requirements of Chapter 5 and Chapter 8. [407: 4.1.1.5]

42.10.2.2 Fuel Storage Tanks. (Reserved)

42.10.2.3 Fuel Dispensing Systems.

42.10.2.3.1 Any valve that controls the flow of fuel into or from an aircraft fuel servicing vehicle or cart, or into or from an aircraft shall have a deadman control(s). [407: 4.1.3.1]

42.10.2.3.2 The deadman flow control in the nozzle shall be permitted for overwing fueling. [407: 4.1.3.2]

42.10.2.3.3 Notches or latches in the handle of an overwing nozzle that could allow the valve to be locked open shall be prohibited. [407: 4.1.3.3]

42.10.2.3.4 Nozzles for underwing fueling shall be designed to be attached securely to the aircraft adapter before the nozzle can be opened. [407: 4.1.3.4]

42.10.2.3.5 Disengaging the nozzle from the aircraft adapter shall not be possible until the nozzle is fully closed. [407: 4.1.3.5]
42.10.2.3.6 Fuel servicing pump mechanisms shall be designed and arranged so that failure or seizure does not cause rupture of the pump housing, of a tank, or of any component containing fuel. [407: 4.1.3.6]

42.10.2.3.7 Fuel pressure shall be controlled within the stress limits of the hose and plumbing by means of either an in-line pressure controller or, a system pressure relief valve, or other suitable means. [407: 4.1.3.7]

42.10.2.3.8 The working pressure of any system component shall equal or exceed any pressure to which it could be subjected. [407: 4.1.3.8]

42.10.3* Fueling Hose.

42.10.3.1 Performance Requirements. Hose and couplings shall comply with the requirements of EI 1529. [407: 4.1.4.1]

42.10.3.2 Fueling Hose Apparatus. Nozzle receptacles and hose storage shall be arranged to avoid kinks and maintain the hose bend radius within the requirements of EI 1529 and EI 1540. [407: 4.1.4.2]

42.10.3.3 Additional Requirements.

42.10.3.3.1 Each coupled length of hose shall be tested at the same minimum proof pressure rating for that grade of hose as defined in EI 1529. [407: 4.1.4.3.1]

42.10.3.3.2 A test certificate shall be provided for each coupled length of hose and shall state the following:
- Manufacturer's name of hose
- Manufacturer's name of couplings
- Hose type
- Hose grade
- Size and length of hose
- Serial number or reference number of hose
- Quarter and year of manufacture of hose
- Model number of couplings
- Sizes of coupling ferrules
- Hydrostatic test pressures
- Coupled length serial number
- Identification of individual responsible for coupling the hose
- Name and address of company responsible for coupling the hose
- Date of certification
[407: 4.1.4.3.2]

42.10.3.3.3 The coupling tests as specified in EI 1529 shall be performed for each hose grade, type, and manufacturer. [407: 4.1.4.3.3]

42.10.3.3.4 Each coupling of a coupled length of hose shall be permanently marked with a serial number corresponding to its hydrostatic test certificate. [407: 4.1.4.3.4]

42.10.3.3.5 The hose at the end of each coupling ferrule shall be permanently marked prior to hydrostatic testing to serve as a reference to determine whether a coupling has slipped during testing or while in service. [407: 4.1.4.3.5]

42.10.3.3.6* Lengths of hose shall not be spliced together. [407: 4.1.4.3.6]

42.10.3.3.7 Hydrostatic Testing. Hydrostatic testing shall be in accordance with ASTM D380. [407: 4.1.4.3.7]
42.10.3.3.7.1 Following a hydrostatic test, all the water shall be drained and the hose shall be dried internally. [407: 4.1.4.3.7.1]

42.10.3.3.7.2 Following a hydrostatic test, the open ends of the hose, including the threads of the couplings, shall be suitably covered to protect the threads and to prevent contamination. [407: 4.1.4.3.7.2]

42.10.3.3.7.3 A hose that is recoupled for any reason shall be hydrostatically tested and recertified to the same criteria as a newly coupled hose. [407: 4.1.4.3.7.3]

42.10.3.3.8 Hose shall be connected to rigid piping or coupled to a hose reel in a manner that prevents kinks or undue bending action or mechanical stress on the hose or hose couplings. [407: 4.1.4.3.8]

42.10.4 Electrostatic Hazards and Bonding.

42.10.4.1 A provision for bonding shall be incorporated in the design of fuel servicing vehicles or carts and airport fueling systems to prevent differences in electrostatic potential. [407: 4.1.5.1]

42.10.4.2 The maximum resistance between the bonding cable clip and the fueling system framework shall not exceed 25 ohms. [407: 4.1.5.2]

42.10.4.3 Bonding cables shall be constructed of conductive, durable, and flexible material. [407: 4.1.5.3]

42.10.4.4 Bonding connections shall be electrically and mechanically firm. [407: 4.1.5.4]

42.10.4.5 Jacks, plugs, clamps, and connecting points shall be clean, unpainted metal to provide a positive electrical connection. [407: 4.1.5.5]

42.10.4.6 EI 1529 Type C hose (semiconductive) shall be used to prevent electrostatic discharges but shall not be used to accomplish required bonding. [407: 4.1.5.6]

42.10.4.7 EI 1529 Type A hose that does not have a semiconductive cover shall not be used. [407: 4.1.5.7]

42.10.4.8 EI 1529 Type F hose (hard wall) and EI 1529 Type CT hose (cold temperature) shall be permitted because they have semiconductive covers. [407: 4.1.5.8]

42.10.4.9* The design of airport fueling systems shall incorporate the provision of a 30-second relaxation period following the filter separator, monitors, or other filtration devices discharging into tanks. [407: 4.1.5.9]

42.10.4.9.1 The relaxation period required by 4.1.5.9 shall not apply to the actual refueling of an aircraft. [407: 4.1.5.9.1]

42.10.4.9.2 The relaxation period required by 4.1.5.9 shall not apply to fuels with static dissipater additives. [407: 4.1.5.9.2]

42.10.5 Electrical Systems. (Reserved)

42.10.6 Control of Fuel Flow. (Reserved)

42.10.7 Filters and Ancillary Equipment.

42.10.7.1 Filter vessels used in aviation fuel service shall have a functional automatic air vent (AAV) or automatic air eliminator (AAE). [407: 4.1.8.1]

42.10.7.2 The AAV or AAE shall discharge to a closed system. [407: 4.1.8.2]
42.10.8 Emergency Fuel Shutoff Systems. (Reserved)

42.10.9 Fire Extinguishers.

42.10.9.1 During fueling operations, fire extinguishers shall be available on aircraft servicing ramps or aprons, in accordance with NFPA 410. [407: 4.1.10.1]

42.10.9.2 All fire extinguishers shall conform to the requirements of NFPA 10. [407: 4.1.10.2]

42.10.9.3* ABC multipurpose dry chemical fire extinguishers (ammonium phosphate) shall not be placed on aircraft fueling vehicles, airport fuel servicing ramps or aprons, or at airport fuel facilities that are located within 150 m (500 ft) of aircraft operating areas. [407: 4.1.10.3]

42.10.10 Marking and Labeling.

42.10.10.1 Each emergency fuel shutoff station location shall be placarded EMERGENCY FUEL SHUTOFF in letters at least 50 mm (2 in.) high. [407: 4.1.11.1]

42.10.10.2 The method of operation shall be indicated by an arrow or by the word PUSH or PULL, as appropriate. [407: 4.1.11.2]

42.10.10.3 Any action necessary to gain access to the shutoff device (e.g., BREAK GLASS) shall be shown clearly. [407: 4.1.11.3]

42.10.10.4 Lettering shall be of a color contrasting sharply with the placard background for visibility. [407: 4.1.11.4]

42.10.10.5 Placards shall be weather resistant. [407: 4.1.11.5]

42.10.11 Aircraft Fueling Ramps.

42.10.11.1 Aircraft Radar Equipment.

42.10.11.1.1 Surveillance radar equipment in aircraft shall not be operated within 90 m (300 ft) of any fueling, servicing, or other operation in which flammable liquids, vapors, or mist could be present. [407: 4.1.12.1.1]

42.10.11.1.2 Weather-mapping radar equipment in aircraft shall not be operated while the aircraft in which it is mounted is undergoing fuel servicing. [407: 4.1.12.1.2]

42.10.11.2* Ground Radar Equipment.

42.10.11.2.1 Antennas of airport flight traffic surveillance radar equipment shall be located so that the beam will not be directed toward any fuel storage or loading racks within 90 m (300 ft). [407: 4.1.12.2.1]

42.10.11.2.2 Aircraft fuel servicing shall not be conducted within the 90 m (300 ft) distance established by 4.1.12.2.1. [407: 4.1.12.2.2]

42.10.11.2.3 Antennas of airport ground traffic surveillance radar equipment shall be located so that the beam will not be directed toward any fuel storage or loading racks within 30 m (100 ft). [407: 4.1.12.2.3]

42.10.11.2.4 Aircraft fuel servicing or any other operations involving flammable liquids or vapors shall not be conducted within 30 m (100 ft) of antennas of airport ground traffic surveillance radar equipment. [407: 4.1.12.2.4]
42.10.11.3 Emergency Fire Equipment Accessibility. Accessibility to aircraft by emergency fire equipment shall be considered in establishing aircraft fuel servicing positions. [407: 4.1.12.3]

42.10.11.4 Ramp and Apron Drainage. Aircraft servicing ramps or aprons shall be sloped and drained in accordance with NFPA 415. [407: 4.1.12.4]

42.10.11.4.1 The ramp or apron shall slope away from the rim or edge of fueling hydrants or fueling pits to prevent flooding. [407: 4.1.12.4.1]

42.10.11.4.2 Fueling hydrant boxes or fueling pits that are connected to a ramp drainage system shall be fitted with vapor-sealing traps. [407: 4.1.12.4.2]

42.11 Operations.

42.11.1 Security. (Reserved)

42.11.2 Training.

42.11.2.1* Only personnel trained in the safe operation of the equipment and the fuels they use, the operation of emergency controls, and the procedures to be followed in an emergency shall be permitted to handle fuel. [407: 4.2.2.1]

42.11.2.2* Fuel servicing personnel shall be trained in the use of the available fire-extinguishing equipment they could be expected to use. [407: 4.2.2.2]

42.11.3* Prevention and Control of Spills.

42.11.3.1 Following fueling of an aircraft or fuel servicing vehicle, all hoses shall be removed, including those from hydrant systems if applicable. [407: 4.2.3.1]

42.11.3.2 All hoses shall also be properly stowed. [407: 4.2.3.2]

42.11.3.3 Fuel nozzles shall not be dragged along the ground. [407: 4.2.3.3]

42.11.3.4 Approved pumps, either hand operated or power operated, shall be used where aircraft are fueled from drums. [407: 4.2.3.4]

42.11.3.4.1 Pouring or gravity flow shall not be permitted from a container with a capacity of more than 19 L (5 gal). [407: 4.2.3.4.1]

42.11.3.5 Fuel Spill Procedures.

42.11.3.5.1 Where a spill is observed, the fuel servicing shall be stopped immediately by release of the deadman controls. [407: 4.2.3.5.1]

42.11.3.5.2 In the event that a spill continues, the equipment emergency fuel shutoff shall be actuated. [407: 4.2.3.5.2]

42.11.3.5.3 In the event that a spill continues from a hydrant system, the system emergency fuel shutoff shall be actuated. [407: 4.2.3.5.3]

42.11.3.5.4 The supervisor shall be notified immediately. [407: 4.2.3.5.4]

42.11.3.5.5 Cleaning operations shall be performed by personnel trained in accordance with 4.2.2.1. [407: 4.2.3.5.5]
42.11.3.5.6 Operation shall not be resumed until the spill has been cleared and conditions are determined to be safe. [407: 4.2.3.5.6]

42.11.3.5.7 The airport fire crew, if established, or the local fire department serving the airport shall be notified if a spill covers over 3 m (10 ft) in any direction or is over 5 m² (50 ft²) in area, continues to flow, or is otherwise a hazard to persons or property. [407: 4.2.3.5.7]

42.11.3.5.8 The spill shall be investigated to determine the cause, to determine whether emergency procedures were properly carried out, and to determine the necessary corrective measures. [407: 4.2.3.5.8]

42.11.3.5.9 Corrective measures identified by the spill investigation shall be implemented as required by the authority having jurisdiction. [407: 4.2.3.5.9]

42.11.3.6 Transferring fuel by pumping from one tank vehicle to another tank vehicle within 61 m (200 ft) of an aircraft shall not be permitted. [407: 4.2.3.6]

42.11.3.7 Not more than one tank vehicle shall be permitted to be connected to the same aircraft fueling manifold, unless means are provided to prevent fuel from flowing back into a tank vehicle due to a difference in pumping pressure. [407: 4.2.3.7]

42.11.4 Emergency Fuel Shutoff.

42.11.4.1 Emergency fuel shutoff control stations shall be accessible at all times. [407: 4.2.4.1]

42.11.4.2 A procedure shall be established to notify the fire department serving the airport in the event of a control station activation. [407: 4.2.4.2]

42.11.4.3 If the fuel flow stops for an unknown reason, the emergency fuel shutoff system shall be checked first. [407: 4.2.4.3]

42.11.4.4 The cause of the shutoff shall be identified and corrected before fuel flow is resumed. [407: 4.2.4.4]

42.11.4.5 Emergency fuel shutoff systems shall be operationally checked at intervals not exceeding 6 months. [407: 4.2.4.5]

42.11.4.6 Each individual device shall be checked at least once during every 12-month period. [407: 4.2.4.6]

42.11.4.7 Suitable records shall be kept of tests required by this section. [407: 4.2.4.7]

42.11.5* Bonding.

42.11.5.1 Prior to making any fueling connection to an aircraft or fuel servicing vehicle, the fueling equipment shall be bonded to the aircraft or fuel servicing vehicle by use of a cable, thus providing a conductive path to equalize the potential between the fueling equipment and the aircraft. [407: 4.2.5.1]

42.11.5.1.1 The electrical bond shall be maintained until fueling connections have been removed, thus allowing separated charges that could be generated during the fueling operation to reunite. [407: 4.2.5.1.1]

42.11.5.1.2 Grounding for the sole purpose of aircraft fueling shall not be permitted. [407: 4.2.5.1.2]
42.11.5.2 Bonding for Overwing Fueling. In addition to the requirements in 4.2.5.1, where fueling overwing, the nozzle shall be bonded to a metallic component of the aircraft that is metallically connected to the tank filler port. [407: 4.2.5.2]

42.11.5.2.1 The bond connection shall be made before the filler cap is removed. [407: 4.2.5.2.1]

42.11.5.2.2 If a nozzle bond cable and plug receptacle or means for attaching a clip is available, the operator shall attach the nozzle bond cable before removing the cap in order to equalize the potential between the nozzle and the filler port. [407: 4.2.5.2.2]

42.11.5.2.3 If no plug receptacle or means for attaching a clip is available, the operator shall touch the filler cap with the nozzle spout before removing the cap in order to equalize the potential between the nozzle and the filler port. [407: 4.2.5.2.3]

42.11.5.2.4 The nozzle spout shall be kept in contact with the filler neck until the fueling is completed. [407: 4.2.5.2.4]

42.11.5.3 Where a funnel is used in aircraft fueling, it shall be kept in contact with the filler neck as well as the fueling nozzle spout or the supply container to avoid the possibility of a spark at the fill opening. [407: 4.2.5.3]

42.11.5.3.1* Only metal funnels shall be used. [407: 4.2.5.3.1]

42.11.5.4 Where a hydrant servicer or cart is used for fueling, the hydrant coupler shall be connected to the hydrant system prior to bonding the fuel equipment to the aircraft. [407: 4.2.5.4]

42.11.5.5 Bonding and fueling connections shall be disconnected in the reverse order of connection. [407: 4.2.5.5]

42.11.5.6 Conductive hose shall be used to prevent electrostatic discharge but shall not be used to accomplish required bonding. [407: 4.2.5.6]

42.11.6 Control of Fuel Flow.

42.11.6.1 Fuel flow shall be controlled by use of a dead-man control device. [407: 4.2.6.1]

42.11.6.2 The use of any means that defeats the dead-man control shall be prohibited. [407: 4.2.6.2]

42.11.7 Fire Protection.

42.11.7.1* During fueling operations, fire extinguishers shall be available on aircraft servicing ramps or aprons, in accordance with NFPA 410. [407: 4.2.7.1]

42.11.7.2* Extinguishers shall be kept clear of elements such as ice and snow. [407: 4.2.7.2]

42.11.7.3 Extinguishers located in enclosed compartments shall be readily accessible, and their location shall be marked clearly in letters at least 50 mm (2 in.) high. [407: 4.2.7.3]

42.11.7.4 Fuel servicing personnel shall be trained in the use of the available fire-extinguishing equipment they could be expected to use. (See A.4.2.2.2.) [407: 4.2.7.4]

42.11.8 Maintenance.

42.11.8.1 Fuel servicing equipment shall be maintained in safe operating condition. [407: 4.2.8.1]

42.11.8.2 Malfunctioning equipment shall be removed from service. [407: 4.2.8.2]
42.11.8.3 Where a valve or electrical device is used for isolation during maintenance or modification of a fuel system, it shall be tagged and locked out. [407: 4.2.8.3]

42.11.8.4 The tag/lock shall not be removed until the operation is completed. [407: 4.2.8.4]

42.11.8.5 All inspection and maintenance activities shall be recorded. [407: 4.2.8.5]

42.11.8.6 Inspection and maintenance records shall be retained for a minimum of 12 months. [407: 4.2.8.6]

42.11.9* Aircraft Fueling Hose. Any hose found to be defective, in accordance with 4.2.9.1 through 4.2.9.4, shall be removed from service. [407: 4.2.9]

42.11.9.1 Suitable records shall be kept of required inspections and hydrostatic tests. [407: 4.2.9.1]

42.11.9.2 Aircraft fueling hose shall be removed from service after 10 years from the date of manufacture. [407: 4.2.9.2]

42.11.9.3 Aircraft fueling hose not placed into service within 2 years of the date of manufacture shall not be used. [407: 4.2.9.3]

42.11.9.4 Daily Inspection. Aircraft fueling hose shall be inspected before use each day. [407: 4.2.9.4]

42.11.9.4.1 The hose shall be extended as it normally would be for fueling. [407: 4.2.9.4.1]

42.11.9.4.2 The hose shall be checked for evidence of any of the following defects:
   (1) Blistering
   (2) Carcass saturation or separation
   (3) Exposure of the reinforcement material
   (4) Slippage, misalignment, or leaks at couplings
   [407: 4.2.9.4.2]

42.11.9.5 Monthly Inspection. At least once each month the hose shall be completely extended and inspected as required in 4.2.9.4 and 4.2.9.5. [407: 4.2.9.5]

42.11.9.5.1* The hose couplings and the hose shall be examined for structural weakness or soft spots. [407: 4.2.9.5.1]

42.11.9.5.2 With the hose completely extended, it shall be pressurized to the working pressure of the fueling equipment to which it is attached and checked for defects, such as abnormal twisting or blistering. [407: 4.2.9.5.2]

42.11.9.6 Quarterly Inspection.

42.11.9.6.1 The nozzle screens shall be examined for evidence of hose deterioration. [407: 4.2.9.6.1]

42.11.9.7 Kinks or short loops in fueling hose shall be avoided. [407: 4.2.9.7]

42.11.10* Lightning. A written procedure shall be established to set the criteria for when and where fueling operations are to be suspended at each airport as approved by the fueling agent and the airport authority. [407: 4.2.10]

42.11.11 Aircraft Fuel Servicing.

42.11.11.1 Location of Aircraft During Fuel Servicing.
42.11.1.1 Aircraft fuel servicing shall be performed outdoors. [407: 4.2.11.1.1]

42.11.1.2 Aircraft fuel servicing incidental to aircraft fuel system maintenance operations shall comply with the requirements of NFPA 410. [407: 4.2.11.1.2]

42.11.1.3* Aircraft being fueled shall be positioned so that aircraft fuel system vents or fuel tank openings are not closer than 7.6 m (25 ft) to any terminal building, hangar, service building, or enclosed passenger concourse other than a loading walkway. [407: 4.2.11.1.3]

42.11.1.4 Aircraft being fueled shall be positioned so that the vent or tank openings are not closer than 15 m (50 ft) of any combustion and ventilation air intake to any boiler, heater, or incinerator room. [407: 4.2.11.1.4]

42.11.1.5 Accessibility to aircraft by emergency fire equipment shall be maintained for aircraft fuel servicing positions. [407: 4.2.11.1.5]

42.11.11.2 Aircraft Occupancy During Fuel Servicing.

42.11.11.2.1 If passengers remain on board an aircraft during fuel servicing, at least one qualified person trained in emergency evacuation procedures shall be in the aircraft at or near a door at which there is a passenger loading walkway, integral stairs that lead downward, or a passenger loading stair or stand. [407: 4.2.11.2.1]

42.11.11.2.1.1 A clear area for emergency evacuation of the aircraft shall be maintained at not less than one additional exit. [407: 4.2.11.2.1.1]

42.11.11.2.1.2 Where fueling operations take place with passengers on board away from the terminal building, and stairways are not provided, such as during inclement weather (diversions), all slides shall be armed and the aircraft rescue and fire fighting (ARFF) services shall be notified to respond in standby position in the vicinity of the fueling activity with at least one vehicle. [407: 4.2.11.2.1.2]

42.11.11.2.1.3 Aircraft operators shall establish specific procedures covering emergency evacuation under such conditions for each type of aircraft they operate. [407: 4.2.11.2.1.3]

42.11.11.2.1.4 All “no smoking” signs shall be displayed in the cabin(s), and the no smoking rule shall be enforced. [407: 4.2.11.2.1.4]

42.11.11.2.2 For each aircraft type, aircraft operators shall determine the areas through which it could be hazardous for boarding or deplaning passengers to pass while the aircraft is being fueled. [407: 4.2.11.2.2]

42.11.11.2.2.1 Controls shall be established so that passengers avoid such areas. [407: 4.2.11.2.2.1]

42.11.11.2 Fire Hazards on Aircraft Fuel Servicing Ramps.

42.11.12.1* Electrical Equipment Operated on Aircraft Fuel Servicing Ramps or Aprons.

42.11.12.1.1 Battery chargers on any fueling equipment shall not be connected or disconnected while fuel servicing is performed on an aircraft. [407: 4.2.12.1.1]

42.11.12.1.2* Aircraft ground-power generators or other electrical ground-power supplies shall not be connected or disconnected while fuel servicing is performed on the aircraft. [407: 4.2.12.1.2]

42.11.12.1.3 Electric tools or similar tools likely to produce sparks or arcs shall not be used while fuel servicing is performed on an aircraft. [407: 4.2.12.1.3]
42.11.12.1.4 Other than aircraft fuel servicing vehicles, battery-powered vehicles that do not comply with the provisions of this standard shall not be operated within 3 m (10 ft) of fueling equipment or spills. [407: 4.2.12.1.4]

42.11.12.1.5 Communication equipment located outside of the cab of fuel servicing vehicles and used during aircraft fuel servicing operations within 3 m (10 ft) of the fill or vent points of aircraft fuel systems shall be listed as intrinsically safe for Class I, Division 1, Group D hazardous (classified) locations in accordance with ANSI/UL 913. [407: 4.2.12.1.5]

42.11.12.2 Open Flames on Aircraft Fuel Servicing Ramps.

42.11.12.2.1 Entrances to fueling areas shall be posted with “no smoking” signs. [407: 4.2.12.2.1]

42.11.12.2.2 Open flames on aircraft fuel servicing ramps or aprons within 15 m (50 ft) of any aircraft fuel servicing operation or fueling equipment shall be prohibited. [407: 4.2.12.2.2]

42.11.12.2.3 The category of open flames and lighted open flame devices shall include, but shall not be limited to, the following:
   (1) Lighted cigarettes, cigars, or pipes
   (2) Electronic cigarettes (e.g., personal vaporizers or electronic nicotine delivery systems)
   (3) Exposed flame heaters, liquid, solid, or gaseous devices, including portable and wheeled gasoline or kerosene heaters
   (4) Heat-producing welding or cutting devices and blowtorches
   (5) Flare pots or other open-flame lights
   [407: 4.2.12.2.3]

42.11.12.2.4 The authority having jurisdiction can establish other locations where open flames and open-flame devices shall not be permitted. [407: 4.2.12.2.4]

42.11.12.2.5 Personnel shall not carry lighters, matches, or electronic cigarettes on their person while engaged in fuel servicing operations. [407: 4.2.12.2.5]

42.11.12.2.6 Lighters, matches, or electronic cigarettes shall not be permitted on or in fueling equipment. [407: 4.2.12.2.6]

42.11.12.2.7 Equipment performing aircraft servicing functions shall not be positioned within a 3 m (10 ft) radius of aircraft fuel system vent openings. [407: 4.2.12.2.7]

42.11.12.3 Operation of Aircraft Engines and Heaters.

42.11.12.3.1 Fuel servicing shall not be performed on a fixed wing aircraft while an onboard engine is operating, except as permitted by 4.2.12.3.2 or 4.2.14. [407: 4.2.12.3.1]

42.11.12.3.2 Aircraft auxiliary power units (APUs) that direct exhaust away from the fueling operation shall be permitted to operate during fuel servicing. [407: 4.2.12.3.2]

42.11.12.3.3 Combustion heaters on aircraft (e.g., wing and tail surface heaters, integral cabin heaters) shall not be operated during fueling operations. [407: 4.2.12.3.3]

42.11.13 Defueling of Aircraft.

42.11.13.1 All requirements of this standard shall apply to defueling operations. [407: 4.2.13.1]

42.11.13.2 Each operator shall establish procedures to prevent the overfilling of the tank vehicle, which is a special hazard when defueling. [407: 4.2.13.2]
42.11.14 Rapid Refueling.

42.11.14.1 Rapid refueling of aircraft shall be limited to the following aircraft types:
(1) Helicopters
(2) Agricultural aircraft actively engaged in aerial application duties
(3) Medical aircraft actively engaged in the transport of medical patients
(4) Fire-fighting and search-and-rescue aircraft actively engaged in emergency operations
[407: 4.2.14.1]

42.11.14.2 Only turbine engine aircraft fueled with JET A or JET A-1 fuels shall be permitted to be fueled while an onboard engine is operating.
[407: 4.2.14.2]

42.11.14.3 Aircraft permitted to be fueled while an onboard engine is operating shall have all sources of ignition of potential fuel spills located above the fuel inlet port(s) and above the vents or tank openings, including but not limited to the following:
(1) Engines
(2) Exhausts
(3) Auxiliary power units (APUs)
(4) Combustion-type cabin heater
[407: 4.2.14.3]

42.11.14.4 Aircraft fueling while onboard engines are operating shall be permitted only under the following conditions:
(1) A pilot licensed by the appropriate governmental body shall be at the aircraft controls during the entire fueling operation.
(2) All passengers shall be deboarded to a safe location prior to rapid refueling operations, except as permitted in 4.2.14.4(3).
(3) Patients on board medical transport aircraft shall be permitted to remain on board the aircraft with medical personnel during rapid refueling operations if, in the opinion of the medical provider, removal from the aircraft would be detrimental to the patient's condition.
(4) Passengers shall not board or deboard during rapid refueling operations.
(5) Only designated personnel, properly trained in rapid refueling operations, shall operate the equipment. Written procedures shall include the safe handling of the fuel and equipment.
(6) All doors, windows, and access points allowing entry to the interior of the aircraft that are adjacent to, or in the immediate vicinity of, the fuel inlet ports shall be closed and shall remain closed during refueling operations.
(7) Fuel shall be permitted to be dispensed by one of the following methods:
(a) Into an open port from approved deadman-type nozzles with a flow rate not to exceed 227 L/min (60 gpm)
(b) Through close-coupled pressure fueling ports
(8) Where fuel is dispensed from fixed piping systems, the hose cabinet shall not extend into the rotor space.
(9) Clearance between aircraft fuel servicing vehicles and rotating components shall be maintained by one of the following methods:
(a) A curb or other approved barrier shall be provided to restrict the fuel servicing vehicle from coming within 3 m (10 ft) of any aircraft rotating components.
(b) Fuel servicing vehicles shall be kept 6 m (20 ft) away from any aircraft rotating components, and a trained person shall direct fuel servicing vehicle approach and departure.
[407: 4.2.14.4]

42.12 Design and Construction.

42.12.1 General Requirements.
42.12.1.1 Each installation shall be designed and installed in conformity with the requirements of this standard and with any additional fire safety measures deemed necessary by the authority having jurisdiction. [407: 5.1.1.1]

42.12.1.2 The system and each of its components shall be designed for the working pressure of the system. [407: 5.1.1.2]

42.12.1.3 The emergency fuel shutoff system shall be designed and installed as an integral part of the airport fuel system. [407: 5.1.1.3]

42.12.1.4 Operating controls for emergency fuel shutoff of the system shall be located to be readily accessible in the event of an accident or spill. [407: 5.1.1.4]

42.12.1.5 In establishing each aircraft fuel dispensing location, consideration shall be given to the accessibility of the location in an emergency by fire-fighting personnel and equipment. [407: 5.1.1.5]

42.12.1.6 System Design and Approval.

42.12.1.6.1 Design Approval. Work shall not be started on the construction or alteration of an airport fuel system until the design, plans, and specifications have been approved by the authority having jurisdiction. [407: 5.1.1.6.1]

42.12.1.6.2 System Approval. The authority having jurisdiction shall inspect and approve the completed system before it is put into service. [407: 5.1.1.6.2]

42.12.1.6.3 Hydrostatic Test.

42.12.1.6.3.1 After completion of the installation (including fill and paving), new airport fuel piping systems shall be subjected to a temperature-compensated hydrostatic test pressure equal to 150 percent of the system working pressure for at least 4 hours and shall be proven tight before the system is placed into service. [407: 5.1.1.6.3.1]

42.12.1.6.3.2 For additions or modifications to existing airport fuel piping systems, hydrostatic testing of new piping prior to final tie-in to existing piping shall be permitted, with final closure (tie-in) welds examined in-process in accordance with ASME B31.3. [407: 5.1.1.6.3.2]

42.12.2 Fuel Storage Tanks.

42.12.2.1* Fuel storage tanks shall conform to the applicable requirements of NFPA 30. [407: 5.1.2.1]

42.12.2.2 The authority having jurisdiction shall determine the clearances required from runways, taxiways, and other aircraft movement and servicing areas to any aboveground fuel storage structure or fuel transfer equipment, with due recognition given to national and international standards establishing clearances from obstructions. [407: 5.1.2.2]

42.12.3 Pumps and Piping Systems.

42.12.3.1 Underground piping or impact-protected aboveground piping shall be used in the vicinity of aircraft operating areas. [407: 5.1.3.1]

42.12.3.2 Piping shall be laid on firm supports using clean, noncorrosive backfill. [407: 5.1.3.2]

42.12.3.3 Transfer piping located within buildings not specifically designed for the purpose of fuel transfer shall be located within a steel casing of a pressure rating equal to that of the carrier pipe. [407: 5.1.3.3]

42.12.3.3.1 The casing shall extend beyond the building. [407: 5.1.3.3.1]
42.12.3.3.2 The casing shall terminate at a low point(s) with an automatic leak detection system. [407: 5.1.3.3.2]

42.12.3.3.3 The casing shall be capable of being drained to a safe location. [407: 5.1.3.3.3]

42.12.3.4 Piping, valves, and fittings shall be of steel or stainless steel, suitable for aviation fuel service and designed for the working pressure and mechanically and thermally produced structural stresses to which they could be subjected and shall comply with ASME B31.3. [407: 5.1.3.4]

42.12.3.5 Cast-iron, copper, copper alloy, and galvanized steel piping, valves, and fittings shall not be permitted. [407: 5.1.3.5]

42.12.3.6 Ductile iron valves shall be permitted. [407: 5.1.3.6]

42.12.3.7 Aluminum piping, valves, and fittings shall be used only where specifically approved by the authority having jurisdiction. [407: 5.1.3.7]

42.12.3.8 In the selection of pipe, valves, and fittings, the following shall be considered:
(1) Working pressure
(2) Bending and mechanical strength requirements (including settlement)
(3) Internal and external corrosion
(4) Impact stresses
(5) Method of system fabrication and assembly
(6) Location of piping and accessibility for repair or replacement
(7) Exposure to mechanical, atmospheric, or fire damage
(8) Expected period of service and effect of future operations
[407: 5.1.3.8]

42.12.3.9 Gaskets in flanged connections shall resist fire temperatures for a duration comparable to the temperature resistance of the flange and bolts. [407: 5.1.3.9]

42.12.3.10 Flanges and their associated bolts shall be steel or stainless steel. [407: 5.1.3.10]

42.12.3.10.1 Flanges shall be rated to the ANSI pressure class suitable to the fuel system working pressures but in no cases shall be less than Class 150. [407: 5.1.3.10.1]

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

42.12.3.11 Allowances shall be made for thermal expansion and contraction by the use of pipe bends, welded elbows, or other flexible design. [407: 5.1.3.11]

42.12.3.12 Pressure relief valves shall be provided in lines that can be isolated. [407: 5.1.3.12]

42.12.3.13 Welded joints shall be made by qualified welders in accordance with the standards of the American Welding Society and ANSI/ASME B31.3. [407: 5.1.3.13]

42.12.3.14* Isolation valves or devices shall be provided to facilitate dismantling portions of the fueling system. [407: 5.1.3.14]

42.12.3.15 Isolation valves shall be capable of being locked closed. [407: 5.1.3.15]

42.12.3.16 Buried flanges and valves shall not be permitted. [407: 5.1.3.16]
42.12.3.17* All fueling systems with underground piping shall have cathodic protection to mitigate corrosion. [407: 5.1.3.17]

42.12.3.18 A heat-actuated shutoff valve shall be provided in the piping immediately upstream of loading hoses or swing arm connections. [407: 5.1.3.18]

42.12.4 Hose and Nozzles. (Reserved)

42.12.5 Bonding. (Reserved)

42.12.6 Electrical Systems.

42.12.6.1 Electrical Equipment. All electrical equipment and wiring shall comply with the requirements of NFPA 70, Article 515, utilizing the Class I liquids requirements for all applications. [407: 5.1.6.1]

42.12.7 Control of Fuel Flow.

42.12.7.1* Deadman Controls.

42.12.7.1.1 The valve that controls the flow of fuel to an aircraft or fueling vehicle shall have a deadman control. [407: 5.1.7.1.1]

42.12.7.1.2 The fuel flow control means shall be one of the following:
(1) The hydrant pit valve
(2) At the feed-side of the fueling hose
(3) A separate valve on the fuel piping system
(4) On the hose nozzle for overwing servicing
(5) An electronic control to stop the pump [407: 5.1.7.1.2]

42.12.7.1.3 Deadman controls shall be designed to preclude defeating their intended purpose. [407: 5.1.7.1.3]

42.12.7.2 Pressure Fuel Servicing System Controls.

42.12.7.2.1 The system shall be designed to minimize surge pressure. [407: 5.1.7.2.1]

42.12.7.2.2* The overshoot shall not exceed 5 percent of actual flow rate in L/min (gal/min) at the time the deadman is released. [407: 5.1.7.2.2]

42.12.7.2.3 The control valve shall be located and designed so that it will not be rendered inoperative by a surface accident, power failure, or spill. [407: 5.1.7.2.3]

42.12.7.2.4 The control valve shall be fail-safe by closing completely in the event of control power loss. [407: 5.1.7.2.4]

42.12.7.3* Hydrant Valves. Hydrant valves shall be designed so that the flow of fuel shall shut off when the hydrant coupler is closed. [407: 5.1.7.3]

42.12.7.3.1 Hydrant valves shall be of the self-closing, dry-break type. [407: 5.1.7.3.1]

42.12.7.4 Flow Control Valves. The flow control valve shall be an integral part of the hydrant valve or coupler. [407: 5.1.7.4]
42.12.7.4.1 The fuel control valve shall be arranged so that it is not rendered inoperative by a surface accident, spill, or malfunction and shall shut off the flow of fuel if the operating energy fails. [407: 5.1.7.4.1]

42.12.7.4.2 The fuel control system shall be designed to minimize overshoot. [407: 5.1.7.4.2]

42.12.7.4.3 The system shall be designed to shut off fuel flow quickly and effectively, even if there is a reduction of pressure downstream of the flow control valve such as could result from a major line or hose break. [407: 5.1.7.4.3]

42.12.7.4.4 A screen shall be provided ahead of the valve to trap foreign material that could interfere with complete closure of the valve. [407: 5.1.7.4.4]

42.12.7.4.5 The hydrant valve that allows the flow of fuel to the aircraft shall have a deadman control. [407: 5.1.7.4.5]

42.12.7.4.6 The use of any means that allows fuel to flow without the operator activating the deadman shall not be permitted. [407: 5.1.7.4.6]

42.12.7.4.7 The deadman control shall be arranged so that the fueling operator can observe the operation while activating the control. [407: 5.1.7.4.7]

42.12.7.4.8 Wireless deadman controls shall be permitted. [407: 5.1.7.4.8]

42.12.7.5* Fuel Pressure. The pressure of the fuel delivered to the aircraft shall be automatically controlled so that it is not higher than that specified by the manufacturer of the aircraft being serviced. [407: 5.1.7.5]

42.12.8 Filters and Ancillary Equipment.
5.1.8.1 All sections of the filtering system shall have electrical continuity with adjoining piping and equipment. [407: 5.1.8.1]

42.12.8.2 In freezing climates, filter separator sumps and associated piping that could contain water shall be protected to prevent freezing and bursting. [407: 5.1.8.2]

42.12.8.3 Heaters shall be constructed of noncorrosive materials. [407: 5.1.8.3]

42.12.8.4 Piping, valves, meters, filters, air eliminators, connections, outlets, fittings, and other components shall be designed to meet the working pressure requirements of the system. [407: 5.1.8.4]

42.12.9 Emergency Fuel Shutoff Systems.

42.12.9.1 Each tank vehicle loading station shall be provided with an emergency fuel shutoff system, in addition to the deadman control required by 5.1.7.4. [407: 5.1.9.1]

42.12.9.2 The emergency fuel shutoff system shall shut down the flow of fuel in the entire system or in sections of the system. [407: 5.1.9.2]

42.12.9.3 The emergency fuel shutoff system shall be of a failsafe design. [407: 5.1.9.3]

42.12.9.4* The method of fuel transfer (gravity, pumping, or use of hydraulic or inert gas pressure) shall be considered in the design of the emergency fuel shutoff system and the location of the emergency fuel shutoff valve. [407: 5.1.9.4]
42.12.9.5 The emergency fuel shutoff system shall include shutoff stations located outside of probable spill areas and near the route that normally is used to leave the spill area or to reach the fire extinguishers provided for the protection of the area. [407:5.1.9.5]

42.12.9.6* At least one emergency shutoff control station shall be accessible to each fueling vehicle loading position or aircraft fueling position. [407:5.1.9.6]

42.12.9.7 The emergency fuel shutoff system shall be designed so that operation of a station shuts off fuel flow to all hydrants that have a common exposure. [407:5.1.9.7]

42.12.9.8 Emergency fuel shutoff systems shall be designed so that they shut off the flow of fuel if the operating power fails. [407:5.1.9.8]

42.12.9.9 Emergency fuel shutoffs shall not be located beneath piping, pumps, vents, or other components containing fuel or fuel vapors. [407:5.1.9.9]

42.12.10 Fire Protection. At least one fire extinguisher, with a minimum rating of 80-B:C, shall be provided at each fueling vehicle loading position or rack. [407:5.1.10]

42.12.11 Marking and Labeling.

42.12.11.1 Emergency fuel shutoff signs shall be located at least 2.1 m (7 ft) above grade, measured to the bottom of the placard. [407:5.1.11.1]

42.12.11.2 Emergency fuel shutoff signs shall be positioned so that they can be seen readily from a distance of at least 15.2 m (50 ft). [407:5.1.11.2]

42.12.11.3 Systems provided with impressed current cathodic protection shall have appropriate signs, located at points of entry, warning against separation of units without prior deenergization or without proper jumpers across the sections to be disconnected. [407:5.1.11.3]

42.12.11.4 Fuel storage tanks shall be labelled in accordance with the requirements of NFPA 704. [407:5.1.11.4]

42.12.11.5 Fuel transfer piping shall be marked in accordance with EI 1542 as to the product type conveyed through the pipe and the proper direction of flow of the product. [407:5.1.11.5]

42.12.12 Aircraft Fuel Servicing Vehicle Loading and Unloading Racks.

42.12.12.1 The loading rack shall be equipped with an automatic shutdown system that stops the tank loading operation when the fuel servicing vehicle tank is full. [407:5.1.12.1]

42.12.12.2 All fuel servicing tank vehicle primary shutdown systems shall be compatible with the system utilized at the loading rack. [407:5.1.12.2]

42.12.12.3 The automatic secondary shutoff control shall not be used for normal filling control. [407:5.1.12.3]

42.12.12.4 New and existing loading systems shall comply with 5.1.12.1 through 5.1.12.3 within 5 years of the effective date of this edition. [407:5.1.12.4]

42.12.13 Fuel Servicing Hydrants, Pits, and Cabinets.

42.12.13.1 Fueling hydrants and fueling pits that are recessed below a ramp or apron surface and are subject to vehicle or aircraft traffic shall be fitted with a cover designed to sustain the load of vehicles or aircraft that taxi over all or part of them. [407:5.1.13.1]
42.12.13.2 Fueling hydrants, cabinets, and pits shall be located at least 15.2 m (50 ft) from any terminal building, hangar, service building, or enclosed passenger concourse (other than loading bridges). [407:5.1.13.2]

42.13 Operations.
42.13.1 Security. Access to fuel storage and fuel vehicle loading areas shall be secured. [407:5.2.1]

42.13.2 Personnel. (Reserved)
42.13.3 Prevention and Control of Spills. (Reserved)
42.13.4 Emergency Fuel Shutoff. (Reserved)
42.13.5 Bonding. (Reserved)
42.13.6 Control of Fuel Flow. If a wireless deadman control is used, the operator shall be located at the fueling point during the fueling operation. [407:5.2.6]

42.13.7 Fire Protection. During fueling operations, fire extinguishers shall be available on aircraft servicing ramps or aprons, in accordance with NFPA 410. [407:5.2.7]

42.13.8 Maintenance. (Reserved)
42.13.9 Aircraft Fueling Hose. (Reserved)

42.14 Design and Construction.
42.14.1 General Requirements.
42.14.1.1 Aircraft fuel servicing tank vehicles that are operated on public roadways shall comply with the requirements of NFPA 385. [407:6.1.1.1]

42.14.1.2 In addition to any specific requirements in this chapter, only materials safe for use in the service intended and compatible with fuel applications shall be used in the construction of aircraft fuel servicing vehicles and hydrant fuel service carts. [407:6.1.1.2]

42.14.1.3 Magnesium shall not be used in the construction of any portion of an aircraft fuel servicing vehicle or cart. [407:6.1.1.3]

42.14.1.4 Trailer connections shall be designed to secure the trailer firmly and to prevent the towed vehicle from swerving from side to side at the speeds anticipated so that the trailer essentially remains in the path of the towing vehicle. [407:6.1.1.4]

42.14.2 Tanks.
42.14.2.1 Every cargo tank shall be supported by and attached to, or shall be a part of, the tank vehicle upon which it is carried in accordance with NFPA 385. [407:6.1.2.1]

42.14.2.2 Cargo tanks shall be constructed in accordance with 49 CFR 178.345, DOT 406, or other equivalent standard for international application. [407:6.1.2.2]

42.14.2.3 Aluminum alloys for high-strength welded construction shall be joined by an inert gas arc welding process using filler metals R-GR40A, E-GR40A (5154 alloy), R-GM50A, and EGM50A (5356 alloy) in accordance with AWS A5.10. [407:6.1.2.3]

42.14.2.4 Tank outlets shall be of substantial construction. [407:6.1.2.4]

42.14.2.5 Tank outlets shall be attached securely to the tank. [407:6.1.2.5]

42.14.2.6 Baffles. Every cargo tank or compartment over 2.3 m (7.5 ft) long shall be provided with baffles, the total number of which shall be such that the distance between any two adjacent baffles, or between any tank head or bulkhead and the baffle closest to it, shall in no case exceed 1.5 m (5 ft). [407:6.1.2.6]
42.14.2.6.1 The cross-sectional area of each baffle shall be not less than 80 percent of the cross-sectional area of the tank. [407:6.1.2.6.1]

42.14.2.6.2 The thickness of a baffle shall be not less than that required for the heads and bulkheads of the cargo tank in which it is installed. [407:6.1.2.6.2]

42.14.2.7 Venting shall be in accordance with 49 CFR, DOT 406. [407:6.1.2.7]

42.14.2.8 Cargo draw-off valves or faucets projecting beyond the frame of a tank vehicle shall be protected against damage. [407:6.1.2.8]

42.14.2.9 Fill Openings and Top Flashings.
42.14.2.9.1 Dome covers shall be provided with a forward mounted hinge and self-latching catches and shall be fitted with watertight fuel-resistant seals or gaskets designed to prevent spillage or leakage from overturn and to prevent water entry. [407:6.1.2.9.1]

42.14.2.9.2 Dome covers shall automatically close and latch with the forward motion of the vehicle. [407:6.1.2.9.2]

42.14.2.9.3 Drains from top flashing shall divert spilled fuel from possible sources of ignition, including the engine, the engine exhaust system, the electrical equipment, or an auxiliary equipment enclosure. [407:6.1.2.9.3]

42.14.2.9.4 The tank fill openings shall be protected against overturn damage by a rigid member(s) fixed to the tank and extending a minimum of 25 mm (1 in.) above any dome cover, handle, vent opening, or projection of the unit. [407:6.1.2.9.4]

42.14.2.9.5 Overturn protection shall be braced adequately to prevent collapse. [407:6.1.2.9.5]

42.14.2.9.6 Overtur protection shall be designed to channel rainwater, snow, or fuel to the exterior of the cargo tank and away from vehicle exhaust components. [407:6.1.2.9.6]

42.14.2.10 Tanks for Flammable Liquids Other than Fuel. Vehicle or cart fuel tanks and containers for other flammable liquids shall be made of metal and shall be designed, constructed, and located in a manner that precludes hazardous arrangements. [407:6.1.2.10]

42.14.2.10.1 Tanks shall be substantially protected by their location. [407: 6.1.2.10.1]

42.14.2.10.2 Fill pipes shall not project beyond the vehicle profile. [407: 6.1.2.10.2]

42.14.2.10.3 Tanks and containers shall vent away from sources of ignition during filling. [407: 6.1.2.10.3]

42.14.2.10.4 Any arrangement not protected by location shall be listed for such use. [407: 6.1.2.10.4]

42.14.2.10.5 The fuel tank arrangement shall allow for drainage without the tank’s removal from its mountings. [407: 6.1.2.10.5]

42.14.2.11 Tests. Cargo tanks, at the time of manufacture, shall be tested by a minimum air or hydrostatic pressure of 24.4 kg/m² (5 psi) applied to the whole tank (or each compartment thereof if the tanks are compartmented) for a period of at least 5 minutes. [407:6.1.2.11]

42.14.2.11.1 If the test is by air pressure, the entire exterior surface of all joints shall be coated with a solution of soap and water, heavy oil, or other substance that causes foaming or bubbling that indicates the presence of leaks. [407:6.1.2.11.1]
42.14.2.11.2 If the test is by hydrostatic pressure, it shall be gauged at the top of the tank, and the tank shall be inspected at the joints for the issuance of liquid to indicate leaks. [407:6.1.2.11.2]

42.14.2.11.3 Any leakage discovered by either of the methods described in 6.1.2.11.1 and 6.1.2.11.2, or by any other method, shall be considered evidence of failure to meet these requirements. [407:6.1.2.11.3]

42.14.3 Pumps and Piping System.
6.1.3.1 All portions of the flammable liquid feed system shall be constructed and located to minimize the fire hazard. [407:6.1.3.1]

42.14.3.2 Piping and plumbing shall be made of materials not adversely affected by the fluid or by other materials likely to be encountered. [407:6.1.3.2]

42.14.3.3 Piping and plumbing shall be of adequate strength for the purpose. [407:6.1.3.3]

42.14.3.4 Piping and plumbing shall be secured to avoid chafing or undue vibration. [407:6.1.3.4]

42.14.3.5 Piping and plumbing shall be supported adequately. [407:6.1.3.5]

42.14.3.6 Product piping shall be metal and rated for the system working pressure or at least 1030 kPa (150 psi), whichever is greater. [407:6.1.3.6]

42.14.3.7 Except as provided in 6.1.3.8, all joints shall be welded. [407:6.1.3.7]

42.14.3.8 Flanged connections or approved couplings shall be provided to avoid the need for cutting and welding where components are serviced or replaced. [407:6.1.3.8]

42.14.3.9 Gaskets in flanged connections shall be of a material and design that resist fire exposure for a time comparable to the flange and bolts. [407:6.1.3.9]

42.14.3.10 Gravity feed systems shall not be used. [407:6.1.3.10]

42.14.3.11 At the time of manufacture, the section of the fuel dispensing system that is under pressure during service shall be subjected to a hydrostatic test pressure equal to 150 percent of the working pressure of the system for at least 30 minutes and shall be proven tight before it is placed in service. [407:6.1.3.11]

42.14.3.11.1 Hose connections shall be permitted to be plugged during this test. [407:6.1.3.11.1]

42.14.3.12 Loading System.
42.14.3.12.1 Top Loading.
42.14.3.12.1.1 Drop tubes shall be used. [407:6.1.3.12.1.1]

42.14.3.12.1.2 Splash filling shall be prohibited. [407:6.1.3.12.1.2]

42.14.3.12.1.3 Drop tubes used in top loading or overhead loading of tank vehicles shall be designed to minimize turbulence. [407:6.1.3.12.1.3]

42.14.3.12.1.4 Drop tubes shall be metallic. [407:6.1.3.12.1.4]

42.14.3.12.1.5 Drop tubes shall extend to the bottom of the tank or to the inside of the sump to maintain submerged loading and to avoid splashing of the fuel. [407:6.1.3.12.1.5]

42.14.3.12.2 Bottom Loading.
42.14.3.12.2.1 The bottom-loading connection of a tank truck shall be a dry-break coupler that cannot be opened until it is engaged to the vehicle tank adapter. [407:6.1.3.12.2.1]
42.14.3.12.2.2 It shall not be possible to disconnect the hose coupler from the tank vehicle until the coupler valve is fully closed. [407: 6.1.3.12.2.2]

42.14.3.12.2.3* The bottom loading fitting of the tank vehicle shall be a spring-loaded check valve that remains in a closed position until opened by connecting the coupler. [407: 6.1.3.12.2.3]

42.14.3.12.2.4 A float-actuated shutoff or other automatic sensing device shall be provided to close the bottom-loading valve when the tank is filled. [407: 6.1.3.12.2.4]

42.14.3.12.2.5 Any liquid bled from a sensing device during loading shall be piped to the bottom of the cargo tank. [407: 6.1.3.12.2.5]

42.14.3.12.2.6 The fill pipe and valving on bottom-loaded tank vehicles shall be arranged to prevent fuel spray and turbulence in the cargo tank. [407: 6.1.3.12.2.6]

42.14.3.12.2.7 The cargo tank vehicle shall be equipped with an automatic primary shutdown system that stops the tank loading operation when the tank is full, unless an automatic shutdown is provided on the loading rack in accordance with 5.1.12. [407: 6.1.3.12.2.7]

42.14.3.12.2.8 The cargo tank vehicle shall be equipped with an automatic secondary shutdown system that stops the tank loading operation when the tank is full. [407: 6.1.3.12.2.8]

42.14.3.12.2.9 The automatic secondary shutoff control shall not be used for normal filling control. [407: 4.1.1.1]

42.14.3.13 Each outlet valve shall be provided with a fusible device that causes the valve to close automatically in case of fire. [407: 6.1.3.13]

42.14.3.14 A shear section shall be provided between shutoff valve seats and discharge outlets that breaks under strain, unless the discharge piping is arranged to afford the same protection and leave the shutoff valve seat intact. [407: 6.1.3.14]

42.14.3.15 Openings in cargo tank compartments that are connected to pipe or tubing shall be fitted with a spring-loaded check valve, a self-closing valve, or a similar device to prevent the accidental discharge of fuel in case of equipment malfunction or line breakage. [407: 6.1.3.15]

42.14.3.15.1 Unless the valves required in 6.1.3.15 are located inside the tank, they shall be equipped with a shear section as described in 6.1.3.14. [407: 6.1.3.15.1]

42.14.3.16 The operating mechanism for each tank outlet valve shall be adjacent to the fuel delivery system operating controls. [407: 6.1.3.16]

42.14.3.16.1 The operating mechanism for each tank outlet valve shall be arranged so that the outlet valve(s) can be closed simultaneously and instantly in the event of a fire or other emergency. [407: 6.1.3.16.1]

42.14.3.16.2 A means shall be provided to assure proper operation. [407: 6.1.3.16.2]

42.14.4 Hose and Nozzles. (Reserved)

42.14.5 Bonding.

42.14.5.1 All metallic components and vehicle or cart chassis shall be electrically bonded to prevent a difference in their electrostatic potential. [407: 6.1.5.1]

42.14.5.2 Such bonding shall be inherent to the installation or by physical application of a suitable bonding mechanism. [407: 6.1.5.2]
42.14.5.3 A provision shall be provided on the vehicle to bond the tank to a fill pipe or loading rack as specified in 6.2.11.10.1. [407:6.1.5.3]

42.14.5.4 Cables shall be provided on the vehicle or cart to allow the bonding operations specified in 4.2.5. [407:6.1.5.4]

42.14.6 Electrical System.
42.14.6.1 Battery Compartments. Batteries that are not in engine compartments shall be securely mounted in compartments to prevent accidental arcing. [407:6.1.6.1]

42.14.6.1.1 The compartment shall be separate from fueling equipment. [407:6.1.6.1.1]

42.14.6.1.2 Suitable shielding shall be provided to drain possible fuel spillage or leakage away from the compartment. [407:6.1.6.1.2]

42.14.6.1.3 The compartment shall be provided with a vent at the top of the compartment. [407:6.1.6.1.3]

42.14.6.2 Wiring. Wiring shall be of adequate size to provide the required current-carrying capacity and mechanical strength. [407:6.1.6.2]

42.14.6.2.1 Wiring shall be installed to provide protection from physical damage and from contact with spilled fuel either by its location or by enclosing it in metal conduit or other oil-resistant protective covering. [407:6.1.6.2.1]

42.14.6.2.2 All circuits shall have overcurrent protection. [407:6.1.6.2.2]

42.14.6.2.3 Junction boxes shall be weatherproofed. [407:6.1.6.2.3]

42.14.6.2.4 The vehicle shall be equipped with a battery disconnect switch. [407:6.1.6.2.4]

42.14.6.3 Spark plugs and other exposed terminal connections shall be insulated to prevent sparking in the event of contact with conductive materials. [407:6.1.6.3]

42.14.6.4* Motors, alternators, generators, and their associated control equipment located outside of the engine compartment or vehicle cab shall be of a type listed for use in accordance with NFPA 70, Class I, Division 1, Group D locations. [407:6.1.6.4]

42.14.6.5 Electrical equipment and wiring located within a closed compartment shall be of a type listed for use in accordance with NFPA 70, Class I, Division 1, Group D locations. [407:6.1.6.5]

42.14.6.6 Lamps, switching devices, and electronic controls, other than those covered in 6.1.6.4 and 6.1.6.5, shall be of the enclosed, gasketed, weatherproof type. [407:6.1.6.6]

42.14.6.7 Other electrical components not covered in 6.1.6.4 through 6.1.6.6 shall be of a type listed for use in accordance with NFPA 70, Class I, Division 2, Group D locations. [407:6.1.6.7]

42.14.6.8 Electronic equipment shall not be installed in compartments with other equipment that can produce flammable vapors, unless permitted by NFPA 70. [407:6.1.6.8]

42.14.6.9 Tractor Trailer Wiring. Electrical service wiring between a tractor and trailer shall be designed for heavy-duty service. [407:6.1.6.9]

42.14.6.9.1 The connector shall be of the positive-engaging type. [407:6.1.6.9.1]

42.14.6.9.2 The trailer receptacle shall be mounted securely. [407:6.1.6.9.2]
42.14.7 Control of Fuel Flow.
42.14.7.1* The valve that controls the flow of fuel to an aircraft shall have a deadman control. [407:6.1.7.1]

42.14.7.2 The fuel flow control valve shall be one of the following:
(1) The hydrant pit valve
(2) At the tank outlet on a tank vehicle
(3) A separate valve on the tank vehicle
(4) On the hose nozzle for overwing servicing [407:6.1.7.2]

42.14.7.3 Deadman controls shall be designed to preclude defeating their intended purpose. [407:6.1.7.3]

42.14.7.4 Pressure Fuel Servicing System Controls.
42.14.7.4.1 The system shall be designed to minimize surge pressure. [407:6.1.7.4.1]

42.14.7.4.2* The overshoot shall not exceed 5 percent of actual flow rate in L/min (gal/min) at the time the deadman is released. [407:6.1.7.4.2]

42.14.7.4.3 The control valve shall be located and designed so that it will not be rendered inoperative by a surface accident, power failure, or spill. [407:6.1.7.4.4]

42.14.7.4.4 The control valve shall be fail-safe by closing completely in the event of control power loss. [407:6.1.7.4.4]

42.14.7.5 On tank full trailer or tank semitrailer vehicles, the use of a pump in the tractor unit with flexible connections to the trailer shall be prohibited unless one of the following conditions exists:
(1) Flexible connections are arranged above the liquid level of the tank in order to prevent gravity or siphon discharge in case of a break in the connection or piping.
(2) The cargo tank discharge valves required by 6.1.7.1 are arranged to be normally closed and to open only when the brakes are set and the pump is engaged. [407:6.1.7.5]

42.14.7.6 Air Elimination. Aircraft fuel servicing tank vehicles having a positive displacement product pump shall be equipped with a product tank low-level shutdown system that prevents air from being ingested into the fueling system. [407:6.1.7.6]

42.14.8 Filters and Ancillary Equipment.
42.14.8.1 Cabinets.
42.14.8.1.1 All cabinets, other than those housing electronic equipment, shall be vented to prevent the accumulation of fuel vapors. (See 6.1.6.) [407:6.1.8.1.1]

42.14.8.1.2 All cabinets, other than those housing electronic equipment, shall be constructed of noncombustible materials. (See 6.1.6.) [407:6.1.8.1.2]

42.14.8.2 Product Recovery Tanks. The refueling system product recovery tank shall be equipped with a control that shuts down the vehicle's fuel dispensing system when the refueling system product recovery tank is three-quarters full. [407:6.1.8.2]

42.14.9 Emergency Fuel Shutoff Systems.
6.1.9.1 The vehicle shall have at least two emergency shutoff controls, one mounted on each side of the vehicle. [407:6.1.9.1]

42.14.9.2 The emergency fuel shutoff controls shall be quick-acting to close the outlet valve in case of emergency. [407:6.1.9.2]
42.14.9.3 The emergency fuel shutoff controls shall be remote from the fill openings and discharge outlets and shall be operable from a ground level standing position. [407:6.1.9.3]

42.14.9.4 All vehicles or carts equipped with a top deck or elevating platform shall have an additional emergency shutoff control operable from the deck or platform. [407:6.1.9.4]

42.14.10 Fire Protection.
42.14.10.1 Each aircraft fuel servicing tank vehicle shall have two listed fire extinguishers, each having a rating of at least 80-B:C, with one extinguisher mounted on each side of the vehicle. [407:6.1.10.1]

42.14.10.2 One listed fire extinguisher having a rating of at least 80-B:C shall be installed on each hydrant fuel servicing vehicle or cart. [407:6.1.10.2]

42.14.10.3 Extinguishers shall be readily accessible from the ground. [407:6.1.10.3]

42.14.10.4 The area of the paneling or tank adjacent to or immediately behind the extinguisher(s) on fueling vehicles or carts shall be painted a color contrasting with that of the extinguisher. [407:6.1.10.4]

42.14.10.5 Extinguishers shall be kept clear of elements such as ice and snow. [407:6.1.10.5]

42.14.10.6 Extinguishers located in enclosed compartments shall be readily accessible. [407:6.1.10.6]

42.14.10.7 The locations of extinguishers in enclosed compartments shall be marked clearly in letters of a contrasting color at least 50 mm (2 in.) high. [407:6.1.10.7]

42.14.10.8 Smoking Equipment.
42.14.10.8.1* Smoking equipment, such as cigarette lighter elements and ashtrays, shall not be provided. [407:6.1.10.8.1]

42.14.10.8.2 If a vehicle includes smoking equipment, it shall be removed or rendered inoperable. [407:6.1.10.8.2]

42.14.10.8.3 Subsection 6.1.10.8.2 shall be retroactive to existing vehicles. [407:6.1.10.8.3]

42.14.11 Marking and Labeling.
6.1.11.1 Aircraft fueling vehicles shall be marked with the name of the operator or the responsible organization. [407:6.1.11.1]

42.14.11.2 The marking shall be approved, legible signs on both sides of the exterior of the vehicle. [407:6.1.11.2]

42.14.11.3 Signage. Each aircraft fuel servicing vehicle or cart shall have a signage viewable from all sides of the vehicle. [407:6.1.11.3]

42.14.11.3.1 Signs shall have letters at least 75 mm (3 in.) high. [407:6.1.11.3.1]

42.14.11.3.2 Signs shall be of a color contrasting sharply with the sign background for visibility. [407:6.1.11.3.2]

42.14.11.3.3 The words “FLAMMABLE,” “NO SMOKING,” and the name of the product carried, such as JET A, JET B, GASOLINE, or AVGAS, shall appear on each sign. [407:6.1.11.3.3]

42.14.11.4 Emergency Fuel Shutoff Signs.
42.14.11.4.1 Each emergency fuel shutoff station location shall be placarded EMERGENCY FUEL SHUTOFF in letters at least 50 mm (2 in.) high. [407:6.1.11.4]
42.14.11.4.2 The method of operation shall be indicated by an arrow or by the word PUSH or PULL, as appropriate. [407:6.1.11.4.2]

42.14.11.4.3 Any action necessary to gain access to the shutoff device (e.g., BREAK GLASS) shall be shown clearly. [407:6.1.11.4.3]

42.14.11.4.4 Lettering shall be of a color contrasting sharply with the placard background for visibility. [407:6.1.11.4.4]

42.14.11.4.5 Placards shall be weather resistant. [407:6.1.11.4.5]

42.14.11.5 A "NO SMOKING" sign shall be posted prominently in the cab of every aircraft fuel servicing vehicle. [407:6.1.11.5]

42.14.11.6 Hazardous material placards meeting the requirements of 49 CFR 172.504 or equivalent shall be displayed on all four sides of fuel servicing tank vehicles. [407:6.1.11.6]

42.14.12 Drive Train.
42.14.12.1 Propulsion or power engine equipment shall be in a compartment housing that shall minimize the hazard of fire in the event of leakage or spillage of fuel during the servicing of an aircraft. [407:6.1.12.1]

42.14.12.2 The engine air intake shall retain the manufacturer’s configuration to prevent the emission of flame in case of backfiring. [407:6.1.12.2]

42.14.12.3 Where provided, the sediment bowl in the fuel supply line shall be of steel or material of equivalent fire resistance. [407:6.1.12.3]

42.14.12.4 Full trailers and semitrailers, except tow carts with a gross vehicle weight rating (GVWR) under 1360 kg (3000 lb), shall be equipped with service brakes on all wheels. [407:6.1.12.4]

42.14.12.5 All full trailers and semitrailers, including tow carts with a GVWR under 1360 kg (3000 lb), shall be equipped with parking brakes. [407:6.1.12.5]

42.14.12.6 Self-propelled aircraft fuel servicing vehicles shall have an integral system or device that prevents the vehicle from being moved unless all of the following conditions are met:
(1) All fueling nozzles and hydrant couplers are properly stowed.
(2) All mechanical lifts are lowered to their stowed position.
(3) Bottom-loading couplers have been disconnected from the vehicle. [407:6.1.12.6]

42.14.12.7 The vehicle shall have a means to override the system or device required by 6.1.12.6 so that the vehicle can be moved during an emergency. [407:6.1.12.7]

42.14.12.7.1 The override control shall be clearly marked and accessible. [407:6.1.12.7.1]

42.14.12.7.2 A light to indicate activation of the override shall be located in the cabin and visible outside. [407:6.1.12.7.2]

42.14.12.7.3 The override control shall be secured in the normal position with a breakaway seal. [407:6.1.12.7.3]

42.14.12.7.4 The override control shall deactivate the fueling system. [407:6.1.12.7.4]

42.14.13 Exhaust System.
42.14.13.1* The engine exhaust system shall be designed, located, and installed to minimize the hazard of fire in the event of any of the following:
(1) Leakage of fuel from the vehicle or cart (where applicable) fuel tank or fuel system
(2) Leakage from the fuel dispensing system of the vehicle or cart
(3) Spillage or overflow of fuel from the vehicle or cart (if applicable) fuel tank or the cargo tank
(4) Spillage of fuel during the servicing of an aircraft
[407:6.1.13.1]

42.14.13.2 Exhaust system components shall be secured and located clear of components carrying flammable liquids and separated from any combustible materials used in the construction of the vehicle.
[407:6.1.13.2]

42.14.13.3 Suitable shielding shall be provided to drain possible fuel spillage or leakage away from exhaust system components safely. [407:6.1.13.3]

42.14.13.3.1 Diesel particulate filter (DPF) regeneration system piping shall be shielded from the engine discharge manifold to the outlet at the tailpipe. [407:6.1.13.3.1]

42.14.13.3.2 DPF regeneration–equipped vehicles shall have a listed diffuser installed at the outlet of the exhaust tailpipe. [407:6.1.13.3.2]

42.14.13.4 Exhaust gases shall not be discharged where they could ignite fuel vapors that could be released during normal operations or by accidental spillage or by leakage of fuel. [407:6.1.13.4]

42.14.13.4.1 DPF regeneration–equipped vehicles shall have a lockout mode that will prevent automatic regeneration when these vehicles are operated within 30 m (100 ft) of aircraft parking areas. [407:6.1.13.4.1]

42.14.13.5 A muffler (or silencer) cutout shall not be provided. [407:6.1.13.5]

42.14.13.6 Carbureted gasoline-powered engines on fuel servicing vehicles shall be provided with flame- and spark-arresting exhaust systems. [407:6.1.13.6]

42.14.13.7* Non-turbo-charged diesel engines on fuel servicing vehicles shall be equipped with flame- and spark-arresting exhaust systems. [407:6.1.13.7]

42.15 Operations.
42.15.1 Security.
42.15.1.1 Parking of Aircraft Fuel Servicing Tank Vehicles. Parking areas for unattended aircraft fuel servicing tank vehicles shall be arranged to provide the following:
(1) Dispersal of the vehicles in the event of an emergency
(2) A minimum of 3 m (10 ft) of clear space between parked vehicles for accessibility for fire control purposes
(3) Prevention of any leakage from draining to an adjacent building or storm drain that is not suitably designed to handle fuel
(4) A minimum of 15 m (50 ft) from any parked aircraft and buildings other than maintenance facilities and garages for fuel servicing tank vehicles
[407:6.2.1.1]

42.15.1.2 Parking of Aircraft Fuel Servicing Hydrant Vehicles and Carts. Parking areas for unattended aircraft fuel servicing hydrant vehicles or carts shall be arranged to provide the following:
(1) Dispersal of the vehicles in the event of an emergency
(2) Prevention of any leakage from draining to an adjacent building or storm drain that is not suitably designed to handle fuel
[407:6.2.1.2]
42.15.1.3* The authority having jurisdiction shall determine the suitability of tunnels, enclosed roadways, or other limited access areas for use by fuel servicing vehicles. [407:6.2.1.3]

42.15.2 Training. (Reserved)
42.15.3 Prevention and Control of Spills. (Reserved)
42.15.4 Emergency Fuel Shutoff. (Reserved)
42.15.5 Bonding. (Reserved)
42.15.6 Control of Fuel Flow.
42.15.6.1 The fueling operator shall monitor the fueling operation. [407:6.2.6.1]

42.15.6.2 During overwing fueling, the operator shall monitor the fill port. [407:6.2.6.2]

42.15.7 Fire Protection. (Reserved)
42.15.8 Maintenance.
42.15.8.1 Aircraft fuel servicing vehicles or carts shall not be operated unless they are in proper repair and free of accumulations of grease, oil, or other combustibles. [407:6.2.8.1]

42.15.8.2 Leaking vehicles or carts shall be removed from service, defueled, and parked in a safe area until repaired. [407:6.2.8.2]

42.15.8.3 Maintenance and servicing of aircraft fuel servicing vehicles and carts shall be performed outdoors or in a building approved for the purpose. [407:6.2.8.3]

42.15.8.4 At least monthly the operator shall perform a check to ensure complete closure of the bottom-loading valve on the tank vehicle. [407:6.2.8.4]

42.15.9 Aircraft Fueling Hose. (Reserved)
42.15.10 Exhaust System.
42.15.10.1 All vehicles that have engines equipped with an exhaust after-treatment device, such as a DPF, that requires the filter to be cleaned at high temperature (regenerated) while installed on the vehicle shall meet the requirements of 6.2.10.2 through 6.2.10.10. [407:6.2.10.1]

42.15.10.2 DPF regeneration shall be performed only in area(s) designated by the authority having jurisdiction. [407:6.2.10.2]

42.15.10.3 DPF regeneration shall not be performed within 30 m (100 ft) of any aircraft refueling operations. [407:6.2.10.3]

42.15.10.4* Vehicle Regeneration Area.
42.15.10.4.1 The immediate area surrounding the DPF exhaust outlet shall be concrete or other high temperature–resistant material and shall be clear of any grass, soil, or flammable materials. [407:6.2.10.4.1]

42.15.10.4.2 The area shall be in a remote location that is a minimum of 30 m (100 ft) from the nearest aircraft parking location, airport terminal, or flammable storage or a minimum of 15 m (50 ft) from any other building. [407:6.2.10.4.2]

42.15.10.4.3 The area shall be clearly marked with a minimum 61 cm by 30 cm (2 ft by 1 ft) sign reading “Vehicle DPF Regeneration Area,” which shall have letters at least 75 mm (3 in.) high and shall be of a color contrasting sharply with the sign background for visibility. [407:6.2.10.4.3]

42.15.10.5 The regeneration cycle shall be performed only by trained personnel, who shall remain with the vehicle until the regeneration cycle is complete. [407:6.2.10.5]

42.15.10.6 The vehicle shall be visually inspected for any signs of fluid leaks under or around the vehicle before regeneration is initiated. [407:6.2.10.6]
DPF regeneration shall not be initiated if there are any signs of any fluid leaks on or beneath the vehicle. [407:6.2.10.7]

Once a regeneration cycle is started, it shall be completed without interruption. [407:6.2.10.8]

After the regeneration process is successfully completed, the vehicle shall be permitted to return to normal service. [407:6.2.10.9]

Problems occurring during the regeneration cycle shall be corrected prior to the vehicle returning to normal service. [407:6.2.10.10]

Aircraft refueling operations shall not be initiated if the regenerative system indicates regeneration is required. [407:6.2.10.11]

Loading and Unloading.

Aircraft fuel servicing tank vehicles shall be loaded only at an approved loading rack. [407:6.2.11.1]

Aircraft fuel servicing tank vehicles shall not be loaded from a hydrant pit, unless permitted by the authority having jurisdiction under emergency circumstances. [407:6.2.11.2]

Filling of the vehicle cargo tank shall be under the observation and control of a qualified and authorized operator at all times. [407:6.2.11.3]

The required deadman and automatic overfill controls shall be in normal operating condition during the filling operation. [407:6.2.11.4]

The controls shall not be blocked open or otherwise bypassed. [407:6.2.11.5]

The engine of the tank vehicle shall be shut off before starting to fill the tank. [407:6.2.11.6]

To prevent leakage or overflow from expansion of the contents due to a rise in atmospheric temperature or direct exposure to the sun, no cargo tank or compartment shall be loaded to the point where it is liquid full. [407:6.2.11.7]

No cargo tank or compartment shall be loaded above the rated net capacity, as specified by the manufacturer’s data plate. [407:6.2.11.7.1]

Space for thermal expansion, in no case less than 3 percent of the tank volume, shall be provided to prevent leakage. [407:6.2.11.7.2]

The driver, operator, or attendant of any tank vehicle shall not remain in the vehicle but shall not leave the vehicle unattended during the loading or unloading process be considered to be a part of the tank vehicle. [407:6.2.11.8]

No fuel shall be transferred to or from any tank vehicle until the parking brake and wheel chocks have been set to prevent motion of the vehicle. [407:6.2.11.9]

Top Loading.

Where loading tank trucks through open domes, a bond shall be established between the loading piping and the cargo tank to equalize potentials. [407:6.2.11.10.1]

The bond connection shall be made before the dome is opened and shall be removed only after the dome is closed. [407:6.2.11.10.2]
42.15.11.10.3 Drop tubes attached to loading assemblies extending into the vehicle tank shall extend to the bottom of the tank and shall be maintained in that position until the tank is loaded to provide submerged loading and avoid splashing or free falling of fuel through the tank atmosphere. [407:6.2.11.10.3]

42.15.11.10.4 Splash filling shall be prohibited. [407:6.2.11.10.4]

42.15.11.10.5 The flow rate into the tanks shall not exceed 25 percent of the maximum flow until the outlet is fully covered. [407:6.2.11.10.5]

42.15.11.10.6 Fixed drop tubes permanently mounted in the vehicle tank shall extend to the bottom of the tank or to the inside of the sump to maintain submerged loading and to avoid splashing of the fuel. [407:6.2.11.10.6]

42.15.11.10.7 The level in the tank shall be visually monitored at all times during top loading. [407:6.2.11.10.7]

42.15.11.11 Bottom Loading.
42.15.11.11.1 A bonding connection shall be made between the cargo tank and the loading rack before any fuel connections are made and shall remain in place throughout the loading operation. [407:6.2.11.11.1]

42.15.11.11.2 The operator shall initiate fuel flow by means of a dead-man control device. [407:6.2.11.11.2]

42.15.11.11.3 The operator shall ensure that the automatic high-level shutoff system is functioning properly for each compartment shortly after flow has been initiated. [407:6.2.11.11.3]

42.15.12 Positioning of Aircraft Fuel Servicing Vehicles and Carts During Fueling.
42.15.12.1 Aircraft fuel servicing vehicles and carts shall be positioned so that a clear path of egress from the aircraft for fuel servicing vehicles shall be maintained. [407:6.2.12.1]

42.15.12.2 The propulsion or pumping engine of aircraft fuel servicing vehicles or carts shall not be positioned under the wing of the aircraft during overwing fueling or where aircraft fuel system vents are located on the upper wing surface. [407:6.2.12.2]

42.15.12.3 Aircraft fuel servicing vehicles or carts shall not be positioned within a 3 m (10 ft) radius of aircraft fuel system vent openings. [407:6.2.12.3]

42.15.12.4 Parking brakes and chocks shall be set on all fuel servicing vehicles or carts before operators begin the fueling operation. [407:6.2.12.4]

42.15.12.5 During overwing aircraft fuel servicing where aircraft fuel system vents are located on the upper wing surface, equipment shall not be positioned under the trailing edge of the wing. [407:6.2.12.5]

42.16 Design and Construction.
42.16.1 General Requirements.
42.16.1.1 System Design and Approval.
42.16.1.1.1 Fueling on rooftop heliports shall be permitted only where approved by the authority having jurisdiction. [407:7.1.1.1.1]

42.16.1.1.2 In addition to the special requirements in this chapter, the heliport shall comply with the requirements of NFPA 418. [407:7.1.1.1.2]
42.16.1.1.3 Facilities for dispensing fuel with a flash point below 37.8°C (100°F) shall not be permitted at any rooftop heliport. [407:7.1.1.1.3]

42.16.1.1.4 In addition to the special requirements of this chapter, the fuel storage, piping, and dispensing system shall comply with the requirements of NFPA 30 and with applicable portions of this standard. [407:7.1.1.1.4]

42.16.1.1.5 The entire system shall be designed so that no part of the system is subjected to pressure above its working pressure. [407:7.1.1.1.5]

42.16.2 Fuel Storage Tanks.
42.16.2.1 Fuel storage tanks and components shall comply with the requirements of NFPA 30. [407:7.1.2.1]

42.16.2.2 The fuel storage system shall be located at or below ground level. [407:7.1.2.2]

42.16.3 Pumps and Piping Systems.
42.16.3.1 Pumps and piping systems shall comply with the requirements of NFPA 30. [407:7.1.3.1]

42.16.3.2 Pumps shall be located at or below ground level. [407:7.1.3.2]

42.16.3.3 Relay pumping shall not be permitted. [407:7.1.3.3]

42.16.3.4 Pumps installed outside of buildings shall be located not less than 1.5 m (5 ft) from any building opening. [407:7.1.3.4]

42.16.3.5 Pumps shall be anchored and protected against physical damage from collision. [407:7.1.3.5]

42.16.3.6 Pumps installed within a building shall be in a separate room with no opening into other portions of the building. [407:7.1.3.6]

42.16.3.7 The pump room shall be adequately ventilated. [407:7.1.3.7]

42.16.3.8 Electrical wiring and equipment in pump rooms shall conform to the requirements of NFPA 70, Article 515. [407:7.1.3.8]

42.16.3.9 Piping above grade shall be steel and, unless otherwise approved by the authority having jurisdiction, shall be suitably cased or shall be installed in a duct or chase. [407:7.1.3.9]

42.16.3.9.1 Such piping duct or chase shall be constructed so that a piping failure does not result in the entry of fuel liquid or vapor entering the building. [407:7.1.3.9.1]

42.16.3.9.2 All pipe casings, ducts, and chases shall be drained. [407:7.1.3.9.2]

42.16.3.10 Piping shall be anchored and shall be protected against physical damage for a height of at least 2.4 m (8 ft) above the ground. [407:7.1.3.10]

42.16.3.11 An isolation valve shall be installed on the suction and discharge piping of each pump. [407:7.1.3.11]

42.16.3.12 A check valve shall be installed at the base of each fuel piping riser to automatically prevent the reverse flow of the fuel into the pump room in the event of pump seal failure, pipe failure, or other malfunction. [407:7.1.3.12]

42.16.3.13 Piping within buildings shall comply with 5.1.3.3. [407:7.1.3.13]
42.16.4 Hose and Nozzles. (Reserved)
42.16.5 Electrostatic Bonding. (Reserved)
42.16.6 Electrical Systems. (Reserved)
42.16.7 Control of Fuel Flow. (Reserved)
42.16.8 Filters and Ancillary Equipment. (Reserved)
42.16.9 Emergency Fuel Shutoff Systems.
42.16.9.1 At least two emergency fuel shutoff stations located on opposite sides of the heliport at exitways or at similar locations shall be provided. [407:7.1.9.1]

42.16.9.2 An additional emergency fuel shutoff station shall be located at ground level and shall be located at least 3 m (10 ft) from the pump but no further than 6 m (20 ft). [407:7.1.9.2]

42.16.10 Fire Protection. Fire protection shall conform to the requirements of NFPA 418. [407:7.1.10]

42.16.11 Marking and Labeling. (Reserved)

42.17 Operations.
42.17.1 Security. (Reserved)
42.17.2 Personnel. All heliport personnel shall be trained in the use of the available fire extinguishers and fixed extinguishing systems. [407:7.2.2]

42.17.3 Prevention and Control of Spills. (Reserved)
42.17.4 Emergency Fuel Shutoff. All heliport personnel shall be trained in the operation of emergency fuel shutoff controls. [407:7.2.4]

42.17.5 Bonding. (Reserved)
42.17.6 Monitoring of Fuel Flow. (Reserved)
42.17.7 Fire Protection. (Reserved)
42.17.8 Maintenance. (Reserved)
42.17.9 Aircraft Fueling Hose. (Reserved)

42.18 Design and Construction.
42.18.1 General Requirements.
42.18.1.1 System Design and Approval. Self-service fueling shall be permitted, subject to the approval of the authority having jurisdiction. [407:8.1.1.1]

42.18.1.2 Dispensing devices shall be located on an island to protect against collision damage or shall be protected with pipe bollards or other approved protection. [407:8.1.1.2]

42.18.2 Fuel Storage Tanks. In addition to the special requirements of this chapter, the fuel storage system shall comply with the requirements of NFPA 30. [407:8.1.2]

42.18.3 Pumps and Piping Systems.
42.18.3.1 In addition to the special requirements of this chapter, the piping and dispensing system shall comply with the requirements of NFPA 30. [407:8.1.3.1]

42.18.3.2 Listed or approved dispensing devices shall be used. [407:8.1.3.2]

42.18.4 Hose and Nozzles. (Reserved)
42.18.5 Electrostatic Bonding. (Reserved)
42.18.6 Electrical Systems. (Reserved)
42.18.7 Control of Fuel Flow. (Reserved)
42.18.8 Filters and Ancillary Equipment. (Reserved)
42.18.9 Emergency Fuel Shutoff Systems.
42.18.9.1 The controls shall be designed to allow only authorized personnel to reset the system after an emergency fuel shutoff. [407:8.1.9.1]
42.18.9.2 The emergency fuel shutoff controls shall be installed in a location acceptable to the authority having jurisdiction and shall be more than 6 m (20 ft) but less than 30 m (100 ft) from the dispensers. [407:8.1.9.2]

42.18.9.3 A clearly identified means to notify the fire department shall be provided and shall be located in the immediate vicinity of each emergency fuel shutoff control. [407:8.1.9.3.]

42.18.9.4 Dispensing devices shall have a listed or approved emergency shutoff valve, incorporating a fusible link or other thermally actuated device designed to close automatically in case of fire. [407:8.1.9.4]

42.18.9.5 The emergency shutoff valve also shall incorporate a shear section that automatically shuts off the flow of fuel due to severe impact. [407:8.1.9.5]

42.18.9.6 The emergency shutoff valve shall be rigidly mounted at the base of the dispenser in accordance with the manufacturer’s instructions. [407:8.1.9.6]

42.18.10 Fire Protection.
42.18.10.1 Each facility shall have a minimum of one fire extinguisher with a rating of at least 80-B:C located at the dispenser. [407:8.1.10.1]

42.18.10.2 At least one fire extinguisher with a rating of at least 80-B:C shall be provided at each emergency fuel shutoff control. [407:8.1.10.2]

42.18.11 Marking and Labeling.
42.18.11.1 Emergency instructions shall be conspicuously posted in the dispensing area and at the emergency fuel shutoff control. [407:8.1.11.1]

42.18.11.2 Emergency instructions shall incorporate the following or equivalent wording:
EMERGENCY INSTRUCTIONS IN CASE OF FIRE OR SPILL
(1) Use emergency fuel shutoff.
(2) Report accident by calling (specify local fire emergency reporting number) on phone.
(3) Report address of site (list address of site here).
[407:8.1.11.2]

42.18.11.3 Operating Instructions. Operating instructions shall be posted. [407:8.1.11.3]

42.18.11.4 The operating instructions shall include the following:
(1) Proper operation and use of all equipment
(2) Correct bonding procedures
(3) Procedures to be employed to dispense fuel safely
(4) Location and use of the emergency fuel shutoff controls
(5) Procedures to be used in the event of an emergency
[407:8.1.11.4]

42.19 Operations.
42.19.1 Security. Access to dispensing equipment shall be controlled by means of mechanical or electronic devices designed to resist tampering and to prevent access or use by unauthorized persons. [407:8.2.1]

42.19.2 Training. (Reserved)
42.19.3 Prevention and Control of Spills. (Reserved)
42.19.4 Emergency Fuel Shutoff. (Reserved)
42.19.5 Bonding. (Reserved)
42.19.6 Monitoring of Fuel Flow. (Reserved)
42.19.7 Fire Protection. (Reserved)
42.19.8 Maintenance. (Reserved)
**42.19.9 Occupancy.** The aircraft shall not be occupied during self-service fueling. [407:8.2.9]

**A.42.10.3** The section on aircraft refueling hose has been altered extensively by referencing EI 1529. NFPA 407 formerly contained many requirements for hose, but these were intended to address only those features that could be related to a fire or the results of a fire. It was not until 1982 that a comprehensive aircraft refueling hose specification was published by the American Petroleum Institute (API). Prior to that time, NFPA 407 was the only document in existence that addressed this subject. In 2010, the API transferred responsibility for aviation fuel-handling standards to the Energy Institute (EI). [407:A.4.1.4]

EI 1529 deals with all aspects of hose safety, including the couplings that are acceptable. [407:A.4.1.4]

NFPA 407 recognizes the need for an extensive document such as EI 1529 and requires hoses that meet that standard. However, it is important to recognize that EI does not perform testing and that it does not regulate those manufacturers who claim to sell hose that meets EI 1529. The hose user and the cognizant authority having jurisdiction could find it prudent to require hose manufacturers to produce copies of test reports or documents that certify that hoses of identical construction and compounds have been tested and have passed all requirements of EI 1529 satisfactorily. [407:A.4.1.4]

**A.42.10.3.3.6** Splicing of a hose with couplings alters the design bend radius of the hose, creating two kinks when the hose is wound on a drum. [407:A.4.1.4.3.6]

**A.42.10.4.9** The charge on the fuel can be reduced by the use of a static dissipater additive that increases the electrical conductivity of the fuel and thereby allows the charge to relax or dissipate more quickly, or by the use of a relaxation chamber that increases the residence time of the fuel downstream of the filter to at least 30 seconds, thereby allowing most of the charge to dissipate before the fuel arrives at the receiving tank. [407:A.4.1.5.9]

API RP 2003 recommends a 30-second relaxation time for loading tank trucks and refuelers. However, it has not been a common practice to require a similar relaxation time for aircraft refueling, primarily because of the relatively few electrostatic incidents that have occurred during aircraft fueling. (For additional information on this topic, see CRC Report No. 583.) [407: A.4.1.5.9]

In filling tank trucks or storage tanks, API RP 2003 recommends that at least 30 seconds of residence time be provided downstream of a filter in order to allow static charges generated in flowing fuel to relax before fuel enters the tank. [407: A.4.1.5.9]

The reason it is possible to fuel aircraft safely with low conductivity fuel without providing 30 seconds of relaxation time is due primarily to the difference in the geometry of aircraft tanks as compared with tank truck compartments. Flow into the aircraft normally is subdivided into several tanks simultaneously and also distributed into adjoining compartments of each tank by a multi-hole inlet. Bachman and Dukek (1972) conducted full-scale research using a simulated large aircraft tank and concluded that none of the tanks or compartments hold sufficient fuel to allow enough charges to accumulate and create large surface voltages. Slower fill rates per compartment also allow more charge to relax. [407: A.4.1.5.9]

Additionally, the inlet system of most aircraft tanks directs fuel toward the bottom of the tank to avoid splashing that generates more charge. Finally, while the hoses that connect the fueler to the aircraft provide only a few seconds of residence time for charge relaxation at high rates of flow, the actual relaxation volume in the system is significantly greater where a coated screen is used as a second stage...
water barrier. In this case, the vessel’s volume after the first stage filter coalescer could represent an additional 15 seconds of residence time for charge relaxation. (The coated screen, unlike other water barriers, does not generate charge.) [407: A.4.1.5.9]

A flammable vapor space in the tank due to the presence of JET B or JP-4 fuels still constitutes a potential hazard. Therefore, to minimize the chance for static ignition, FAA regulations require that fueling be conducted at half of the rated flow where civil aircraft have used such fuels. [407: A.4.1.5.9]

**A. 42.10.9.1** Carbon dioxide extinguishers should not be selected due to their limited range and effectiveness in windy conditions. [407:A.4.1.10.1]

**A. 42.10.9.3** Multipurpose dry chemical (ammonium phosphate) fire-extinguishing agent is known to cause corrosion to aircraft components. Although the agent is capable of extinguishing fires on or near aircraft, it is likely that the agent will spread to other, uninvolved aircraft, causing damage from corrosion. [407:A.4.1.10.3]

**A. 42.10.11.2.1** The beam of radar equipment has been known to cause ignition of flammable vapor–air mixtures from inductive electric heating of solid materials or from electrical arcs or sparks from chance resonant conditions. The ability of an arc to ignite flammable vapor–air mixtures depends on the total energy of the arc and the time lapse involved in the arc’s duration, which is related to the dissipation characteristics of the energy involved. The intensity or peak power output of the radar unit, therefore, is a key factor in establishing safe distances between the radar antenna and fueling operations, fuel storage or fuel loading rack areas, fuel tank truck operations, or any operations where flammable liquids and vapors could be present or created. [407:A.4.1.12.2]

Most commercially available weather-mapping airborne radar equipment operates at peak power outputs, varying from 25 kW to 90 kW. Normally this equipment should not be operated on the ground. Tests have shown that the beam of this equipment can induce energy capable of firing flash bulbs at considerable distances. If the equipment is operated on the ground for service checking or for any other reason, the beam should not be directed toward any of the hazards described in the previous paragraph that are located within 30 m (100 ft). Higher power radar equipment can require greater distances. [407:A.4.1.12.2]

Airport surface detection radar operates under a peak power output of 50 kW. It is fixed rather than airborne equipment. [407:A.4.1.12.2]

Airborne surveillance radar of the type currently carried on military aircraft has a high peak power output. Aircraft carrying this type of radar can be readily distinguished by radomes atop or below the fuselage, or both. [407:A.4.1.12.2]

Aircraft warning radar installations are the most powerful. Most of these installations are, however, remotely located from the hazards specified in the first paragraph and therefore are not covered herein. Ground radar for approach control or traffic pattern surveillance is considered the most fire hazardous type of radar normally operating at an airport. The latter type of equipment has a peak power output of 5 MW. Where possible, new installations of this type of equipment should be located at least 150 m (500 ft) from any of the hazards described in the first paragraph. [407:A.4.1.12.2]

**A. 42.11.2.1** Records should be kept of personnel training. These records should be made available to the authority having jurisdiction upon request. [407:A.4.2.2.1]

**A. 42.11.2.2** Fuel servicing personnel should be given adequate training with extinguishers so that such equipment is used effectively in an emergency. Such training should be given on fires of the type that could be encountered on the job. To ensure prompt action in the event of a spill or other hazardous
condition developing during fueling operations, aircraft servicing personnel also should be trained in the operation of emergency fuel shutoff controls. Each new fuel servicing employee should be given indoctrination training covering these and similar safety essentials that are related to the job. Follow-up and advanced training should be given as soon as the employee is sufficiently acquainted with the work to benefit from such training. Supervisors should be given training in the more technical aspects of fire safety so that they understand the reason for these and similar requirements and have an appreciation for the responsibility of a supervisor and the safety of an operation. [407A.4.2.2.2]

A. 42.11.3 The following actions are appropriate in the event of a fuel spill, although each spill should be treated as an individual case due to such variables as the size of the spill, type of flammable or combustible liquid involved, wind and weather conditions, equipment arrangement, aircraft occupancy, emergency equipment, and personnel available:

(1) The flow of fuel should be stopped, if possible. If the fuel is discovered leaking or spilling from fuel servicing equipment or hoses, the emergency fuel shutoff should be operated at once. If the fuel is discovered leaking or spilling from the aircraft at the filler opening, vent line, or tank seams during fueling operations, fueling should be stopped immediately. Evacuation of the aircraft should be ordered when necessary. The aircraft then should be thoroughly checked for damage or entrance of flammable liquid or vapors into any concealed wing or fuselage area, and corrective action should be taken as necessary before it is returned to normal operational service.  

(2) The airport fire crew should be notified if the spill presents a fire hazard. The only routine exceptions are for small spills. Supervisory personnel should be notified to ensure that operations in progress can be continued safely or halted until the emergency is past and that corrective measures can be taken to prevent recurrence of a similar accident.  

(3) It could be necessary to evacuate the aircraft if the spill poses a serious fire exposure to the aircraft or its occupants. Walking through the liquid area of the fuel spill should not be permitted. Persons who have been sprayed with fuel or had their clothing soaked with fuel should go to a place of refuge, remove their clothing, and wash. Individuals whose clothing has been ignited should be wrapped in blankets, coats, or other items or should be told to or forced to roll on the ground.  

(4) Mobile fueling equipment and all other mobile equipment should be withdrawn from the area or left as is until the spilled fuel is removed or made safe. No fixed rule can be made as fire safety varies with circumstances. Shutting down equipment or moving vehicles can provide a source of ignition if no fire immediately results from the spillage.  

(5) Aircraft, automotive, or spark-producing equipment in the area should not be started before the spilled fuel is removed or made safe. If a vehicle or cart engine is running at the time of the spill, it normally is good practice to drive the vehicle away from the hazard area unless the hazard to personnel is judged too severe. Fuel servicing vehicles or carts in operation at the time of the spill should not be moved until a check is made to verify that any fuel hose that could have been in use or connected between the vehicle and the aircraft is safely stowed.  

(6) If any aircraft engine is operating at the time of the spill, it normally is good practice to move the aircraft away from the hazard area unless air currents set up by operating power plants would aggravate the extent or the nature of the existing vapor hazard.  

(7) If circumstances dictate that operating internal combustion engine equipment within a spill area that has not ignited should be shut down, engine speeds should be reduced to idle prior to cutting ignition in order to prevent backfire.  

(8) The volatility of the fuel can be a major factor in the initial severity of the hazard created by a spill. Gasoline and other low flash point fuels at normal temperatures and pressures produce vapors that are capable of forming ignitable mixtures with the air near the surface of the liquid, whereas this condition does not normally exist with kerosene fuels (JET A or JET A-1) except where ambient temperatures are 38°C (100°F) or above or where the liquid has been heated to a similar temperature.  

(9) Spills of gasoline and low flash point turbine fuels (JET B) greater than 3 m (10 ft) in any dimension and covering an area of over 5 m² (50 ft²) or that are of an ongoing nature should be blanketed or covered with foam. The nature of the ground surface and the existing exposure conditions dictate the exact method to be followed. Such fuels should not be washed down sewers or drains. The decision to use a sewer or drain should be made only by the chief of the airport fire brigade or the fire department. If fuels do enter sewers, either intentionally or unintentionally, large volumes of water should be introduced to flush such sewers or drains as quickly as possible to dilute the flammable liquid content of the sewer or
drain to the maximum possible extent. Normal operations involving ignition sources (including aircraft and vehicle operations) should be prohibited on surface areas adjacent to open drains or manholes from which flammable vapors could issue due to the introduction of liquids into the sewer system until it can be established that no flammable vapor–air mixture is present in the proximity. (NOTE: NFPA 415 provides further information on aircraft fueling ramp drainage designs to control the flow of fuel that could be spilled on a ramp and to minimize the resulting possible danger.)

(10) Spills of kerosene grades of aviation fuels (JET A or JET A-1) greater than 3 m (10 ft) in any dimension and covering an area of over 5 m² (50 ft²) or that are of an ongoing nature and that have not ignited should be blanketed or covered with foam if there is danger of ignition. If there is no danger of ignition, an absorbent compound or an emulsion-type cleaner can be used to clean the area. Kerosene does not evaporate readily at normal temperatures and should be cleaned up. Smaller spills can be cleaned up using an approved, mineral type, oil absorbent.

(11) Aircraft on which fuel has been spilled should be inspected thoroughly to ensure that no fuel or fuel vapors have accumulated in flap well areas or internal wing sections not designed for fuel tankage. Any cargo, baggage, express, mail sacks, or similar items that have been wetted by fuel should be decontaminated before being placed aboard any aircraft.

A. 4.2.11.5 Hydrocarbon fuels, such as aviation gasoline and JET A, generate electrostatic charge when passing through the pumps, filters, and piping of a fuel transfer system. (The primary electrostatic generator is the filter/separator that increases the level of charge on a fuel by a factor of 100 or more as compared with pipe flow.) Splashing, spraying, or freefalling of the fuel further enhances the charge. When charged fuel arrives at the receiving tank (cargo tank or aircraft fuel tank), one of two possible events will occur:

(1) The charge will relax harmlessly to ground.
(2) If the charge or the fuel is sufficiently high, a spark discharge can occur. Whether or not an ignition follows depends on the energy (and duration) of the discharge and the composition of the fuel-air mixture in the vapor space (i.e., whether or not it is in the flammable range). The amount of charge on a fuel when it arrives at the receiving tank, and hence its tendency to cause a spark discharge, depends on the nature and amount of impurities in the fuel, its electrical conductivity, the nature of the filter media (if present), and the relaxation time of the system [i.e., the residence time of the fuel in the system between the filter (separator) and the receiving tank]. The time needed for this charge to dissipate is dependent upon the conductivity of the fuels; it could be a fraction of a second or several minutes. No amount of bonding or grounding prevents discharges from occurring inside a fuel tank. Bonding ensures that the fueling equipment and the receiving tank (aircraft or fueler) are at the same potential and provides a path for the charges separated in the fuel transfer system (primarily the filter/separator) to combine with and neutralize the charges in the fuel. Also, in overwing fueling and in top loading of cargo tanks, bonding ensures that the fuel nozzle or the fill pipe is at the same potential as the receiving tank, so that a spark does not occur when the nozzle or fill pipe is inserted into the tank opening. For this reason, the bonding wire has to be connected before the tank is opened. Grounding during aircraft fueling or fuel servicing vehicle loading is no longer required because of the following:

(1) Grounding does not prevent sparking at the fuel surface (see NFPA 77).
(2) Grounding is not required by NFPA 77.
(3) The static wire might not be able to conduct the current in the event of an electrical fault in the ground support equipment connected to the aircraft and could constitute an ignition source if the wire fuses. If ground support equipment is connected to the aircraft or if other operations are being conducted that necessitate electrical earthing, separate connections should be made for this purpose. Static electrical grounding points can have high resistance and, therefore, are unsuitable for grounding. For a more complete discussion of static electricity in fuels, see NFPA 77.

A. 4.2.11.5.3.1 Ordinary plastic funnels or other nonconducting materials can increase static generation. The use of chamois as a filter is extremely hazardous. [407:A.4.2.5.3.1]
A. 42.11.7.1 Portable fire extinguishers for ramps where fueling operations are conducted are intended to provide an immediate means of fire protection in an area likely to contain a high concentration of personnel and valuable equipment. The prominent and strategic positioning of portable fire extinguishers is essential for them to be of maximum value in the event of an emergency. Extinguishers should not be located in probable spill areas. For normal single parking configurations, extinguishers specified for protection of fuel servicing operations should be located along the fence, at terminal building egress points, or at emergency remote control stations of airport fixed-fuel systems. To provide accessibility from adjoining gates, particularly where more than one unit is specified, extinguishers can be permitted to be located approximately midway between gate positions. Where this is done, the maximum distance between extinguishers should not be over 60 m (200 ft). Where the specified extinguishers are not located along the fence but are brought into the servicing area prior to the fueling operation, they should be located upwind not over 30 m (100 ft) from the aircraft being serviced. For protection of fuel servicing of aircraft that are double parked or triple parked, extinguishers should be located upwind not over 30 m (100 ft) from the aircraft being serviced. [407:A.4.2.7.1]

A. 42.11.7.2 During inclement weather, extinguishers not in enclosed compartments can be permitted to be protected by canvas or plastic covers. [407:A.4.2.7.2]

A. 42.11.9 Failure of an aircraft fueling hose in service is a potential source of fuel spillage and a potential fire hazard. The principal reasons for failure of aircraft fueling hoses include the following:
(1) Using damaged hoses
(2) Using aged hoses
(3) Exceeding hose pressure limits
(4) Installing hoses improperly
[407:A.4.2.9]

A. 42.11.9.5.1 Particular attention should be paid to the 305 mm (12 in.) adjacent to the couplings. These areas are prone to premature failure. [407:A.4.2.9.5.1]

A. 42.11.10 Establishing precise rules for fueling is impossible when the electrical storms are in the vicinity of the airport. The distance of the storm from the airport, the direction in which it is traveling, and its intensity are all factors to be weighed in making the decision to suspend fueling operations temporarily. Experience and good judgment are the best guides. Sound travels approximately 322 m/sec (1/5 mi/sec). The approximate number of miles to the storm can be determined by counting the seconds between a flash of lightning and the sound of thunder and dividing by 5. [407:A.4.2.10]

A. 42.11.11.1.3 The precautions in 4.2.11.1.3 and 4.2.11.1.4 are intended to minimize the danger of the ignition of any flammable vapors discharged during fueling and of fuel spills by sources of ignition likely to be present in airport terminal buildings. [407:A.4.2.11.1.3]

A. 42.11.12.1 Electric hand lamps used in the immediate proximity of the fueling operation should be of the type approved for use in NFPA 70, Class I, Division 1, Group D hazardous locations. No supportable basis exists for requiring, in the petroleum industry, the use of approved, listed, or permitted two- or three-cell flashlights to avoid igniting Class I, Group D vapors. [407:A.4.2.12.1]

A. 42.11.12.1.2 Aircraft ground-power generators should be located as far as practical from aircraft fueling points and tank vents to reduce the danger of igniting flammable vapors that could be discharged during fueling operations at sparking contacts or on hot surfaces of the generators. [407:A.4.2.12.1.2]

A. 42.11.12.1.5 For further information on intrinsically safe apparatus, see ANSI/UL 913, FM Class 3610, or ANSI/UL 60079-11. [407:A.4.2.12.1.5]

A. 42.12.2.1 Where pressure tanks are used, details on construction, spacing, and location should be in accordance with industry good practice and approved by the authority having jurisdiction. When AVGAS, MOGAS, or JET B turbine fuels are stored in bulk quantities in aboveground tanks, they should be
stored in floating roof-type tanks. Covered floating roof tanks minimize the hazardous flammable vapor–air space above the liquid level. The vapor spaces of underground tanks storing fuels should not be interconnected. [407:A.5.1.2.1]

**A. 42.12.3.14** Flanged connections should be provided for ease of dismantling and to avoid cutting and welding after the system has been placed in service. The location of these isolation devices depends upon the size and character of each system, but the following locations generally apply (see Figure A.42.12.3.14):

1. At each storage tank
2. At each pump
3. At each filter separator
4. At each hydrant or on each hydrant lateral
5. At each flow regulator or pressure control valve

[407:A.5.1.3.14]

**A. 42.12.3.17** Cathodic protection is recommended for metal components of airport fueling systems and fuel storage facilities that are in contact with the ground. The two types of cathodic protection are as follows:

1. Galvanic anode method, which generates its own current
2. Impressed current method, which has an external current source

[407:A.5.1.3.17]

**A. 42.12.7.1** Deadman controls should be designed so that the operator can use them comfortably while wearing gloves and hold them for the time needed to complete the operation. A pistol grip deadman device that is squeezed to operate is preferable to a small button that needs to be held by a thumb or finger. [407:A.5.1.7.1]

**A. 42.12.7.2.2** The overshoot of pressure control release, $V_{\text{max}}$, should be calculated by the following equation:

$$V_{\text{max}} = Q \times 1 \text{ min} \times 0.05$$

where:

$Q$ = actual fuel flow rate, L/min (gal/min)

**Example**

If the actual fuel flow rate at the time of deadman control release is 1500 L/min (400 gpm), total overshoot must not exceed 75 L/min (20 gal/min). [407:A.5.1.7.2.2]

**A. 42.12.7.3** Hydrant valves and couplers should be in accordance with EI 1584. [407:A.5.1.7.3]

**A. 42.12.7.5** Where surge suppressors are necessary, they should be located so that exposure to vehicular traffic, weather conditions, and the result of accidental rupture is minimized. [407:A.5.1.7.5]

**A. 42.12.9.4** Fuel transfer by pumping is the more common procedure and normally is preferred from a fire protection standpoint, since it allows rapid shutdown of fuel flow through pump shutdown. Gravity transfer is the simplest method but normally is limited to relatively low flow rates. Because the static head does exert some pressure in the system, a safety shutdown should include a valve or valves located as close to the tank as practicable. [407:A.5.1.9.4]

**A. 42.12.9.6** The operation of the emergency shutoff control should sound an alarm at the airport fire crew station and at the fuel storage facility. [407:A.5.1.9.6]

**A. 42.13.1** The airport perimeter fence can be sufficient to meet this requirement. [407:A.5.2.1]

**A. 42.14.3.12.2.3** An optional precaution against misfueling of aircraft fuel servicing tank vehicles is to equip the coupler and truck fitting with coded lugs or a mechanical device to ensure product selection and
to prevent mixing of products. This might not be feasible on over-the-road-type tank vehicles. [407:A.6.1.3.12.2.3]

**A. 42.14.6.4** Electrical equipment contained in aircraft fuel servicing vehicles or cart engine compartments and located 460 mm (18 in.) or more above ground can be permitted to be of the general-purpose type. [407:A.6.1.6.4]

**A. 42.14.7.1** See A.5.1.7.1. [407:A.6.1.7.1]

**A. 42.14.7.4.2** See A.5.1.7.2.2. [407:A.6.1.7.4.2]

**A. 42.14.10.8.1** It is not the intent of 6.1.10.8.1 to prohibit 12 V power outlets. The intent is to prohibit glowing elements. [407:A.6.1.10.8.1]

**A. 42.14.13.1** Wherever possible, flexible engine exhaust pipe should be avoided due to the potential of breaking. Where used, stainless steel is preferable, and the length should be limited to approximately 460 mm (18 in.). The USDA Forest Service, the governmental body that regulates the spark arrester standard, clearly identifies that all diesel engines with a turbocharger and no waste gate (also clearly identified therein) are exempt from the requirements to have an additional spark-arresting device. [407:A.6.1.13.1]

**A. 42.15.1.3** The use of tunnels or enclosed roadways is discouraged. Where there is no alternate route, and the fuel servicing vehicle requires the use of a tunnel or enclosed roadway, the authority having jurisdiction should examine the following considerations:

1. Length
2. Clearances
3. Fixed fire suppression or extinguishing systems
4. Frequency of use
5. Ventilation
6. Overlying structures and operations
7. Other traffic
8. Fire department access
9. Emergency egress
10. Drainage
11. Other conditions

[407:A.6.2.1.3]

**A. 42.15.10.4** The size of the DPF regeneration area depends on the equipment being used (fleet size). The authority having jurisdiction should designate the size and number of DPF regeneration pads and determine whether a centralized facility is advantageous. [407:A.6.2.10.4]
Second Revision No. 46-NFPA 1-2016 [ Global Comment ]


Supplemental Information

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Submitter Information Verification

**Submitter Full Name:** Kristin Bigda  
**Organization:** National Fire Protection Assoc

**Street Address:**  
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**State:**  
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**Submittal Date:** Wed Oct 12 12:09:35 EDT 2016

Committee Statement

**Committee Statement:** Extract update.  
**Response Message:**

National Fire Protection Association Report

http://submittals.nfpa.org/TerraViewWeb/ContentFetcher?commentPara...
NFPA 10:

3.3.114.1 Class A Fires.
Class A fires are fires in ordinary combustible materials, such as wood, cloth, paper, rubber, and many plastics. [10, 2017]

3.3.114.2 Class B Fires.
Class B fires are fires in flammable liquids, combustible liquids, petroleum greases, tars, oils, oil-based paints, solvents, lacquers, alcohols, and flammable gases. [10, 2017]

3.3.114.3 Class C Fires.
Class C fires are fires that involve energized electrical equipment. [10, 2017]

3.3.114.4 Class D Fires.
Class D fires are fires in combustible metals, such as magnesium, titanium, zirconium, sodium, lithium, and potassium. [10, 2017]

3.3.114.5 Class K Fires.
Class K fires are fires in cooking appliances that involve combustible cooking media (vegetable or animal oils and fats). [10, 2017]

13.6.1.1.1 The requirements given herein are minimum. [10:1.1.1.1]

13.6.1.1.2 The requirements shall not apply to permanently installed systems for fire extinguishment, even where portions of such systems are portable (such as hose and nozzles attached to a fixed supply of extinguishing agent). [10:1.1.2]

13.6.1.2* Where Required.
Fire extinguishers shall be provided where required by this Code as specified in Table 13.6.1.2 and the referenced codes and standards listed in Chapter 2.
Table 13.6.1.2 Portable Fire Extinguishers Required

13.6.1.3 Listing and Labeling.
13.6.1.3.1* Portable fire extinguishers used to comply with Section 13.6 shall be listed and labeled and shall meet or exceed all the requirements of ANSI/UL 711, CAN/ULC-S508, Standard for Rating and Fire Testing of Fire Extinguishers, one of the following fire test standards and one of the following applicable performance standards:

2. Performance standards:

1. Carbon dioxide types: ANSI/UL 154, CAN/ULC-S503, Standard for Carbon-Dioxide Fire Extinguishers
2. Dry chemical types: ANSI/UL 299, CAN/ULC-S504, Standard for Dry Chemical Fire Extinguishers
5. Film-forming foam types: ANSI/UL 8, CAN/ULC-S554, Water Based Agent Fire Extinguishers
6. Halocarbon types: ANSI/UL 2129, CAN/ULC-S566, Standard for Halocarbon Clean Agent Fire Extinguishers

13.6.1.3.2*
Each fire extinguisher shall be marked with the following:

1. Identification of the listing and labeling organization
2. Product category indicating the type of extinguisher
3. Extinguisher classification as indicated in Section 5.3 of NFPA 10
4. Performance and fire test standards that the extinguisher meets or exceeds

13.6.1.3.2.1
Fire extinguishers manufactured prior to January 1, 1986, shall not be required to comply with 13.6.1.3.2. [10:4.1.2.1]

13.6.1.3.2.2
Halon extinguishers listed and labeled to UL 1093, Standard for Halogenated Agent Fire Extinguishers, shall be permitted to be used to comply with the requirements of Section 13.6 when installed, inspected and maintained in accordance with Section 13.6. [10:4.1.2.2]

13.6.1.3.4.1
In addition to successfully meeting the requirements of ANSI/UL 711, CAN/ULC-S508, Standard for Rating and Fire Testing of Fire Extinguishers, water-based agents that are listed for the Class C rating shall be tested in accordance with ASTM D5391, Standard Test for Electrical Conductivity and Resistivity of a Flowing High Purity Water Sample. [10:4.1.4.1]

13.6.1.4* Identification of Contents.
A fire extinguisher shall have a label, tag, or stencil attached to it providing the following information:

1. The content's product name as it appears on the manufacturer's Material Safety Data Sheet (MSDS)
2. Listing of the hazardous material identification in accordance with Hazardous Materials Identification System (HMIS), Implementational Manual [in Canada, Globally Harmonized System of Classification and Labeling of Chemicals (GHS)] developed by the National Paint and Coatings Association
3. List of any hazardous materials that are in excess of 1.0 percent of the contents
4. List of each chemical in excess of 5.0 percent of the contents
5. Information as to what is hazardous about the agent in accordance with the MSDS
6. Manufacturer’s or service agency's name, mailing address, and phone number

13.6.1.6 Obsolete Fire Extinguishers.

The following types of fire extinguishers are considered obsolete and shall be removed from service:

1. Soda acid
2. Chemical foam (excluding film-forming agents)
3. Vaporizing liquid (e.g., carbon tetrachloride, methyl bromide, and chlorobromomethane (CBM))
4. Cartridge-operated water
5. Cartridge-operated loaded stream
6. Copper or brass shell (excluding pump tanks) joined by soft solder or rivets
7. Carbon dioxide extinguishers with metal horns
8. Solid charge–type AFFF extinguishers (paper cartridge)
9. Pressurized water fire extinguishers manufactured prior to 1971
10. Any extinguisher that needs to be inverted to operate
11. Any stored pressure extinguisher manufactured prior to 1955
12. Any extinguishers with 4B, 6B, 8B, 12B, and 16B fire ratings
13. Stored-pressure water extinguishers with fiberglass shells (pre-1976)
Dry chemical stored-pressure extinguishers with an indicated manufacturing date of manufactured prior to October 1984 or prior shall be removed from service at the next 6-year maintenance interval or the next hydrotest, whichever comes first. [10:4.4.1]

13.6.2.3.2.7* Wheeled fire extinguishers shall be considered for hazard protection in areas in which a fire risk assessment has shown the following:

1. High hazard areas are present
2. Limited available personnel are present, thereby requiring an extinguisher that has the following features:
   (a) High agent flow rate
   (b) Increased agent stream range
   (c) Increased agent capacity

[10:5.3.2.7]

13.6.2.5.1.1.1 Selection of fire extinguishers for this type of hazard shall be made on the basis of recommendations by manufacturers of this specialized equipment. [10:5.5.1.1.1]

13.6.2.5.1.1.2* Extinguishers for Pressurized Flammable Liquids and Pressurized Gas Fires.
Large capacity dry chemical extinguishers of 10 lb (4.54 kg) or greater and a discharge rate of 1 lb/sec (0.45 kg/sec) or more shall be used to protect these hazards. [10:5.5.1.1.2]

13.6.2.5. Water-Soluble Flammable Liquid Fires (Polar Solvents).
Aqueous film-forming foam (AFFF) and film-forming fluoroprotein foam (FFFP) types of fire extinguishers shall not be used for the protection of water-soluble flammable liquids, such as alcohols, acetone, esters, ketones, and so forth, unless specifically referenced on the fire extinguisher nameplate. [10:5.5.3.4]

13.6.2.5.4 Obstacle Fires.
Selection of a fire extinguisher for this type of hazard shall be based on one of the following:

1. Extinguisher containing a vapor-suppressing foam agent
2. Multiple extinguishers containing non-vapor-suppressing Class B agents intended for simultaneous application
3. Larger capacity extinguishers of 10 lb (4.54 kg) or greater and a minimum discharge rate of 1 lb/sec (0.45 kg/sec)
Only water or foam-type extinguishers shall be installed in areas containing oxidizers, such as where pool chemicals containing chlorine or bromine are stored. [10:5.5.7.1]

Multipurpose dry chemical fire extinguishers shall not be installed in areas containing oxidizers, such as pool chemicals where pool chemicals containing chlorine or bromine are stored. [10:5.5.7.2]

Fire extinguishers intended for use on oxidizer fires where oxidizers are stored or used shall be selected and installed based on the specific recommendations contained within the material’s safety data sheet (SDS) for the oxidizer, surrounding conditions, and NFPA 400. [10:5.5.7.3]

Where portable fire extinguishers are required to be installed, the following documents shall be reviewed for the occupancies outlined in their respective scopes:

1. This Code
2. NFPA 2, Hydrogen Technologies Code
3. NFPA 22, Standard for Water Tanks for Private Fire Protection
4. NFPA 30, Flammable and Combustible Liquids Code
5. NFPA 30A, Code for Motor Fuel Dispensing Facilities and Repair Garages
6. NFPA 33, Standard for Spray Application Using Flammable or Combustible Materials
7. NFPA 40, Standard for the Storage and Handling of Cellulose Nitrate Film
8. NFPA 45, Standard on Fire Protection for Laboratories Using Chemicals
10. NFPA 51B, Standard for Fire Prevention During Welding, Cutting, and Other Hot Work
11. NFPA 52, Vehicular Natural Gas Cylinders Fuel Systems Code
12. NFPA 58, Liquefied Petroleum Gas Code
13. NFPA 59, Utility LP-Gas Plant Code
14. NFPA 59A, Standard for the Production, Storage, and Handling of Liquefied Natural Gas (LNG)
15. NFPA 72, National Fire Alarm and Signaling Code
17. NFPA 76, Standard for the Fire Protection of Telecommunications Facilities
22. NFPA 102, *Standard for Grandstands, Folding and Telescopic Seating, Tents, and Membrane Structures*
27. NFPA 140, *Standard on Motion Picture and Television Production Studio Soundstages, Approved Production Facilities, and Production Locations*
29. NFPA 160, *Standard for the Use of Flame Effects Before an Audience*
30. NFPA 232, *Standard for the Protection of Records*
32. NFPA 301, *Code for Safety to Life from Fire on Merchant Vessels*
33. NFPA 302, *Fire Protection Standard for Pleasure and Commercial Motor Craft*
34. NFPA 303, *Fire Protection Standard for Marinas and Boatyards*
36. NFPA 326, *Standard for the Safeguarding of Tanks and Containers for Entry, Cleaning, or Repair*
37. NFPA 385, *Standard for Tank Vehicles for Flammable and Combustible Liquids*
39. NFPA 403, *Standard for Aircraft Rescue and Fire-Fighting Services at Airports*
40. NFPA 407, *Standard for Aircraft Fuel Servicing*
41. NFPA 408, *Standard for Aircraft Hand Portable Fire Extinguishers*
42. NFPA 409, *Standard on Aircraft Hangars*
43. NFPA 410, *Standard on Aircraft Maintenance*
44. NFPA 418, *Standard for Heliports*
45. NFPA 423, *Standard for Construction and Protection of Aircraft Engine Test Facilities*
46. NFPA 484, *Standard for Combustible Metals*
47. NFPA 495, *Explosive Materials Code*
50. NFPA 502, *Standard for Road Tunnels, Bridges, and Other Limited Access Highways*
51. NFPA 505, *Fire Safety Standard for Powered Industrial Trucks Including Type Designations, Areas of Use, Conversions, Maintenance, and Operations*
52. NFPA 655, *Standard for Prevention of Sulfur Fires and Explosions*
53. NFPA 731, Standard for the Installation of Electronic Premises Security Systems
54. NFPA 801, Standard for Fire Protection for Facilities Handling Radioactive Materials
55. NFPA 804, Standard for Fire Protection for Advanced Light Water Reactor Electric Generating Plants
57. NFPA 820, Standard for Fire Protection in Wastewater Treatment and Collection Facilities
60. NFPA 1123, Code for Fireworks Display
61. NFPA 1125, Code for the Manufacture of Model Rocket and High Power Rocket Motors
62. NFPA 1126, Standard for the Use of Pyrotechnics Before a Proximate Audience
63. NFPA 1141, Standard for Fire Protection Infrastructure for Land Development in Wildland, Rural, and Suburban Areas
64. NFPA 1192, Standard on Recreational Vehicles
65. NFPA 1194, Standard for Recreational Vehicle Parks and Campgrounds
66. NFPA 1221, Standard for the Installation, Maintenance, and Use of Emergency Services Communications Systems
67. NFPA 1901, Standard for Automotive Fire Apparatus
68. NFPA 1906, Standard for Wildland Fire Apparatus
69. NFPA 1925, Standard on Marine Fire-Fighting Vessels
70. NFPA 5000, Building Construction and Safety Code

[10:5.6.1]

13.6.3.1.3.1
Fire extinguishers shall not be installed in locations where they are visible except as permitted by 13.6.3.1.3.2 obstructed or obscured from view. [10:6.1.3.3.1]

13.6.3.1.3.2*
In large rooms and in certain locations where visual obstructions cannot be completely avoided, signs or other means shall be provided to indicate the extinguisher location. [10:6.1.3.3.2]

13.6.3.1.3.3
Where signs are used to indicate fire extinguisher location, the signs shall comply with the following:

1. They shall be located in close proximity to the extinguisher.
2. They shall be visible from the normal path of travel. [10:6.1.3.3.3]
13.6.3.1.3.3.3
Signs or other means used to indicate fire extinguisher location shall be located in close proximity to the extinguisher. [10:6.1.3.3.3]

13.6.3.1.3.3.4
Signs or other means used to indicate fire extinguisher location shall be visible from the normal path of travel. [10:6.1.3.3.4]

13.6.3.1.3.4*
Portable fire extinguishers other than wheeled extinguishers shall be installed using any of the following means:

1. *Securely on a hanger intended for the extinguisher
2. In a bracket incorporating releasing straps or bands supplied by the extinguisher manufacturer
3. In a listed bracket incorporating releasing straps or bands approved for such purpose
4. In approved cabinets or wall recesses

4. [10:6.1.3.4]

13.6.3.1.3.7
Fire extinguishers installed under conditions or in locations where they are subject to physical damage (e.g., from impact, vibration, the environment) shall be protected against such damage. [10:6.1.3.7]

13.6.3.1.3.9.1
Fire extinguishers shall be installed so that the fire extinguisher's operating instructions face outward shall be located on the front of the extinguisher and shall be clearly visible. [10:6.1.3.9.1]

13.6.3.1.3.9.3
The restrictions of 13.6.3.1.3.9.2 shall not apply to the original manufacturer’s labels, labels that specifically relate to the extinguisher's operation or fire classification, or inventory control labels specific to that extinguisher. [10:6.1.3.9.3]

13.6.3.1.3.10.6*
For fire resistance–rated walls, only surface-mounted cabinets or listed fire-rated cabinets shall be installed. [10:6.1.3.10.6]
13.6.3.2.1.1
Minimal sizes of fire extinguishers for the listed grades of hazards shall be provided on the basis of Table 13.6.3.2.1.1, except as modified by 13.6.3.2.1.4 and 13.6.3.2.1.5. [10:6.2.1.1]

Table 13.6.3.2.1.1 Fire Extinguisher Size and Placement for Class A Hazards

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Light Hazard Occupancy</th>
<th>Ordinary Hazard Occupancy</th>
<th>Extra Hazard Occupancy</th>
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<tbody>
<tr>
<td>Minimum rated single extinguisher</td>
<td>2-A</td>
<td>2-A</td>
<td>4-A</td>
</tr>
<tr>
<td>Maximum floor area per unit of A</td>
<td>3000 ft²</td>
<td>1500 ft²</td>
<td>1000 ft²</td>
</tr>
<tr>
<td>Maximum floor area per extinguisher</td>
<td>11,250 ft²</td>
<td>11,250 ft²</td>
<td>11,250 ft²</td>
</tr>
<tr>
<td>Maximum travel distance to extinguisher</td>
<td>75 ft</td>
<td>75 ft</td>
<td>75 ft</td>
</tr>
</tbody>
</table>

For SI units, 1 ft = 0.305 m; 1 ft² = 0.0929 m².
Note: For maximum floor area explanations, see E.3.3 of NFPA 10. [10: Table 6.2.1.1]

13.6.3.2.1.7
The protection requirements shall be permitted to be fulfilled with fire extinguishers of higher rating, provided the travel distance to such larger fire extinguishers does not exceed 75 ft (22.9 m) and the maximum floor area per unit of A is not exceeded. [10:6.2.1.6]

13.6.3.3.1.1
Minimum ratings of fire extinguishers for the listed grades of hazards shall be provided in accordance with Table 13.6.3.3.1.1 [10:6.3.1.1].

Table 13.6.3.3.1.1 Fire Extinguisher Size and Placement for Class B Hazards

<table>
<thead>
<tr>
<th>Type of Hazard</th>
<th>Basic Minimum Extinguisher</th>
<th>Maximum Travel Distance to Extinguishers</th>
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<tbody>
<tr>
<td>Light (low)</td>
<td>5-B 30 ft 9.14 m</td>
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</tr>
<tr>
<td>Ordinary (moderate)</td>
<td>10-B 50 ft 15.25 m</td>
<td></td>
</tr>
<tr>
<td>Extra (high)</td>
<td>20-B 50 ft 15.25 m</td>
<td></td>
</tr>
</tbody>
</table>

Note:
The specified ratings do not imply that fires of the magnitudes indicated by these ratings will occur, but rather they are provided to give the operators more time and agent to handle difficult spill fires that have the potential to occur. [10: Table 6.3.1.1]

13.6.3.3.1.2
Fire extinguishers of lesser rating, designed for small specific hazards within the general hazard area, shall be permitted to be installed but shall not be considered as fulfilling any part of the requirements of Table 13.6.3.3.1.1, unless permitted by 13.6.3.3.1.1 or 13.6.3.3.1.2. [10:6.3.1.2]

13.6.3.3.3.1
Where hand portable fire extinguishers are installed or positioned for obstacle, gravity/threedimensional, or pressure fire hazards, the actual travel distance to hazard shall not exceed 30 ft (9 m) unless otherwise specified (See 5.6.1 of NFPA 10.) [10:6.3.3.1]

13.6.3.6.2
Maximum travel distance shall not exceed 30 ft (9.15 m) from the hazard to the extinguishers. [10:6.6.2]

13.6.3.6.3
All solid fuel cooking appliances (whether or not under a hood) with fire boxes of 5 ft³ (0.14 m³) volume or less shall have at least a listed 2-A rated water-type fire extinguisher or a 1.6 gal (6 L) wet chemical fire extinguisher that is listed for Class K fires. [10:6.6.3]

13.6.4.1.2.1.3
The test shall, at a minimum, be based upon knowledge of the chapters and annexes of NFPA 10. [10:7.1.2.1.3]

13.6.4.2.2
Inspection Procedures.
Periodic inspection or electronic monitoring of fire extinguishers shall include a check of at least the following items:

1. Location in designated place
2. No obstruction to access or visibility
3. Visibility of the extinguisher or means of indicating the extinguisher location
4. Access to the extinguisher
5. Pressure gauge reading or indicator in the operable range or position
6. Fullness determined by weighing or hefting
7. Condition of fires, wheels, carriage, hose, and nozzle for wheeled extinguishers
8. Indicator for nonrechargeable extinguishers using push-to-test pressure indicators
13.6.4.2.2.1

The owner or the owner’s agent shall determine the method of extinguisher inspection such as manual inspection, electronic monitoring, or any combination of the two.

13.6.4.2.2.2

Any method(s) of inspection other than manual inspection shall require the approval of the authority having jurisdiction.

13.6.4.2.2.2.1

In addition to 13.6.4.2.2, fire extinguishers shall be visually inspected in accordance with 13.6.4.2.2 if they are located where any of the following conditions exists:

1. High frequency of fires in the past
2. Severe hazards
3. Locations that make fire extinguishers susceptible to mechanical injury or physical damage
4. Exposure to abnormal temperatures or corrosive atmospheres

13.6.4.2.2.2.2

Where required by 13.6.4.2.2.1, the following inspection procedures shall be in addition to those addressed in 13.6.4.2.2:

1. Verify that operating instructions on nameplates are legible and face outward
2. Check for broken or missing safety seals and tamper indicators
3. Examine for obvious physical damage, corrosion, leakage, or clogged nozzle

13.6.4.2.2.4

Inspection Procedure for Containers of Class D Extinguishing Agent. Periodic inspection of containers of Class D extinguishing agent used to protect Class D hazards shall include verification of at least the following:

1. Located in designated place
2. No obstruction to access or visibility
3. Visibility of the container or means of indicating the container location
4. Access to the container
5. Lid is sealed
6. Fullness by hefting or weighing
5.6. No obvious physical damage to container

[10:7.2.2.35]

13.6.4.3.1.1 Fire extinguishers shall be subjected to maintenance at intervals of not more than 1 year, at the time of hydrostatic test, or when specifically indicated by an inspection discrepancy or electronic notification. [10:7.3.1.1]

13.6.4.3.2.1 Physical Condition.
An annual external visual examination of all fire extinguishers shall be made to detect obvious physical damage, corrosion, or nozzle blockage; to verify that the operating instructions are present, legible, and facing forward, and that the HMIS information is present and legible, and to determine if a 6-year interval examination or hydrostatic test is due. [10:7.3.2.1]

13.6.4.3.4.1.1 The tag or label, as a minimum, shall identify the following:

1. Month and year maintenance was performed
2. Person performing the work
3. Name of the agency performing the work

[10:7.3.4.1.1]

13.6.4.3.5.3 The 6-year internal examination label shall, as a minimum, identify the following:

1. Month and year the 6-year internal examination was performed
2. Person performing the work
3. Name of the agency performing the work

[10:7.3.6.5.3]

13.6.4.4.2.1 Carbon dioxide hose assemblies that pass a conductivity test shall have the test information recorded on a durable weatherproof label that has a minimum of 1/2 in. × 3 in. (13 mm × 76 mm). [10:7.4.2.1]

13.6.4.4.2.3 The label shall include the following information:
1. Month and year the test was performed, indicated by perforation such as is done by a hand punch

2. Name or initials of person performing the test and the name of the agency performing the test

13.6.4.5 Hose Station Maintenance.

Where hose stations are installed to comply with 6.2.1.4, they shall be maintained in accordance with NFPA 1962. [10:7.5]

13.6.4.5.1 Electronic Monitoring.

The components of the monitoring device/system shall be tested and maintained annually in accordance with the manufacturer’s listed maintenance manual, with the following items included as a minimum:

1. Power supply inspection/battery change
2. Obstruction sensor inspection
3. Location sensor inspection
4. Pressure indication inspection
5. Connection continuity inspection (see 13.6.4.5.1.1 and 13.6.4.5.1.2)

[10:7.56.1]

13.6.4.5.1.1

One hundred percent of all units shall be tested upon initial installation or reacceptance with verification of receipt of signal at the control panel or a local alarm. [10:7.56.1.1]

13.6.4.5.1.2

Twenty percent of units shall be tested annually on a rotating basis so that all units are tested within a 5-year period. [10:7.56.1.2]

13.6.4.5.1.2

When used in conjunction with fire alarm systems, fire extinguisher electronic monitoring devices shall be inspected and maintained in accordance with NFPA 72 and 13.6.4.5.1. [10:7.56.2]
13.6.4.5 Corrective Action.
When maintenance of any monitoring system reveals a deficiency, immediate corrective action shall be taken. [10:7.56.3]

13.6.4.6.1 Wheeled Unit Hoses.
Discharge hoses on wheeled-type fire extinguishers shall be completely uncoiled and examined for damage annually. [10:7.67.1]

13.6.4.6.2* Wheeled Unit Hoses.
Discharge hoses on wheeled extinguishers shall be coiled in a manner to prevent kinks and to allow rapid deployment in accordance with the manufacturer's instructions. [10:7.6.27.1.1]

13.6.4.6.3 Pressure Regulators.
Pressure regulators provided with wheeled-type fire extinguishers shall be tested annually for outlet static pressure and flow rate in accordance with the manufacturer's instructions. [10:7.6.37.2]

13.6.4.6.4 Corrective Action.
When maintenance of any fire extinguisher hose or pressure regulator reveals a deficiency, immediate corrective action shall be taken. [10:7.6.47.3]

13.6.4.7.1 All rechargeable-type fire extinguishers shall be recharged after any use or when the need is indicated by an inspection or servicing. [10:7.78.1.1]

13.6.4.7.2* When recharging is performed, the manufacturer’s service manual shall be followed. (For recharge agents, see 13.6.4.7.3.) [10:7.78.1.2]

13.6.4.7.3* The amount of recharge agent shall be verified by weighing. [10:7.78.1.3]

13.6.4.7.3.1 For those fire extinguishers that do not have the gross weight marked on the nameplate or valve, a permanent label that indicates the gross weight shall be affixed to the cylinder. [10:7.78.1.3.1]
The added label containing the gross weight shall be a durable material of a pressure-sensitive, self-destruct type. *(For stored-pressure water-type extinguishers, see 13.6.4.7.3.10.)* [10:7.28.1.3.2]

13.6.4.7.3 Pump tank water and pump tank calcium chloride–based antifreeze types shall not be required to have weight marked. [10:7.28.1.3.3]

13.6.4.7.8.1.3.4* After recharging, a leak test shall be performed on stored-pressure and self-expelling types of fire extinguishers. [10:7.28.1.3.4]

13.6.4.7.8.1.3.5 In no case shall an extinguisher be recharged without hydrostatic testing if it is beyond its specified hydrostatic test date. [10:7.28.1.3.5]

13.6.4.7.8.2.1 Pump Tank. Every 12 months, pump tank water and pump tank calcium chloride–based antifreeze types of fire extinguishers shall be recharged with new chemicals or water as applicable. [10:7.28.2.1]

13.6.4.7.8.2.2 Wetting Agent. The agent in stored-pressure wetting agent fire extinguishers shall be replaced annually. [10:7.28.2.2]

13.6.4.7.8.2.2.1 Only the agent specified on the nameplate shall be used for recharging. [10:7.28.2.2.1]

13.6.4.7.8.2.2.2 The use of water or any other additives shall be prohibited. [10:7.28.2.2.2]

13.6.4.7.8.2.3.1 The premixed agent in liquid charge–type AFFF and FFPF fire extinguishers shall be replaced at least once every 3 years. [10:7.28.2.3.1]

13.6.4.7.8.2.3.2 Only the foam agent specified on the extinguisher nameplate shall be used for recharge. [10:7.28.2.3.2]

13.6.4.7.8.2.3.3
The agent in nonpressurized AFFF and FFFP fire extinguishers that is subjected to agent analysis in accordance with manufacturer's instructions shall not be required to comply with

13.6.4.72.3.1. \[10:7.28.2.3.3\]

Only those agents specified on the nameplate or agents proven to have equal chemical composition, physical characteristics, and fire-extinguishing capabilities shall be used. \[10:7.28.3.1\]

Agents listed specifically for use with that fire extinguisher shall be considered to meet these requirements. \[10:7.28.3.1.1\]

Multipurpose dry chemicals shall not be mixed with alkaline-based dry chemicals. \[10:7.28.3.2\]

The remaining dry chemical in a discharged fire extinguisher shall be permitted to be re-used, provided that it is thoroughly checked for the proper type, contamination, and condition. \[10:7.28.3.3.1\]

Dry chemical found to be of the wrong type or contaminated shall not be re-used. \[10:7.28.3.3.2\]

The dry chemical agent shall be permitted to be re-used, provided a closed recovery system is used and the agent is stored in a sealed container to prevent contamination. \[10:7.28.3.4.1\]

Prior to re-use, the dry chemical shall be thoroughly checked for the proper type, contamination, and condition. \[10:7.28.3.4.2\]

Where doubt exists with respect to the type, contamination, or condition of the dry chemical, the dry chemical shall be discarded. \[10:7.28.3.4.3\]

Dry Chemical Closed Recovery System.

(A) The system shall be constructed in a manner that does not introduce foreign material into the agent being recovered. \[10:7.28.3.4.4.1\]

(B) The system shall have a means for visual inspection of the recovered agent for contaminants. \[10:7.28.3.4.4.2\]
13.6.4.78.3.5.1
Pails or drums containing dry powder agents for scoop or shovel application for use on metal fires shall be kept full and sealed with the lid provided with the container. [10:7.28.3.5.1]

13.6.4.78.3.5.2
The dry powder shall be replaced if found damp. (See A.13.6.4.7.3.) [10:7.28.3.5.2]

13.6.4.78.3.6* Removal of Moisture.
For all non-water types of fire extinguishers, any moisture shall be removed before recharging. [10:7.28.3.6]

13.6.4.78.3.7* Halogenated Agent.
Halogenated agent fire extinguishers shall be charged with only the type and weight of agent specified on the nameplate. [10:7.28.3.7]

13.6.4.78.3.8.1
The removal of Halon 1211 from fire extinguishers shall be done using only a listed halon closed recovery system. [10:7.28.3.8.1]

13.6.4.78.3.8.2
The removal of agent from other halogenated agent fire extinguishers shall be done using only a closed recovery system. [10:7.28.3.8.2]

13.6.4.78.3.8.3
The fire extinguisher shall be examined internally for contamination or corrosion or both. [10:7.28.3.8.3]

13.6.4.78.3.8.4
The halogenated agent retained in the system recovery cylinder shall be re-used only if no evidence of internal contamination is observed in the fire extinguisher cylinder. [10:7.28.3.8.4]

13.6.4.78.3.8.5
Halogenated agent removed from fire extinguishers that exhibits evidence of internal contamination or corrosion shall be processed in accordance with the fire extinguisher manufacturer's instructions. [10:7.28.3.8.5]

13.6.4.78.3.9.1
The vapor phase of carbon dioxide shall be not less than 99.5 percent carbon dioxide. [10:7.28.3.9.1]

13.6.4.78.3.9.2
The water content shall be not more than 60 parts per million (ppm) by weight at –52°F (–47°C) dew point. [10:7.28.3.9.2]
Oil content shall not exceed 10 ppm by weight. [10:7.28.3.9.3]

13.6.4.28.3.10* Water Types.

The amount of liquid agent shall be determined by using one of the following:

1. Exact measurement by weight
2. Exact measurement in by volume
3. Anti-overfill tube, if provided
4. Fill mark on fire extinguisher shell, if provided

[10:7.28.3.10]

13.6.4.28.3.10.1 Only the agent specified on the extinguisher nameplate shall be used for recharge. [10:7.28.3.10.1]

13.6.4.28.3.10.2 Only additives identified on the original nameplate shall be permitted to be added to water type extinguishers. [10:7.28.3.10.2]

13.6.4.28.3.11.1 Wet chemical and water mist agents shall not be re-used. [10:7.28.3.11.1]

13.6.4.28.3.11.2 If a wet chemical or water mist extinguisher is partially discharged, all remaining wet chemical or water mist shall be discarded. [10:7.28.3.11.2]

13.6.4.28.3.11.3 Wet chemical or water mist agent shall be discarded and replaced at the hydrostatic test interval. [10:7.28.3.11.3]

(A) Only the agent specified on the extinguisher nameplate shall be used for recharge. [10:7.28.3.11.3.1]

13.6.4.28.4 Only standard industrial-grade nitrogen with a maximum dew point of −60°F (−51°C), in accordance with CGA G-10.1. Commodity Specification for Nitrogen, shall be used to pressurize stored-pressure dry chemical and halogenated-type fire extinguishers that use nitrogen as a propellant. [10:7.28.4.1]

13.6.4.28.4.1 Halogenated-type fire extinguishers that require argon shall be pressurized with argon with a dew point of −65°F (−54°C) or lower. [10:7.28.4.2]
Compressed air shall be permitted to be used from special compressor systems capable of delivering air with a dew point of \(-60^\circ F\) (\(-51^\circ C\)) or lower. (See Annex J of NFPA 10.) [10:7.28.4.3]

The special compressor system shall be equipped with an automatic monitoring and alarm system to ensure that the dew point remains at or below \(-60^\circ F\) (\(-51^\circ C\)) at all times. [10:7.28.4.3.1]

Compressed air through moisture traps shall not be used for pressurizing even though so stated in the instructions on older fire extinguishers. [10:7.28.4.3.2]

Compressed air without moisture removal devices shall be permitted for pressurizing water extinguishers and foam hand extinguishers only. [10:7.28.4.3.3]

Class D, wet chemical, water mist, and halogenated agent fire extinguishers shall be repressurized only with the type of expellant gas referred to on the fire extinguisher label. [10:7.28.4.4]

A rechargeable stored-pressure-type fire extinguisher shall be pressurized only to the charging pressure specified on the fire extinguisher nameplate. [10:7.28.4.5]

The manufacturer's pressurizing adapter shall be connected to the valve assembly before the fire extinguisher is pressurized. [10:7.28.4.5.1]

A regulated source of pressure, set no higher than 25 psi (172 kPa) above the operating (service) pressure, shall be used to pressurize fire extinguishers. [10:7.28.4.5.2]

The gauge used to set the regulated source of pressure shall be calibrated at least annually. [10:7.28.4.5.3]
13.6.4.78.4.6*
An unregulated source of pressure, such as a nitrogen cylinder without a pressure regulator, shall not be used. [10:7.28.4.6]

13.6.4.78.4.7*
A fire extinguisher shall not be left connected to the regulator of a high-pressure source for an extended period of time. [10:7.28.4.7]

13.6.4.78.4.8.1
Each fire extinguisher shall have a tag or label attached that indicates the month and year recharging was performed, identifies the person performing the service, and identifies the name of the agency performing the work. [10:7.28.4.8.1]

13.6.4.78.4.8.2
Each extinguisher that has been recharged shall have a verification-of-service collar located around the neck of the container, except as identified in 13.6.4.10.4. [10:7.28.4.8.2]

13.6.4.89.1
Replacement pressure gauges shall have the correct indicated charging (service) pressure. [10:7.89.1]

13.6.4.89.2
Replacement pressure gauges shall be marked for use with the agent in the fire extinguisher. [10:7.89.2]

13.6.4.89.3
Replacement pressure gauges shall be compatible with the fire extinguisher valve body material. [10:7.89.3]

13.6.4.1010.1
Fire extinguishers shall not be used for any purpose other than that of a fire extinguisher. [10:7.410.1]

13.6.4.1010.2
Fire extinguishers shall not be converted from one type to another, modified, or altered. [10:7.410.2]

13.6.4.1010.3
Fire extinguishers shall not be converted for the use of a different type of extinguishing agent. [10:7.410.3]

13.6.4.101* Maintenance and Recharge Service Collar.
Each extinguisher that has undergone maintenance that included internal examination or that has been recharged requiring the removal of the valve assembly shall have a verification-of-service collar located around the neck of the container. [10:7.1011]

13.6.4.1011.1
The collar shall contain a single circular piece of uninterrupted material forming a hole of a size that does not permit the collar assembly to move over the neck of the container unless the valve is completely removed. [10:7.1011.1]

13.6.4.1011.2
The collar shall not interfere with the operation of the fire extinguisher. [10:7.1011.2]

13.6.4.1011.3
The verification-of-service collar shall, as a minimum, identify the following:

1. Month and year the recharging or internal examination was performed
2. Name of the agency performing the work

13.6.4.1011.4.1
New extinguishers requiring an initial charge in the field (such as pressurized water, AFFF, FFPF, or wet chemical extinguishers) shall not be required to have a verification-of-service collar installed. [10:7.1011.4.1]

13.6.4.1011.4.2
Liquefied gas, halogenated agent, and carbon dioxide extinguishers that have been recharged without valve removal shall not be required to have a verification-of-service collar installed following recharge. [10:7.1011.4.2]

13.6.4.1011.4.3
Cartridge- and cylinder-operated extinguishers shall not be required to have a verification-of-service collar installed. [10:7.1011.4.3]

13.6.1112*  Weight Scales.
Weight scales used for the maintenance and recharge of fire extinguishers shall have the reading increments and the accuracy necessary to verify the charge weights required in the service manuals and on the nameplates. [10:7.1112]

A.13.6.1.3.1
Listed and labeled halon portable fire extinguishers currently comply with Section 13.6 and have demonstrated compliance with the requirements of UL-1093, Standard for Halogenated Agent Fire Extinguishers, which also includes fire testing and rating criteria. As a result of the Montreal Protocol on Substances that Deplete the Ozone Layer, UL has withdrawn UL-1093. This does not imply that extinguishers that are listed and labeled to the requirements of UL-1093 are unsafe for use as fire extinguishers, nor does it mean that UL or the EPA is requiring that...
halon extinguishers be removed from service. It does mean that UL will not accept new designs of halon extinguishers for testing or UL listing. It also means that no changes or updates are allowed to models that are currently listed and that had previously demonstrated compliance with UL 1093. [10:A.4.1.1]

Extinguisher manufacturers are allowed to manufacture their current design of UL-listed halon extinguishers with the UL listing mark until October 20142025. Halon extinguishers currently in use will continue to be listed beyond the 2014-2025 date and should be permitted to be used to comply with the requirements of NFPA 10 and this Code when installed, inspected, and maintained in accordance with NFPA 10 and this Code. [10:A.4.1.1]

A.13.6.1.4
Federal OSHA regulations require that manufacturers communicate information as to the type of chemicals in a product that can be hazardous and the level of hazard. This information is contained in the MSDS created for each chemical or mixture of chemicals and is summarized on labels or tags attached to the product. Additionally, state and local authorities have enacted similar acts and regulations requiring identification of chemicals and hazardous ingredients in products. MSDSs for fire extinguisher agents are available on request from fire equipment dealers or distributors or the fire equipment manufacturer. [10:A.4.2]

The identification of contents information enables determination of the type of chemicals contained in the fire extinguisher and helps to resolve complications arising from an unusual use of the agent. The Hazardous Materials Identification System (HMIS) [in Canada, the WHMIS], developed by the American National Paint and Coatings Association uses a three-place format with numerical indexes from 0 to 4. The first place is for “toxic properties,” the second place is for “flammability,” and the third place is for “reactivity” with other chemicals. Most fire extinguishers have a 0 numerical index in the second and third places because they are nonflammable and relatively inert. [10:A.4.2]

Information on the HMIS can be obtained from Label Master, Inc., in Chicago, IL, or from the American National Paint and Coatings Association in Washington, DC. Extinguisher contents information can be integrated into the standard fire extinguisher label in some form, or it can be on a separate label or tag. The following example is a typical chemical contents identification marking:

CONTENTS: ABC DRY CHEMICAL/HMIS 1-0-0 MUSCOVITE MICA, MONOAMMONIUM PHOSPHATE AMMONIUM SULFATE/NUISANCE DUST IRRITANT/CONTENTS UNDER PRESSURE [Manufacturer's Name, Mailing Address, Phone Number]
[10:A.4.2]

A.13.6.1.6.1
The requirement in 13.6.1.6.1 brings the standard into line with the 1984 changes to ANSI/UL 299, CAN/ULC-S504, Standard for Dry Chemical Fire Extinguishers, and to ANSI/UL 711, Rating and Fire Testing of Fire Extinguishers.

1. **Hose.** The 1984 edition of UL 299 requires extinguishers rated 2-A or higher or 20-B or higher to be equipped with a discharge hose. Before this change, almost all 5 lb (2.3 kg) extinguishers and many 10 lb (4.5 kg) extinguishers were equipped with a fixed nozzle on the outlet of the extinguisher valve and **without** hoses. These extinguishers, rated 2-
A to 4-A and 10-B to 60-B are the ones used to comply with the installation requirements now contained in Chapter 6 of NFPA 10. To properly use one of these extinguishers, the user must keep it in the upright position, apply the dry chemical to the base of the fire, and sweep the discharge back and forth. The requirement for the addition of a hose to these extinguishers came out of the novice fire tests sponsored by Underwriters Laboratories (UL) and the Fire Equipment Manufacturers Association. The film footage of these tests shows that persons who had never used a fire extinguisher before often used both hands to operate these extinguishers, turning the extinguisher cylinder in a horizontal position while squeezing the handle and lever to open the valve. Sometimes they even inverted the extinguisher. The result of such actions is only a partial discharge of the extinguisher contents or possibly only the expellant gas and, therefore, no extinguishment of the fire can be achieved. The addition of a hose also makes it much easier to direct the discharge at the base of the flames and to sweep the discharge from side to side. The requirement to add a hose makes it more likely that the extinguisher will be used in an upright position. In fact, it is almost impossible to do otherwise, since one hand opens the valve and the other hand, which holds the hose, directs the discharge stream to the fire. It is important to note that field modification of an extinguisher is generally not allowed since the modification might not have been evaluated to comply with the test requirements in the applicable UL extinguisher standards, and the extinguisher might not operate as intended. Thus, a fixed nozzle cannot simply be removed from an extinguisher and replaced with a hose and nozzle.

2. **Minimum Discharge Time.** This requirement, found in the 1984 edition of UL 711, requires a minimum 13-second discharge duration for an extinguisher rated 2-A or higher. The 13-second minimum requirement was the result of recommendations from the novice fire tests mentioned in A.13.6.1.6.1(1). Before 1984, almost all 2-A-rated dry chemical extinguishers had discharge durations of only 8 seconds to 10 seconds. The novice fire tests clearly showed that longer discharge duration resulted in an increased likelihood of extinguishment. The revision to UL 711 mandated a 50 percent to 60 percent increase in the minimum discharge duration for a 2-A-rated dry chemical extinguisher. Modification of extinguishers with a nozzle/hose that gives different or longer discharge duration is not allowed. Such modification would not have been evaluated to comply with the test requirements in the applicable UL extinguisher standards, and the extinguisher might not operate as intended.

3. **Pull Pins.** A revision to the extinguisher standards, including UL 299, required a maximum 30 lb (133 N) of force to remove a safety pin or pull pin from an extinguisher. This again came from the novice testing, in which some individuals could not physically remove the pin and actuate the extinguisher. The UL extinguisher standards also included a design requirement so that the pin is be visible from the front of the extinguisher unless noted by the operating instructions.

4. **Operating Instructions/Marking.** The extinguisher standards, including the 1984 revision of UL 299, mandated the use of pictographic operating instructions and code symbols on all but Class D extinguishers and wheeled extinguishers. These requirements also came out of the novice fire tests, which showed many individuals taking too long to read and
understand the written operating instructions. The novice tests actually developed the pictographic operating instructions and tested them on novice operators for effectiveness. The details of the number of instructions per pictogram came from the test program. The novice fire tests were also the impetus for making the use code symbols for the various classes of fires more understandable. The new pictographic use code symbols were also mandated in 1984 as well as a uniform method of applying A, B, and C symbols to extinguishers with ABC or BC only ratings. The result was a uniform, consistent set of easily understood symbols that made the extinguisher more user friendly.

5. Service Manuals. The extinguisher standards, including UL 299, for the first time mandated that extinguisher manufacturers have a service manual for their products. In addition, the 1984 edition of UL 299 required a reference to the service/maintenance manual on the extinguisher nameplate. Prior to 1984, service manuals were not required.

10:A.4.4.1

A.13.6.2.3.2.6.1
ANSI/UL 2129, CAN/ULC-S566, Standard for Halocarbon Clean Agent Fire Extinguishers, and CAN/ULC-S512, Standard for Halogenated Agent Hand and Wheeled Fire Extinguishers, require halocarbon and halogenated agent nameplates to provide safety guidelines for avoiding overexposure to agent vapors when the agents are discharged into confined spaces. The UL minimum volume requirement for confined spaces is based on exposure to the agent in the absence of a fire and does not include considerations for fire or agent decomposition products.

10:A.5.3.2.6.1

A.13.6.2.4.1.2
Ordinary hazard occupancies could consist of dining areas, mercantile shops and allied storage, light manufacturing, research operations, auto showrooms, parking garages, workshop or support service areas of light hazard occupancies, and warehouses containing Class I or Class II commodities as defined by NFPA 13. [10:A.5.4.1.2]

A Class I commodity is defined by NFPA 13 as a noncombustible product that meets one of the following criteria:

1. It is placed directly on wooden pallets
2. It is placed in single-layer corrugated cartons, with or without single-thickness cardboard dividers, with or without pallets
3. It is shrink-wrapped or paper-wrapped as a unit load, with or without pallets

10:A.5.4.1.2

A Class II commodity is defined by NFPA 13 as a noncombustible product that is in slatted wooden crates, solid wood boxes, multiple-layered corrugated cartons, or equivalent combustible packaging material, with or without pallets. [10:A.5.4.1.2]
A.13.6.2.4.2
Most All buildings have Class A fire hazards. In any occupancy, there could be a predominant hazard as well as special hazard areas requiring supplemental protection. extinguishers with ratings to match those hazards. For example, a hospital will generally have need for Class A fire extinguishers covering patients' rooms, corridors, offices, and so forth, but will need Class B fire extinguishers in laboratories and where flammable anesthetics are stored or handled, Class C fire extinguishers in electrical switch gear or generator rooms, and Class K extinguishers in kitchens. [10:A.5.4.2]

A.13.6.2.5.1.1.2
A three-dimensional Class B fire involves Class B materials in motion, such as pouring, running, or dripping flammable liquids, and generally includes vertical as well as one or more, horizontal surfaces. Fires of this nature are considered to be a special hazard. The system used to rate fire extinguishers on Class B fires (flammable liquids in depth) is not directly applicable to this type of hazard. The installation of fixed systems should be considered where applicable. [10:A.5.5.1.1.2]

A.13.6.2.5.4(2)
Where multiple extinguishers are utilized, simultaneous discharge from multiple locations to eliminate any blind spots created by an obstacle should be employed. [10:A.5.5.4(2)]

A.13.6.2.5.6
Where occupancies are required to have extinguishers installed, this section is applicable to areas where the electronic equipment is located. Delicate electronic equipment includes, but is not limited to, telecommunications, data processing, computers, CAD, CAM servers, robotics, and reproduction equipment. Use of fire extinguishers containing other extinguishing agents can damage beyond repair both the equipment at the source of the fire and related equipment in the immediate vicinity of the fire. [10:A.5.5.6]

A.13.6.2.5.7.2
A dry chemical fire extinguisher containing ammonium compounds should not be used on oxidizers that contain chlorine. The reaction between the oxidizer and the ammonium salts can produce the explosive compound nitrogen trichloride (NCl3). [10:A.5.5.7.2]

A.13.6.2.5.8.1
Other nonlisted agents can be used if acceptable to the AHJ. Other nonlisted agents include specially dried sand, dolomite, soda ash, lithium chloride, talc, foundry flux, and zirconium silicate or other agents shown to be effective. Consult NFPA 484 for use and limitations of these agents and other non-listed alternatives. [10:A.5.5.8.1]

A.13.6.2.6.1
Where portable fire extinguishers are required to be installed, the following documents should be reviewed for the occupancies outlined in their respective scopes:

1. NFPA 77, Recommended Practice on Static Electricity
2. NFPA 402, Guide for Aircraft Rescue and Fire-Fighting Operations
4. NFPA 850, Recommended Practice for Fire Protection for Electric Generating Plants and High Voltage Direct Current Converter Stations
5. NFPA 851, Recommended Practice for Fire Protection for Hydroelectric Generating Plants
6. NFPA 921, Guide for Fire and Explosion Investigations
7. NFPA 1452, Guide for Training Fire Service Personnel to Conduct Community Risk Reduction Dwelling Fire Safety Surveys

A.13.6.3.1.1
The following items affect distribution of portable fire extinguishers:

1. Area and arrangement of the building occupancy conditions
2. Severity of the hazard
3. Anticipated classes of fire
4. Other protective systems or devices
5. Distances to be traveled to reach fire extinguishers

A.6.1.1
In addition, the following factors should be considered:

1. Anticipated rate of fire spread
2. Intensity and rate of heat development
3. Smoke contributed by the burning materials
4. Accessibility of a fire to close approach with portable fire extinguishers

A.6.1.1
Wheeled fire extinguishers have additional agent and range and should be considered for areas where the additional protection is needed. Portable fire extinguishers offer the occupant a means to assist in evacuation of a building or occupancy. They are useful to knock down the fire if it occurs along the evacuation route. If possible, the individual property should be surveyed for actual protection requirements. [10:A.6.1.1]

A.13.6.3.1.3.3.2
The primary acceptable means of identifying the locations of fire extinguishers should be by the installation of signs that are specifically designed for that location.
Purpose. Examples of other means of identifying the fire extinguisher locations include arrows, lights, signs, or coding of the wall or column. [10:A.6.1.3.2]

A.13.6.3.1.3.4
In situations where it is necessary that fire extinguishers be provided temporarily, a good practice is to provide portable stands, consisting of a horizontal bar on uprights with feet, on which the fire extinguishers can be installed. Portable stands should be designed to comply with the mounting heights for extinguishers hung. [10:A.6.1.3.4]

A.13.6.3.1.3.10.4
Vented fire extinguisher cabinets should utilize tinted glass and should be constructed to prevent the entrance of insects and the accumulation of water. Vented fire extinguisher cabinets constructed in this manner lower the maximum internal temperature by 10°F to 15°F (5.6°C to 8.3°C). [10:A.6.1.3.10.4]

A.13.6.3.1.3.10.6
Certain fire resistance-rated cabinets are intended for installation into fire resistance-rated walls. Cabinets that are not fire resistance-rated make the entire fire resistance-rated wall noncompliant, so only surface-mounted cabinets or fire resistance-rated cabinets are appropriate for installation in fire resistance-rated walls. [10:A.6.1.3.10.6]

A.13.6.3.1.3.11
The following precautions should be noted where fire extinguishers are located in areas that have temperatures outside the range of 40°F to 120°F (4°C to 49°C):

1. AFFF and FFFP fire extinguishers cannot be protected against temperatures below 40°F (4°C) by adding an antifreeze charge, because it tends to destroy the effectiveness of the extinguishing agent.
2. Plain water fire extinguishers should not be protected against temperatures below 40°F (4°C) with ethylene glycol antifreeze. Calcium chloride solutions should not be used in stainless steel fire extinguishers.
3. Fire extinguishers installed in machinery compartments, diesel locomotives, automotive equipment, marine engine compartments, and hot processing facilities can easily be subjected to temperatures above 120°F (49°C). Selection of fire extinguishers for hazard areas with temperatures above the listed limits should be made on the basis of recommendations by manufacturers of this equipment.

[10:A.6.1.3.11]

A.13.6.3.5.3
See NFPA 484 for additional information. [10:A.6.5.3]

A.13.6.3.5.4
See NFPA 484 for additional information. [10:A.6.5.4]

A.13.6.4.2.1.2
Inspections should be performed on extinguishers 12 times per year, at regular intervals not exceeding 31 days. [10:A.7.2.1.2]

A.13.6.4.2.1.3
Inspections should be more frequent if any of the following conditions exist:

1. High frequency of fires in the past
2. Severe hazards
3. Susceptibility to tampering, vandalism, or malicious mischief
4. Possibility of, or history of, theft of fire extinguishers
5. Locations that make fire extinguishers susceptible to mechanical injury
6. Possibility of visible or physical obstructions
7. Exposure to abnormal temperatures or corrosive atmospheres
8. Characteristics of fire extinguishers, such as susceptibility to leakage

More frequent inspections could be enhanced through electronic monitoring of the fire extinguisher. [10:A.7.2.1.3]

A.13.6.4.2.2.1
Fire extinguishers in vehicles should be inspected at the beginning of a shift or whenever the vehicle is used. The inspection should ensure that the extinguisher is charged and ready for use. Extinguishers in compartments or trunks can become damaged or otherwise compromised because of weather exposure, other items in the compartment that are not secured, or other factors. [10:A.7.2.2.13]

A.13.6.4.3.1
The annual maintenance of a fire extinguisher requires the services of a trained and certified technician who has the proper tools, listed parts, and appropriate manufacturer’s service manual. Maintenance of fire extinguishers should not be confused with inspection, which is a quick check of the extinguishers that is performed at least every 30 days. Because the detailed maintenance procedures for various extinguisher types and models differ, the procedures specified within service manuals need to be followed. [10:A.7.3.1]

The following list is a sample of maintenance procedures that should be followed to determine deficiencies that require additional attention to remediate the condition of the extinguisher as appropriate for rechargeable, stored-pressure, dry chemical, and halogenated agent hand portable fire extinguishers:

1. Visually examine the extinguisher for damage by removing the extinguisher from the hanger, bracket, or cabinet, and visually examine the extinguisher for damage, including
pressure gauge, cylinder dents, repairs, general corrosion, hose or nozzle threads, handles, and levers.

2. Verify that the hanger, bracket, or cabinet is the proper one for the extinguisher.
3. Verify that the hanger, bracket, or cabinet is secure, undamaged, and properly mounted.
4. Verify that the nameplate operating instructions are legible and facing outward.
5. Confirm that the extinguisher model is not subject to recall and is not obsolete.
6. Verify the extinguisher records to determine internal examination and hydrostatic test intervals. Thoroughly examine the cylinder for dents, damage, repairs, or corrosion.
7. Verify the pull pin functions properly and examine for damage or corrosion by removing the pull pin.
8. Verify that the handle and levers are undamaged and operable.
9. Verify that the valve stem is correctly extended and not corroded or damaged.
10. Verify that the pressure gauge or indicator is in the operable range.
11. Verify that the gauge operating pressure corresponds with the nameplate instructions.
12. Verify that the gauge face corresponds with the proper agent type.
13. Verify that the gauge threads are compatible with the valve body material.
14. Verify that the nozzle or hose assembly, or both, is unobstructed by, removing and examining the nozzle.
15. Confirm that the nozzle and hose assembly are correct for the model of extinguisher.
16. Verify that the hose and couplings are not cut, cracked, damaged, or deformed.
17. Examine internal valve port surfaces and threads for signs of leakage or corrosion by removing the nozzle or hose assembly and reinstalling the nozzle and hose assembly securely after examination.
18. Verify that the hose retention band is secure and properly adjusted.
19. Weigh the extinguisher and verify that it corresponds to the weight listed on the nameplate.
20. Reinstall the ring pin and install a new tamper seal.
21. Clean exposed extinguisher surfaces to remove any foreign material.
22. Record the maintenance on the extinguisher tag or label.
23. Return the extinguisher to the hanger, bracket, or cabinet.

The following list is a sample of maintenance procedures that should be followed to determine deficiencies that require additional attention to remediate the condition of the extinguisher as appropriate for carbon dioxide hand portable fire extinguishers:

(1) Visually examine the extinguisher for damage by removing the extinguisher from the hanger or cabinet, and visually examine the extinguisher for damage, including cylinder dents, repairs, general corrosion, hose or nozzle threads, handles, and levers.
(2) Verify that the bracket or cabinet is the proper one for the extinguisher.
(3) Verify that the bracket or cabinet is secure, undamaged, and properly mounted.
(4) Verify that the nameplate operating instructions are legible and facing outward.
(5) Confirm that the extinguisher model is not subject to recall and is not obsolete.
(6) Verify the extinguisher records to determine hydrostatic test intervals.
(7) Verify the pull pin functions properly and examine for damage or corrosion by removing the pull pin.
(8) Examine the handle and levers to ensure that they are undamaged and operable.
(9) Verify that the valve stem is correctly extended and not corroded or damaged.
(10) Verify that the nozzle or hose assembly, or both, is unobstructed, by removing and examining the nozzle.
(11) Confirm that the nozzle and hose assembly are correct for the model of extinguisher.
(12) Verify that the hose and couplings are not cut, cracked, damaged, or deformed.
(13) Examine the discharge port for signs of leakage or corrosion by removing the nozzle or hose assembly and reinstalling the nozzle and hose assembly securely after examination.
(14) Conduct a conductivity test on the hose assembly.
(15) Affix the conductivity test label to hose assemblies that pass the conductivity test and replace hoses that fail the conductivity test.
(16) Verify that the safety assembly is not damaged or blocked.
(17) Verify that the hose retention band is secure and properly adjusted.
(18) Weigh the extinguisher to verify that it corresponds to the weight listed on the nameplate.
(19) Reinstall the ring pin and install a new tamper seal.
(20) Clean exposed extinguisher surfaces to remove any foreign material.
(21) Record the maintenance on the extinguisher tag or label.
(22) Return the extinguisher to the hanger, bracket, or cabinet.

The following list is a sample of maintenance procedures and checks that are commonly associated with water-type hand portable fire extinguishers:

(1) Visually examine the extinguisher for damage by removing the extinguisher from the hanger, bracket, or cabinet, and visually examine the extinguisher for damage, including pressure gauge, cylinder dents, repairs, general corrosion, hose or nozzle threads, handles, and levers.
(2) Verify that the hanger, bracket, or cabinet is the proper one for the extinguisher.
(3) Verify that the hanger, bracket, or cabinet is secure, undamaged, and properly mounted.
(4) Verify that the nameplate operating instructions are legible and facing outward.
(5) Confirm that the extinguisher model is not subject to recall and is not obsolete.
(6) Check the extinguisher records to determine hydrostatic test intervals.
(7) Verify that the pull pin functions properly and examine for damage or corrosion by removing the pull pin.
(8) Examine the handle and levers to ensure that they are undamaged and operable.
(9) Verify that the valve stem is correctly extended and not corroded or damaged.
(10) Verify that the pressure gauge is in the operable range.
(11) Verify that the gauge operating pressure corresponds with the nameplate instructions.
(12) Verify that the gauge face corresponds with the proper agent type.
(13) Verify that the gauge threads are compatible with the valve body material.
(14) Verify that the nozzle or hose assembly, or both, is unobstructed, by removing and examining the nozzle.
(15) Confirm that the nozzle and hose assembly are correct for the model of extinguisher.
(16) Verify that the hose and couplings are not cut, cracked, damaged, or deformed.
(17) Examine the internal valve port surfaces and threads for signs of leakage or corrosion by removing the nozzle or hose assembly and reinstalling the nozzle and hose assembly securely after examination.
(18) Verify that the hose retention band is secure and properly adjusted.
(19) Weigh the extinguisher to verify that it corresponds to the weight listed on the nameplate.
(20) Reinstall the ring pin and install a new tamper seal.
(21) Clean exposed extinguisher surfaces to remove any foreign material.
(22) Record the maintenance on the extinguisher tag or label.
(23) Return the extinguisher to the hanger, bracket, or cabinet.

The following list is a sample of maintenance procedures and checks that are commonly associated with cartridge-operated dry chemical and dry powder hand portable fire extinguishers:

1. Visually examine the extinguisher for damage by removing the extinguisher from the hanger, bracket, or cabinet, and visually examine the extinguisher for damage, including pressure gauge, cylinder dents, repairs, general corrosion, hose or nozzle threads, handles, and levers.
2. Verify that the hanger, bracket, or cabinet is the proper one for the extinguisher.
3. Verify that the hanger, bracket, or cabinet is secure, undamaged, and properly mounted.
4. Verify that the nameplate operating instructions are legible and facing outward.
5. Confirm that the extinguisher model is not subject to recall and is not obsolete.
6. Verify the extinguisher hydrostatic test records to determine the hydrostatic test interval.
7. Invert the extinguisher and open the nozzle to ensure any pressure is relieved from the shell.
8. Remove the cartridge guard and check the integral components for damage or corrosion.
9. Unscrew the cartridge to examine the seal. (Replace the cartridge if the seal is punctured, damaged, or corroded.) Verify that the seal is not punctured, that it is the proper cartridge for that extinguisher, and that it has the proper manufacturer’s seal.
10. Install the shipping cap on the cartridge.
11. Weigh the cartridge on a scale and verify the weight is within the tolerance specified in the manufacturer’s service manual.
12. Remove the discharge nozzle from its holder and lift the hose, breaking the tamper seal.
13. Operate the puncture lever to verify proper operation.
14. Check and clean the pressure relief vent in the cartridge receiver in accordance with manufacturer’s service manual.
15. Remove and examine the cartridge receiver gasket. Replace the gasket if brittle, compression set, cracked, cut, or missing.
16. Lubricate the gasket in accordance with the manufacturer’s manual and install.
17. Slowly loosen the fill cap to relieve any trapped pressure and reinstall hand tight.
18. Examine the hose, nozzle, and couplings for any damage.
19. Operate the discharge nozzle to verify proper operation.
20. Remove the nozzle tip in accordance with the manufacturer’s service manual and verify the proper tip is installed and that it is not damaged. Install the nozzle tip in accordance with manufacturer’s manual.
21. Remove the discharge hose from the extinguisher and ensure that the hose is not obstructed.
22. Examine the hose o-ring and replace if necessary.
23. Verify that the hose connection is clean and not damaged.
24. Install the hose on the extinguisher.
25. Remove the fill cap and examine the threads and seating surfaces for any damage or corrosion.
26. Verify that the pressure relief vent is not obstructed.
Verify that the dry chemical agent is the correct type and that there are no foreign materials or caking.
Examine and clean the fill cap, gasket, and indicator in accordance with manufacturer’s manual.
Lubricate and install the fill cap and gasket in accordance with manufacturer’s manual.
Secure the discharge hose in place and install the proper cartridge.
Replace the cartridge guard and install new tamper seals.
Record the maintenance on the extinguisher tag or label.
Return the extinguisher to the hanger, bracket, or cabinet.

Where a safety seal or tamper indicator is missing, it can be evidence that the fire extinguisher has been used, and therefore should be removed from service. Extreme caution should be exercised before replacing. If a tamper seal is found to be missing from a nonrechargeable fire extinguisher, it should be removed from service.

Persons performing maintenance operations usually come from two major groups:

1. Fire extinguisher service agencies
2. Trained industrial safety or maintenance personnel

Fire extinguishers owned by individuals are often neglected because a periodic follow-up program is not planned. It is recommended that such owners become familiar with their fire extinguishers so they can detect telltale warnings during inspection that suggest the need for maintenance. When maintenance is indicated, it should be performed by trained persons having proper equipment. (See 13.6.4.1.2.2.)

The purpose of a well-planned and well-executed maintenance program for a fire extinguisher is to maximize the following probabilities:

1. That the extinguisher will operate properly between the time intervals established for maintenance examinations in the environment to which it is exposed
2. That the extinguisher will not constitute a potential hazard to persons in its vicinity or to operators or rechargers of fire extinguishers

Any replacement parts needed should be obtained from the manufacturer or a representative.

In addition to the required tag or label, a permanent file record should be kept for each fire extinguisher. This file record should include the following information, as applicable:
1. Maintenance date and the name of the person and the agency performing the maintenance
2. Date of the last recharge and the name of the person and the agency performing the recharge
3. Hydrostatic retest date and the name of the person and the agency performing the hydrostatic test
4. Description of dents remaining after passing of the hydrostatic test
5. Date of the 6-year maintenance for stored-pressure dry chemical and halogenated agent types (See 13.6.4.3.6.)

It is recognized that an electronic bar coding system is often acceptable to the AHJ in lieu of a tag or label for maintenance record keeping. Under special circumstances, or when local requirements are in effect, additional information can be desirable or required.

A.13.6.4.6.7.2
The following procedure permits rapid removal of the hose by one person without kinking of the hose and without obstruction of flow of the extinguishing agent:

1. Form a standard loop over the hose supports [see Figure A.13.6.4.6.2(a)].
2. Follow with a reverse loop over the hose supports so that the hose passes behind the loop [see Figure A.13.6.4.6.2(b)].
3. Repeat steps (1) and (2), alternating standard loops and reverse loops, until all hose is coiled on the support [see Figure A.13.6.4.6.2(c)].
4. Adjust the coil so that the nozzle is in the downward position [see Figure A.13.6.4.6.2(d)]. Hose coiled in this manner pulls off free of twists.
5. Place the nozzle in the holder with the handle forward in the closed position [see Figure A.13.6.4.6.2(e)].

[10:A.7.6.27.1.1]

Figure A.13.6.4.6.7.2(a) Counterclockwise Loop. [10:Figure A.7.6.27.1.1(a)]
Figure A.13.6.4.67.2(b) Reverse Loop. [10:Figure A.7.6.27.1.1(b)]

Figure A.13.6.4.67.2(c) Procedures in Figure A.13.6.4.67.2(a) and Figure A.13.6.4.67.2(b) Continued. [10:Figure A.7.6.27.1.1(c)]
Figure A.13.6.4.67.2(d) Nozzle in Downward Position. [10:Figure A.7.6.27.1.1(d)]

Figure A.13.6.4.67.2(e) Nozzle in Holder. [10:Figure A.7.6.27.1.1(e)]
General safety guidelines for recharging include the following:

1. Make sure all pressure is vented from the fire extinguisher before attempting to remove the valve body or to fill the closure. (Warning: Do not depend on pressure-indicating devices to tell if the container is under pressure, because the devices could malfunction.)
2. Use proper recharge materials when refilling a fire extinguisher. Mixing of some extinguishing agents can cause a chemical reaction, resulting in a dangerous pressure buildup in the container.
3. The weight of agent as specified on the nameplate is critical. Overfilling could render the fire extinguisher dangerous or ineffective.
4. Clean and properly lubricate all sealing components to prevent leakage after recharge.
5. Check the pressure-indicating device to ascertain that it is reading properly.
6. Most manufacturers recommend the use of dry nitrogen as an expellant gas for stored-pressure fire extinguishers. Limiting the charging pressure regulator setting to 25 psi (172 kPa) above service pressure, as 13.6.4.7.4, prevents gauge damage and loss of calibration. (Warning: Never connect the fire extinguisher to be charged directly to the high-pressure source. Connecting directly to the high-pressure source could cause the container to rupture, resulting in injury. Never leave a fire extinguisher connected to the regulator of a high-pressure source for an extended period of time. A defective regulator could cause the container to rupture due to excess pressure.)
7. Use the manufacturer’s recommended charging adapter to prevent damage to a valve and its components.
8. When recharging separate expellant source fire extinguishers, make sure the filled enclosure is in place and tightened down. Replace all safety devices prior to installing replacement cartridges.
9. Use only gas cartridges recommended by the manufacturer. Cartridge features such as pressure relief, puncturing capabilities, fill density, and thread compatibility are designed and approved to specific functional requirements.
10. Use proper safety seals; other types, such as meter seals, could fail to break at the prescribed requirements.
11. Regulators utilized on wheeled fire extinguishers are factory pinned at the operating pressure and should not be field adjusted.

A.13.6.4.78.1
Some manufacturers require that their fire extinguishers be returned to the factory for recharging. [10:A.7.78.1.2]

A.13.6.4.78.1.3
To determine the gross weight, the entire fire extinguisher should be weighed empty. The weight of the specified recharge agent should be added to that amount. [10:A.7.78.1.3]

A.13.6.4.78.1.3.4
The leak test required for stored-pressure and self-expelling types should be sufficiently sensitive to ensure that the fire extinguisher remains operable for at least 1 year. Any tamper indicators or seals need to be replaced after recharging. [10:A.7.78.1.3.4]

A.13.6.4.78.3
On properties where fire extinguishers are maintained by the occupant, a supply of recharging agents should be kept on hand. These agents should meet the requirements of 13.6.4.7.3. [10:A.7.78.3]

The intent of this provision is to maintain the efficiency of each fire extinguisher as produced by the manufacturer and as labeled by one or more of the fire testing laboratories. For example, the extinguishing agent and the additives used in the various types of dry chemical fire extinguishers vary in chemical composition and in particle size and, thus, in flow characteristics. Each fire extinguisher is designed to secure maximum efficiency with the particular formulation used. Changing the agent from that specified on the fire extinguisher nameplate could affect flow rates, nozzle discharge characteristics, and the quantity of available agent (as influenced by density) and would void the label of the testing laboratory. [10:A.7.78.3]

Certain recharging materials deteriorate with age, exposure to excessive temperature, and exposure to moisture. Storage of recharge agents for long periods of time should be avoided. [10:A.7.78.3]

Dry powder used for combustible metal fires (Class D) should not become damp, because the powder will not be free flowing. In addition, when dry powder contains sufficient moisture, a hazardous reaction could result when applied to a metal fire. [10:A.7.78.3]

A.13.6.4.78.3.2
Mixing multipurpose dry chemicals with alkaline-based dry chemicals could result in a chemical reaction capable of developing sufficient pressures to rupture a fire extinguisher. Substituting a different formulation for the one originally employed could cause malfunctioning of the fire extinguisher or result in substandard performance. [10:A.7.78.3.2]
Moisture within a non-water-type fire extinguisher creates a serious corrosion hazard to the fire extinguisher shell and also indicates that the extinguisher is probably inoperative. Moisture could possibly enter under the following conditions:

1. After a hydrostatic test
2. When recharging is being performed
3. When the valve has been removed from the cylinder
4. Where compressed air and a moisture trap are used for pressurizing non-water types

It is extremely important to remove any water or moisture from any fire extinguisher before recharging. Excess moisture in a dry chemical fire extinguisher causes the agent to cake and lump and become unusable. It also causes corrosion to the fire extinguisher shell and valve. In carbon dioxide and halogenated fire extinguishers, excess moisture combined with the extinguishing agent causes extremely corrosive acids to form. These acids can corrode the fire extinguisher shell and valve.

If the fire extinguisher valve is removed for servicing, it is recommended that the fire extinguisher be purged with nitrogen or argon (as appropriate) or that a vacuum be drawn on the fire extinguisher cylinder prior to recharging.

The preferred source of carbon dioxide for recharging fire extinguishers is from a low-pressure [300 psi at 0°F (2068 kPa at −17.8°C)] supply, supplied either directly or via dry cylinders used as an intermediary means. Dry ice converters should not be used to recharge carbon dioxide portable fire extinguishers.

When stored-pressure fire extinguishers are recharged, overfilling results in improper discharge.

Some Class D fire extinguishers are required to be pressurized with argon.

The reason an unregulated source of pressure is not to be used is because the fire extinguisher has the potential to be overpressurized and possibly rupture.
A defective regulator could cause the container to rupture due to excess pressure. [10:A.7.28.4.7]

If it becomes necessary to replace a pressure gauge on a fire extinguisher, in addition to knowing the charging pressure, it is important to know the type of extinguishing agent for which the gauge is suitable, as well as the valve body with which the gauge is compatible. This information often is available in the form of markings on the dial face. Where the marking is provided, the extinguishing agent is indicated by instructions such as “Use Dry Chemicals Only,” while the valve body compatibility is indicated as follows:

1. Gauges intended for use with aluminum or plastic valve bodies are marked with a line above the gauge manufacturer’s code letter.
2. Gauges intended for use with brass or plastic valve bodies are marked with a line below the manufacturer’s code letter.
3. Universal gauges that can be used with aluminum, brass, or plastic valve bodies are marked with lines above and below the manufacturer’s code letter or by the absence of any line above or below the manufacturer’s code letter.

Using the proper replacement gauge as to pressure range, extinguishing agent, and valve body compatibility is recommended to avoid or to reduce gauge-related problems. [10:A.7.89]

A verification-of-service collar is installed to show that an extinguisher has been depressurized, if the valve has been removed, and if a complete maintenance has been performed. The verification-of-service collar design also requires that the valve be removed before the collar can be attached to the extinguisher. The collar provides an AHJ with a more convenient visual proof that the extinguisher has been disassembled and that maintenance most likely has been performed. [10:A.7.10]
All extinguishers are to have the valve removed for hydrostatic testing and are to be subsequently recharged before they are returned to service. To be valid, the date on the verification-of-service collar should always be the same as or more recent than the date on the hydrostatic test label. [10:A.7.40]

Figure A.13.6.4.10 provides a guide to the design of a verification-of-service collar. [10:A.7.40]

Figure A.13.6.4.10 Design of a Verification-of-Service Collar. [10:A.7.40]
A.13.6.4.11

Weight scales used for weighing a fire extinguisher with a gross weight of 60 lb (27.2 kg) or less should permit readings to 0.25 lb (0.10 kg). Weight scales used for weighing extinguishers and cartridges should permit readings consistent with the tolerances identified on the nameplate of the extinguisher or cartridge. All scales should be calibrated (tested) for accuracy. Accuracy of weight scales should be demonstrated at least daily by the use of a test weight(s) having a verified weight. The test method involves placing a test weight on the scale and reading the results. The following method should be used to calibrate weight scales daily or more frequently as needed:

1. With nothing on the scale, “zero out” the weight scale by adjusting the weight scale calibration knob or wheel or tare/zero button so that it reads zero. A digital scale should be powered and allowed to stabilize before adjusting to read zero.
2. Place the test weight(s) on the scale.
3. Read the weight that is registered on the scale, and, if needed, adjust the scale by turning the calibration knob or wheel to show the weight of the test weight that is being tested. Some digital scales have an electronic push-button calibration feature to calibrate the weight during a test.
4. Repeat the testing procedure twice after any adjustment. The weight that is registered should be exactly the same.

Weight scales that do not provide repeatable results within the tolerances specified in the manufacturer’s literature should be repaired or replaced.

[10:A.7.4+12]

### Supplemental Information

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### Submitter Information Verification

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National Fire Protection Association Report

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Chapter 50  Commercial Cooking

50.1  Application.

50.1.1*

The design, installation, operation, inspection, and maintenance of all public and private commercial cooking equipment and mobile and temporary cooking operations shall comply with this chapter and NFPA 96.

50.1.2

This chapter shall apply to residential cooking equipment used for commercial cooking operations. [96:1.1.2]

50.1.3

This chapter shall not apply to cooking equipment located in a single dwelling unit. [96:1.1.3]

50.1.4*

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. [96:1.1.4]

50.2  General Requirements.

50.2.1  General.

50.2.1.1

Cooking equipment used in processes producing smoke or grease-laden vapors shall be equipped with an exhaust system that complies with all the equipment and performance requirements of this chapter. [96:4.1.1]

50.2.1.1.1*

Cooking equipment that has been listed in accordance with ANSI/UL 197, Standard for 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]

50.2.1.2

The listing evaluation of cooking equipment covered by 50.2.1.1 shall demonstrate that the grease discharge at the exhaust duct of a test hood placed over the appliance shall not exceed 0.00018 oz/ft³ (5 mg/m³) when operated with a total airflow of 500 cfm (0.236 m³/s). [96:4.1.1.2]

50.2.1.2

All such equipment and its performance shall be maintained in accordance with the requirements of this chapter during all periods of operation of the cooking equipment. [96:4.1.2]
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]

50.2.1.3.1
Maintenance and repairs shall be performed on all components at intervals necessary to maintain
good working condition. [96:4.1.3.1]

50.2.1.4
All airflows shall be maintained. [96:4.1.4]

50.2.1.5
The responsibility for inspection, testing, maintenance, and cleanliness of the ventilation control and
fire protection of the commercial cooking operations, including cooking appliances, shall ultimately
be that of the owner of the system, provided that this responsibility has not been transferred in
written form to a management company, tenant, or other party. [96:4.1.5]

50.2.1.6*
All solid fuel cooking equipment are required to comply with the requirements of Chapter 14 of
NFPA 96. [96:4.1.6]

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]

50.2.1.8
All interior surfaces of the exhaust system shall be accessible for cleaning and inspection purposes.
[96:4.1.8]

50.2.1.9*
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 NFPA 96 or this chapter unless
otherwise exempted by the AHJ in accordance with 1.3.2 of NFPA 96. [96:4.1.9]

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]

50.2.2.3  Clearance Reduction.

50.2.2.3.1

Where a clearance reduction system consisting of 0.013 in. (0.33 mm) (28 gauge) sheet metal spaced out 1 in. (25 mm) on noncombustible spacers is provided, there shall be a minimum of 9 in. (229 mm) clearance to combustible material. [96:4.2.3.1]

50.2.2.3.2

Where a clearance reduction system consisting of 0.027 in. (0.69 mm) (22 gauge) sheet metal on 1 in. (25 mm) mineral wool batts or ceramic fiber blanket reinforced with wire mesh or equivalent spaced 1 in. (25 mm) on noncombustible spacers is provided, there shall be a minimum of 3 in. (76 mm) clearance to combustible material. [96:4.2.3.2]

50.2.2.3.3

Where a clearance reduction system consisting of a listed and labeled field-applied grease duct enclosure material, system, product, or method of construction specifically evaluated for such purpose in accordance with ASTM E2336, the required clearance shall be in accordance with the listing. [96:4.2.3.3]

50.2.2.3.4

Zero clearance to limited-combustible materials shall be permitted where protected by one of the following:

1. Metal lath and plaster
2. Ceramic tile
3. Quarry tile
4. Other noncombustible materials or assembly of noncombustible materials that are listed for the purpose of reducing clearance
5. Other materials and products that are listed for the purpose of reducing clearance

[96:4.2.3.4]

50.2.3  Drawings.

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. [96:4.6]

50.2.4  AHJ Notification.
If required by the AHJ, notification in writing shall be given of any alteration, replacement, or relocation of any exhaust or extinguishing system or part thereof or cooking equipment. [96:4.7]

50.3 Protection of Coverings and Enclosure Materials.

50.3.1
Measures shall be taken to prevent physical damage to any covering or enclosure material. [96:7.7.3.1]

50.3.2
Any damage to the covering or enclosure shall be repaired, and the covering or enclosure shall be restored to meet its intended listing and fire resistance rating and to be acceptable to the AHJ. [96:7.7.3.2]

50.3.3
In the event of a fire within a kitchen exhaust system, the duct, the enclosure, and the covering directly applied to the duct shall be inspected by qualified personnel to determine whether the duct, the enclosure, and the covering directly applied to the duct are structurally sound, capable of maintaining their fire protection functions, suitable for continued operation, and acceptable to the AHJ. [96:7.7.3.3]

50.3.4
Listed grease ducts shall be installed in accordance with the terms of the listing and the manufacturer's instructions. [96:7.7.3.4]

50.4.3 General Requirements.

50.4.3.1
Fire-extinguishing equipment for the protection of grease removal devices, hood exhaust plenums, and exhaust duct systems shall be provided. [96:10.1.1]

50.4.3.2*
Cooking equipment that produces grease-laden vapors and that might be a source of ignition of grease in the hood, grease removal device, or duct shall be protected by fire-extinguishing equipment. [96:10.1.2]

50.4.3.3 Fume incinerators, thermal recovery units, air pollution control devices, or other devices installed in the exhaust duct, shall be protected by an automatic fire-extinguishing system. [96:10.1.3]

50.4.4 Types of Equipment.

50.4.4.1
Fire-extinguishing equipment shall include both automatic fire-extinguishing systems as primary protection and portable fire extinguishers as secondary backup. [96:10.2.1]

50.4.4.2*
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. [96:10.2.2]

50.4.4.2.1
The language and wording for the placard shall be approved by the AHJ. [96:10.2.2.1]

50.4.4.3*
Automatic fire-extinguishing systems shall comply with ANSI/UL 300, Standard for 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]

50.4.4.3.1*
In existing dry or wet chemical systems not in compliance with ANSI/UL 300, the fire-extinguishing system shall be made to comply with 50.4.4.3 when any of the following occurs:

1. The cooking medium is changed from animal oils and fats to vegetable oils.
2. The positioning of the cooking equipment is changed.
3. Cooking equipment is replaced.
4. The equipment is no longer supported by the manufacturer.

[96:10.2.3.1]

50.4.4.3.2
Effective January 1, 2014, all existing fire-extinguishing systems shall meet the requirements of 50.4.4.3. [96:10.2.3.2]

50.4.4.4
Grease removal devices, hood exhaust plenums, exhaust ducts, and cooking equipment that are not addressed in ANSI/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 ANSI/UL 710B, Outline of Investigation for Recirculating Exhaust System. [96:10.2.5]

50.4.4.6
Automatic fire-extinguishing systems shall be installed in accordance with the terms of their listing, the manufacturer's instructions, and the following standards where applicable:

1. NFPA 12
2. NFPA 13
3. NFPA 17
4. NFPA 17A
50.4.4.7 Modifications to Existing Hood Systems.

50.4.4.7.1
Any abandoned pipe or conduit from a previous installation shall be removed from within the hood, plenum, and exhaust duct. [96:10.2.7.1]

50.4.4.7.2
Penetrations and holes resulting from the removal of conduit or piping shall be sealed with listed or equivalent liquidtight sealing devices. [96:10.2.7.2]

50.4.4.7.3
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. [96:10.2.7.3]

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]

50.4.4.8 Fixed Baffle Hoods with Water Wash.

50.4.4.8.1
Grease removal devices, hood exhaust plenums, and exhaust ducts requiring protection in accordance with 50.4.3.1 shall be permitted to be protected by a listed fixed baffle hood containing a constant or fire-actuated water-wash system that is listed and in compliance with ANSI/UL 300 or other equivalent standards and shall be installed in accordance with the requirements of their listing. Areas requiring protection in accordance with 50.4.3.1 shall be permitted to be protected by a water-wash system that is listed as a fire-extinguishing system in compliance with ANSI/UL 300 or other equivalent standards and installed in accordance with the requirements of its listing. [96:10.2.8.1]

50.4.4.8.2
Each such area not provided with a listed water-wash fire-extinguishing system shall be provided with a fire-extinguishing system listed for the purpose. [96:10.2.8.2]

50.4.4.8.3
The water supply for water-wash fire-extinguishing systems shall be permitted to be supplied from the domestic water supply when the minimum water pressure and flow are provided in accordance with the terms of the listing. [96:10.2.8.3]

50.4.4.8.4
The water supply for water-wash fire-extinguishing systems shall be controlled by a supervised water supply control listed indicating valve. [96:10.2.8.4]
The water wash in a fixed baffle hood specifically listed to extinguish a fire shall be activated by the cooking equipment extinguishing system. 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. [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 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 fire-extinguishing system provides protection for the cooking equipment, hood, and duct, activation of the water wash shall not be required. [96:10.2.8.7]

50.4.4.8.7.1-

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. [96:10.2.8.7.1]

50.4.4.8

Grease removal devices, hood exhaust plenums, and exhaust ducts on fixed baffle hoods with water wash shall be permitted to be protected by a sprinkler system with an individual control valve if the design of the hood prevents the water from reaching the cooking appliances. [96:10.2.8.8]

50.4.4.9 Water-Based Fire-Extinguishing System.

50.4.4.9.1

The water required for listed automatic fire-extinguishing systems shall be permitted to be supplied from the domestic water supply where the minimum water pressure and flow are provided in accordance with the terms of the listing. The water supply shall be controlled by a supervised water supply control valve. [96:10.2.9.1]

50.4.4.9.2

Where the water supply is from a dedicated fire protection water supply in a building with one or more fire sprinkler systems, separate indicating control valves and drains shall be provided and arranged so that the hood system and sprinkler systems can be controlled individually. [96:10.2.9.2]

50.4.4.10 Water Valve Supervision.

Valves controlling the water supply to listed water-wash fire-extinguishing systems, fixed baffle hood assemblies, automatic fire-extinguishing systems, or both shall be listed indicating type of valve and shall be supervised open by one of the following methods:
Central station, proprietary, or remote station alarm service

Local alarm service that will cause the sounding of an audible signal at a constantly attended point

Locking valves open

*Sealing of valves and approved weekly recorded inspection [96:10.2.10]

50.4.5 Simultaneous Operation.

50.4.5.1

Fixed pipe extinguishing systems in a single hazard area (see 3.3.44 of NFPA 96 for the definition of single hazard area) shall be arranged for simultaneous automatic operation upon actuation of any one of the systems. [96:10.3.1]

50.4.5.1.1

Hoods installed end to end, back to back, or both, or sharing a common ductwork, not exceeding 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 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]

50.4.5.1.2

Hoods installed end to end, back to back, or both that do not share a common exhaust duct and are separated by a wall(s) or other means to ensure that grease-laden vapors exhausted under one hood cannot propagate to the other hoods or exhaust systems shall not be required to comply with 50.4.5.1.4. The hoods’ fire-extinguishing system(s) shall be independent and shall not be required to simultaneously discharge. [96:10.3.1.2]

50.4.5.1.3

Fume incinerators, thermal recovery units, air pollution control devices, or other devices installed in the exhaust duct shall not be required to comply with 50.4.5.1.1. [96:10.3.1.3]

50.4.5.2

Simultaneous operation shall not be required where the one fixed pipe extinguishing system is an automatic sprinkler system. [96:10.3.2]

50.4.5.2.1
Where an automatic sprinkler system is used in conjunction with a water-based fire-extinguishing system served by the same water supply, hydraulic calculations shall consider both systems operating simultaneously. [96:10.3.2.1]

50.4.5.3

Simultaneous operation shall be required where a dry or wet chemical system is used to protect common exhaust ductwork by one of the methods specified in NFPA 17 or NFPA 17A. [96:10.3.3]

50.4.6 Fuel and Electric Power Shutoff.

50.4.6.1

Upon activation of any fire-extinguishing system for a cooking operation, all sources of fuel and electric power that produce heat to all equipment requiring protection by that system shall automatically shut off. [96:10.4.1]

50.4.6.2

Steam supplied from an external source shall not be required to automatically shut off. [96:10.4.2]

50.4.6.3

Any gas appliance not requiring protection but located under ventilating equipment where protected appliances are located shall be automatically shut off upon activation of the extinguishing system. [96:10.4.3]

50.4.6.4

Shutoff devices shall require manual reset. [96:10.4.4]

50.4.6.5

Solid fuel cooking operations shall not be required to be shut down. [96:10.4.4]

50.4.7 Manual Activation.

50.4.7.1

All systems shall have both automatic and manual methods of actuation. A readily accessible means for manual activation shall be located between 42 in. and 48 in. (1067 mm and 1219 mm) above the floor, be accessible in the event of a fire, be located in a path of egress, and clearly identify the hazard protected. [96:10.5.1]

50.4.7.1.1

At least one manual actuation device shall be located in a minimum of 10 ft (3 m) and a maximum of 20 ft (6 m) from the protected hood exhaust system(s) within the path means of egress or at an alternative location acceptable to the AHJ. [96:10.5.1.1]

50.4.7.1.2

Manual activation using a cable-operated pull station shall not require more than 40 lb (178 N) of force, with a pull movement not to exceed 14 in. (356 mm) to activate the automatic fire-
The manual actuation device shall clearly identify the hazard protected. [96:10.5.1.2]

50.4.7.2

An automatic sprinkler system shall not require a method of manual actuation. The automatic and manual means of system activation external to the control head or releasing device shall be separate and independent of each other so that failure of one will not impair the operation of the other except as permitted by 50.4.7.3. [96:10.5.2]

50.4.7.3–

The manual means of system activation shall be permitted to be common with the automatic means if the manual activation device is located between the control head or releasing device and the first fusible link. [96:10.5.3]

50.4.7.4–

An automatic sprinkler system shall not require a manual means of system activation. [96:10.5.4]

50.4.7.5–

The means for manual activation shall be mechanical or rely on electrical power for activation in accordance with 50.4.7.6. [96:10.5.5]

50.4.7.6–

Electrical power shall be permitted to be used for manual activation if a standby power supply is provided or if supervision is provided in accordance with 50.4.9. [96:10.5.6]

50.4.7.7–

Instruction shall be provided to employees 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. [96:10.5.73]

50.4.8 System Annunciation.

50.4.8.1

Upon activation of an automatic fire-extinguishing system, an audible alarm or visual indicator shall be provided to show that the system has activated. [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 of the automatic fire-extinguishing system shall activate the fire alarm signaling system. [96:10.6.2]

50.4.9 System Supervision.

50.4.9.1–
Where electrical power is required to operate the fixed automatic fire-extinguishing system, the system shall be provided with a reserve power supply and be monitored by a supervisory alarm except as permitted in 50.4.9.2. [96:10.7.1]

50.4.9.2–

Where fixed automatic fire-extinguishing systems include automatic mechanical detection and actuation as a backup detection system, electrical power monitoring and a reserve power supply shall not be required. [96:10.7.2]

50.4.9.3–

System supervision shall not be required where a fire-extinguishing system(s) is interconnected or interlocked with the cooking equipment power source(s) so that if the fire-extinguishing system becomes inoperable due to power failure, all sources of fuel or electrical power that produce heat to all cooking equipment serviced by that hood shall automatically shut off. [96:10.7.3]

50.4.9.4–

System supervision shall not be required where an automatic fire-extinguishing system, including automatic mechanical detection and actuation, is electrically connected to a listed fire-actuated water-wash system for simultaneous operation of both systems. [96:10.7.4]

50.4.10–9 Special Design and Application.

50.4.109.1

Hoods containing automatic fire-extinguishing systems are protected areas; therefore, these hoods are shall not be considered obstructions to overhead sprinkler systems and shall not require floor additional sprinkler coverage underneath. [96:10.87.1]

50.4.109.2

A single detection device, listed with the extinguishing system, shall be permitted for more than one appliance where installed in accordance with the terms of the listing. [96:10.87.2]

50.4.11–10 Review and Certification.

50.4.1110.1

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. [96:10.98.1]

50.4.1110.2* Installation Requirements.

50.4.1110.2.1

Installation of systems shall be performed only by persons properly trained and qualified to install the specific system being provided. [96:10.98.2.1]

50.4.1110.2.2

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. [96:10.98.2.2]
50.4.12-11 Portable Fire Extinguishers.

50.4.1211.1 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. [96:10.409.1]

50.4.1211.2 Class K fire extinguishers shall be provided for cooking appliance hazards that involve combustible cooking media (vegetable oils and animal oils and fats). [96:10.409.2]

50.4.1211.3 Portable fire extinguishers shall be provided for other hazards in kitchen areas and shall be selected and installed in accordance with Section 13.6. [96:10.409.3]

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

50.4.1211.4-5 Portable fire extinguishers shall be maintained in accordance with Section 13.6. [96:10.109.45]

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

50.5.1 Operating Procedures.

50.5.1.1 Exhaust systems shall be operated whenever cooking equipment is turned on. [96:11.1.1]

50.5.1.2 Filter-equipped exhaust systems shall not be operated with filters removed. [96:11.1.2]

50.5.1.3 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. [96:11.1.3]

50.5.1.4 Instructions shall be provided to new employees on hiring and to all employees semiannually on the use of portable fire extinguishers and the manual actuation of the fire-extinguishing system for manually operating the fire-extinguishing system shall be posted conspicuously in the kitchen and shall be reviewed with employees by the management. [96:11.1.4]

50.5.1.4.1 Responsibility for compliance with 11.1.4 shall be that of management of the commercial cooking operation. [96:11.1.4.1]
Records of compliance with 11.1.4 shall be maintained and shall be available to the authority having jurisdiction. [96:11.1.4.2]

50.5.1.4.3
Instructions for manually operating the fire-extinguishing system shall be posted conspicuously in the kitchen and shall be reviewed with employees by the management. [96:11.1.4.3]

50.5.1.5
Listed exhaust hoods shall be operated in accordance with the terms of their listings and the manufacturer's instructions. [96:11.1.5]

50.5.1.6
Cooking equipment shall not be operated while its fire-extinguishing system or exhaust system is nonoperational or impaired. [96:11.1.6]

50.5.1.6.1
Where the fire-extinguishing system or exhaust system is nonoperational or impaired, the systems shall be tagged as noncompliant, and the system owner or owner's representative shall be notified in writing of the impairment, and where required, the AHJ shall be notified. [96:11.1.6.1]

50.5.1.7
Secondary filtration and pollution control equipment shall be operated in accordance with the terms of its listing and the manufacturer's recommendations. [96:11.1.7]

50.5.1.8
Inspection and maintenance of "other equipment" 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 equipment listing. [96:11.1.8]

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

50.5.2.1*
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. [96:11.2.1]

50.5.2.2*
All actuation and control components, including remote manual pull stations, mechanical or electrical devices, detectors, and actuators, shall be tested for proper operation during the inspection in accordance with the manufacturer's procedures. [96:11.2.2]

50.5.2.3
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. [96:11.2.3]
50.5.2.4*
Fusible links of the metal alloy type and automatic sprinklers of the metal alloy type shall be replaced at least semiannually except as permitted by 50.5.2.6 and 50.5.2.7. [96:11.2.4]

50.5.2.5
The year of manufacture and the date of installation of the fusible links shall be marked on the system inspection tag. [96:11.2.5]

50.5.2.5.1
The tag shall be signed or initialed by the installer. [96:11.2.5.1]

50.5.2.5.2
The fusible links shall be destroyed when removed. [96:11.2.5.2]

50.5.2.6
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. [96:11.2.6]

50.5.2.7
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. [96:11.2.7]

50.5.2.8
Where required, certificates of inspection and maintenance shall be forwarded to the AHJ. [96:11.2.8]

50.5.2.8.1
Records, including certificates of inspection and maintenance, shall be permitted to be forwarded to or shared with the authority having jurisdiction either by hard copy or electronically. [96:11.2.8.1]

50.5.3 Inspection of Fire Dampers.

50.5.3.1
Actuation components for fire dampers shall be inspected for proper operation in accordance with the manufacturer's listed procedures. [96:11.3.1]

50.5.3.2 Replacement of Fusible Links.

50.5.3.2.1
Fusible links on fire damper assemblies shall be replaced at least semiannually or more frequently as necessary. [96:11.3.2.1]
Replacement shall be made by a certified person acceptable to the AHJ. [96:11.3.2.2]

50.5.3.3* Documentation Tag.

50.5.3.3.1
The year of manufacture and the date of installation of the fusible links shall be documented. [96:11.3.3.1]

50.5.3.3.2
The tag shall be signed or initialed by the installer. [96:11.3.3.2]

50.5.4* 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. [96:11.4]

Table 50.5.4 Schedule of Inspection for Grease Buildup

<table>
<thead>
<tr>
<th>Type or Volume of Cooking</th>
<th>Inspection Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Systems serving solid fuel cooking operations</td>
<td>Monthly</td>
</tr>
<tr>
<td>*Systems serving high-volume cooking operations, such as 24-hour cooking, charbroiling, or wok cooking</td>
<td>Quarterly</td>
</tr>
<tr>
<td>Systems serving moderate-volume cooking operations</td>
<td>Semiannually</td>
</tr>
<tr>
<td>†Systems serving low-volume cooking operations, such as churches, day camps, seasonal businesses, or senior centers</td>
<td>Annually</td>
</tr>
</tbody>
</table>

*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 11.4]

50.5.5 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. [96:11.5]

50.5.6 Cleaning of Exhaust Systems.

50.5.6.1*
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. [96:11.6.1]
50.5.6.1.1
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 11.4. [96:11.6.1.1]

50.5.6.1.1.1
Hoods, grease removal devices, fans, ducts, and other appurtenances shall be cleaned to remove combustible contaminants to a minimum of 50 μm (0.002 in.). [96:11.6.1.1.1]

50.5.6.1.1.2
A grease depth gauge comb, as shown in Figure 50.5.6.1.1.2, shall be placed upon the surface to measure grease depth. [96:11.6.1.1.2]

Figure 50.5.6.1.1.2 Depth Gauge Comb. (copy Figure 11.6.1.1.2 from NFPA 96)

50.5.6.1.1.3
Where a measured depth of 2000 μm (0.078 in.) is observed, the surfaces shall be cleaned in accordance with 50.5.6.1. [96:11.6.1.1.3]

50.5.6.1.1.4
Where a measured depth of 3175 μm (0.125 in.) is observed in a fan housing, the surfaces shall be cleaned in accordance with 50.5.6.1. [96:11.6.1.1.4]

50.5.6.2*
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. [96:11.6.2]

50.5.6.3
At the start of the cleaning process, electrical switches that could be activated accidentally shall be locked out. [96:11.6.3]

50.5.6.4
Components of the fire suppression system shall not be rendered inoperable during the cleaning process. [96:11.6.4]

50.5.6.5
Fire-extinguishing systems shall be permitted to be rendered inoperable during the cleaning process where serviced by properly trained and qualified persons. [96:11.6.5]

50.5.6.6
Flammable solvents or other flammable cleaning aids shall not be used. [96:11.6.6]

50.5.6.7
Cleaning chemicals shall not be applied on fusible links or other detection devices of the automatic extinguishing system. [96:11.6.7]
50.5.6.8
After the exhaust system is cleaned, it shall not be coated with powder or other substance. [96:11.6.8]

50.5.6.9
When cleaning procedures are completed, all access panels (doors) and cover plates shall be restored to their normal operational condition. [96:11.6.9]

50.5.6.10
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. [96:11.6.10]

50.5.6.11
Dampers and diffusers shall be positioned for proper airflow. [96:11.6.11]

50.5.6.12
When cleaning procedures are completed, all electrical switches and system components shall be returned to an operable state. [96:11.6.12]

50.5.6.13
When an exhaust cleaning service is used, 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. [96:11.6.13]

50.5.6.14
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. [96:11.6.14]

50.5.6.15
Where required, certificates of inspection and cleaning and reports of areas not cleaned shall be submitted to the AHJ. [96:11.6.15]

50.5.6.16
Metal containers used to collect grease drippings shall be inspected or emptied at least weekly. [96:11.6.16]

50.5.7 Cooking Equipment Maintenance.

50.5.7.1
Inspection and servicing of the cooking equipment shall be made at least annually by properly trained and qualified persons. [96:11.7.1]

50.5.7.2
Cooking equipment that collects grease below the surface, behind the equipment, or in cooking equipment flue gas exhaust, such as griddles or charbroilers, shall be inspected and, if found with grease accumulation, cleaned by a properly trained, qualified, and certified person acceptable to the AHJ. [96:11.7.2]

50.6 Minimum Safety Requirements for Cooking Equipment.

50.6.1 Cooking Equipment.

50.6.1.1 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 [96:12.1.1]

50.6.1.2 Installation.

50.6.1.2.1 All listed appliances shall be installed in accordance with the terms of their listings and the manufacturer’s instructions. [96:12.1.2.1]

50.6.1.2.1.1 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. [96:12.1.2.1.1]

50.6.1.2.2 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. [96:12.1.2.2]

50.6.1.2.2.1 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. [96:12.1.2.2.1]

50.6.1.2.3 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. [96:12.1.2.3]

50.6.1.2.3.1 An approved method shall be provided that will ensure that the appliance is returned to an approved design location. [96:12.1.2.3.1]

50.6.1.2.4 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. [96:12.1.2.4]
50.6.1.2.5
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. [96:12.1.2.5]

50.6.1.2.5.1
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. [96:12.1.2.5.1]

50.6.2 Operating Controls.
Deep-fat fryers shall be equipped with a separate high-limit control in addition to the adjustable operating control (thermostat) to shut off fuel or energy when the fat temperature reaches 475°F (246°C) at 1 in. (25.4 mm) below the surface. [96:12.2]

50.6.3 Commercial Kitchen Cooking Oil Storage Tank Systems.
Commercial kitchen cooking oil storage tank systems shall comply with 66.19.7.

A.50.1.4
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

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.1.1.4]

A.50.2.1.1.1
As referenced in ANSI/UL 197, some products evaluated using the emission test procedure EPA 202, as described in ANSI/UL 710B, are listed in the UL directory under the category KNLZ, Commercial, with Integral Systems for Limiting the Emission of Grease-laden Air. See ANSI/UL 710B. [96:A.4.1.1.1]

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 of NFPA 96. [96:A.4.1.6]

A.50.2.1.9
The AHJ can exempt temporary facilities, such as a tent, upon evaluation for compliance to the applicable portions of NFPA 96 or this Code. Although it might not be practical to enforce all requirements of NFPA 96 in temporary facilities, the AHJ should determine that all necessary provisions that affect the personal safety of the occupants are considered. [96:A.4.1.9]

A.50.2.2
See Figure A.50.2.2(a) through Figure A.50.2.2(h) for clarification of the appropriate clearances required in 50.2.2. [96:A.4.2]

A.50.2.2.1 Measurement of Clearance.
The measurement of clearance to combustible or limited-combustible material is intended to be measured from the closest point of the exhaust system component to that material. Example: The clearance where ceramic tile is installed over gypsum board that extends behind the hood should be measured from the hood to the gypsum board. Placing a noncombustible material over a combustible or limited-combustible material does not permit a zero clearance installation. [96:A.4.2.1]

A.50.4.3.2
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.10.1.2]

A.50.4.4.2
NFPA 10, Annex A, provides recommendations for placards. [96:A.10.2.2]

A.50.4.4.3
ANSI/UL 300 primarily addresses the method of fire testing for self-contained chemical extinguishing systems commonly referred to as pre-engineered systems. ANSI/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 ANSI/UL 300 test standard. Current examples include, but are not limited to, ANSI/UL 199, UL Subject 199B, UL Subject 199E, and ANSI/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 or equivalent standards. [96:A.10.2.3.1]
A.50.4.4.10(4)
An approved weekly recorded inspection could consist of a log of entries that would display the date and time of each inspection and the initials of the person(s) conducting the visual inspection. Attaching the log to a clipboard and mounting it near the valve in question serves as a convenient reminder of the need to conduct the inspection. [96:A.10.2.10(4)]

A.50.4.1110.2
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.10.9.2]

A.50.4.1211.1
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.10.10.1]

A.11.1.4
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.

A.50.5.2.1
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.11.2.1]

A.50.5.2.2
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 control components, an alternate means for testing those components should be provided and used. [96:A.11.2.2]

A.50.5.2.4
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 50.5.2.4 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.11.2.4]

A.50.5.3.3
See A.50.5.2.4. [96:A.11.3.3]

A.50.5.4
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.11.4]

A.50.5.6.1
ANSI/IKECA Standard C-10 provides guidance for cleaning the exhaust system.

A good operating practice is for cleaning personnel of commercial kitchen exhaust systems to have personal protective equipment (PPE) and height access equipment. The following items should be considered as a minimum:

1. Eye protection
2. Hand protection
3. Head protection
4. Foot protection
5. Respiratory protection
6. Fall protection
7. Ladders
8. Lock-out/tag-out kit

[96:A.11.6.1]

Preparation. The fan should be turned off, locked out, and tagged out. Open flames should be extinguished, and switches/breakers serving the appliance and cooking area outlets should be locked out. If the switches/breakers are not capable of being locked out and tagged out, any solid-fuel cooking appliances should be extinguished and the solid fuel removed. [96:A.11.6.1]

Removal or Covering of Equipment. Food products, cookware, and cooking support equipment that can be removed should be removed from the cleaning area. Equipment that cannot be removed should be covered. [96:A.11.6.1]

Cleaning Methods. The following methods for cleaning surfaces covered with grease and contaminants been proved to be effective:

1. Manual cleaning by scraping, grinding, or scrubbing
2. Chemical cleaning with agents and water
3. Pressure washing with pressurized water or pressurized water and agents
4. Steam cleaning with pressurized steam

[96:A.11.6.1]
Waste Water and Solid Waste. Water and agents used in the cleaning process and solid waste should be collected for disposal. [96:A.11.6.1]

A.50.5.6.2
Hoods, grease removal devices, fans, ducts, and other appurtenances should be cleaned to remove combustible contaminants to a minimum of 0.002 in. (50 µm). [96:A.11.6.2]
When to clean: A measurement system of deposition should be established to trigger a need to clean. [96:A.11.6.2]
The method of measurement is a depth gauge comb, shown in Figure A.50.5.6.2, which is scraped along the duct surface. For example, a measured depth of 0.078 in. (2000 µm) indicates the need to remove the deposition risk. The system would also include point measurement in critical areas. For example, 0.125 in. (3175 µm) in a fan housing requires cleaning. [96:A.11.6.2]
Figure A.50.5.6.2 Depth Gauge Comb. [96:Figure A.11.6.2]

A.11.7.2
Once the agent has fully discharged and if the fire has not been extinguished, the fire can continue to burn and spread. This can occur if the fire starts in or before system discharge and spreads to an area outside the protected area. Examples of areas outside the zone of protection include the flue of a gas-fired fryer, the area below the cooking surface of a griddle, inside the grease drip collectors, and any area behind or below an appliance. To minimize the probability of a fire spreading out of control, it is important that these areas outside the zone of protection be kept clean of grease and other combustible cooking residues. [96:A.11.7.2]

A.50.6.1.1
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 ANSI/UL 197.
2. Microwave cooking appliances should be listed and labeled in accordance with ANSI/UL 923.
3. Oil-burning stoves should be listed and labeled in accordance with ANSI/UL 896.
4. Wood-fired cooking appliances should be listed and labeled in accordance with ANSI/UL 737, 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, ANSI/UL 737, and/or UL Subject 2162, depending on exact appliance type.

[A.12.1.1]

A.50.6.1.2.1
Gas-fueled appliances should be installed to the requirements of NFPA 54 or NFPA 58. [A.12.1.2.1]

A.50.6.1.2.2
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. [A.12.1.2.2]

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. [A.12.1.2.2]
Second Revision No. 49-NFPA 1-2016 [ Global Comment ]


Supplemental Information

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Submitter Information Verification

Submitter Full Name: Kristin Bigda
Organization: National Fire Protection Assoc
Street Address:
City:
State:
Zip:

Committee Statement

Committee Statement: Extract update.
Response Message:
NFPA 1: Updated Extracts from NFPA 30

Yellow – Change
Blue – New
Red - Question

Chapter 3

A.3.3.225  Safety Can.
Safety cans listed to ANSI/UL 30, Standard for Metal Safety Cans, are limited to 5 U.S. gal (19 L). ANSI/UL 1313, Standard for Nonmetallic Safety Cans for Petroleum Products, allows for capacities up to 5 Imperial gal (23 L). [30:A.3.3.48] [A.3.3.49]

A.3.3.258.15  Vapor Processing System.
Examples are systems using blower-assist for capturing vapors and refrigeration, absorption, and combustion systems for processing vapors. [30:A.3.3.56] [A.3.3.57]

A.3.3.258.16  Vapor Recovery System.
Examples are balanced-pressure vapor displacement systems and vacuum-assist systems without vapor processing. [30:A.3.3.55] [A.3.3.58]

Chapter 42 – all up to date

Chapter 43 – all up to date

Chapter 63 – all up to date

Chapter 66

66.3.3.10  Container.
Any vessel of 119 gal (450 L) or less capacity used for transporting or storing liquids. [30, 20122018]

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, 20122018]

66.3.3.19*  Hazardous Material or Hazardous Chemical.
Material presenting dangers beyond the fire problems relating to flash point and boiling point.

66.3.23 High Hazard Level 2 Contents.
Contents that present a deflagration hazard or a hazard from accelerated burning. For the purposes of this chapter, this includes Class I, Class II, or Class IIIA liquids 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.

66.3.24 High Hazard Level 3 Contents.
Contents that readily support combustion or that present a physical hazard. For the purposes of this chapter, this includes Class I, Class II, or Class IIIA liquids that are used or stored in normally closed containers or in closed systems at gauge pressures of less than 15 psi (103 kPa).

66.3.3.3.2 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 psig (6.9 kPa) but not more than a gauge pressure of 15 psi (103 kPa) measured at the top of the tank.

66.3.3.3.1* Nonmetallic Portable Tank.
A portable tank, as herein defined, constructed of plastic, fiber, or a material other than metal.

A 66.3.3.3.1 Nonmetallic Portable Tank. Permissible nonmetallic portable tanks for shipping Class I, Class II, and Class IIIA liquids 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 IIIIB liquids are not governed by either UN or DOT hazardous materials regulations. Fiber portable tanks for Class IIIIB liquids include composite designs consisting of a multi-ply corrugated box with a rigid or flexible inner plastic bladder.

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.

66.3.40* Warehouse.
A 66.3.40 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.
An approved means shall be provided for prompt notification of fire or other emergency to those within the plant and to the available public or mutual aid fire department shall be provided identified in the emergency action plan in accordance with Section 66.6.8. [30:6.6.1]

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 liquid-processing facilities. The application of one or a combination of these systems and methods as well as the use of fire-resistant materials shall be determined in accordance with this chapter Sections 66.6.3 and 66.6.4. [30:6.7.1]

66.6.9.2
Maintenance and operating practices shall be established and implemented to prevent and control leakage and prevent spillage of flammable 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 flammable and combustible liquids. [30:6.10.1.1]

66.9.2 Definitions specific to Section 66.9
66.9.2.1* Protected.
For the purposes of this chapter, this term shall apply to the storage of containers that meet the appropriate provisions of Chapter 16 or alternate provisions that have been approved by the authority having jurisdiction (see 16.3.5 and Section 16.9). [30:9.2.1]

A.66.9.2.1*
The term protected indicates that the fire risk is managed so as to control the fire and prevent it from spreading beyond the design area of the automatic fire protection system. [30:A.9.2.1]

66.9.2.2* Unprotected.
For the purposes of this chapter, this term shall apply to the storage of containers that do not meet the criteria to be considered protected, as defined in 9.2.1. [30:9.2.2]

A.66.9.2.2*
The term unprotected indicates that the growth of a fire might exceed the capabilities of the automatic fire protection system and extend beyond the design area of the system. In such cases, the total contents of the fire area might become involved in a fire, regardless of the protection features provided. [30:A.9.2.2]

66.9.3.3.1
Storage of liquids shall not physically obstruct a means of egress. [30:9.3.3.1]

66.9.3.4
For the purposes of this section and Chapters 10, 12, and 16 of NFPA 30, *protected storage* shall mean storage installed after January 1, 1997 that is protected in accordance with Section 66.16. All other storage shall be considered to be unprotected storage unless an alternate means of protection has been approved by the AHJ. [30:9.3.4]

66.9.3.5
Wood of at least 1 in. (25 mm) nominal thickness shall be permitted to be used for shelving, racks, dunnage, scuffboards, floor overlay, and similar installations. [30:9.3.5]

66.9.3.6
Class I liquids shall not be permitted to be stored in basements as defined in 3.3.22. [30:9.3.6]

66.9.3.7
Class II and Class IIIA liquids 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. [30:9.3.7]

66.9.3.8
Class IIIB liquids shall be permitted to be stored in basements as defined in 3.3.22. [30:9.3.8]

66.9.3.9
Where containers, intermediate bulk containers, or portable tanks are stacked, they shall be stacked so that stability is maintained and excessive stress on container walls is prevented. [30:9.3.9]

66.9.3.9.1
Portable tanks and intermediate bulk containers stored more than one high shall be designed to stack securely, without the use of dunnage. [30:9.3.9.1]

66.9.3.9.2
Materials-handling equipment shall be capable of handling containers, portable tanks, and intermediate bulk containers that are stored at all storage levels. [30:9.3.9.2]

66.9.3.9.3*
Power-operated industrial trucks used to move Class I liquids shall be selected, operated, and maintained in accordance with NFPA 505. [30:9.3.9.3]

A.66.9.3.9.3
Section 5.1 of NFPA 505 states “In locations used for the storage of flammable liquids 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) and should be used in inside liquid storage areas where conditions warrant. [30:A.9.3.9.3 A.9.3.8.3]

66.9.3.10 Containers, intermediate bulk containers, and portable tanks in unprotected liquid storage areas shall not be stored closer than 36 in. (915 mm) to the nearest beam, chord, girder, or other roof or ceiling member. [30:9.3.109.3.9]

66.9.3.11 Liquids used for building maintenance, painting, or other similar infrequent maintenance purposes shall be permitted to be stored in closed containers outside of storage cabinets or inside liquid storage areas, if limited to an amount that does not exceed a 10-day supply at anticipated rates of use. [30:9.3.119.3.10]

66.9.3.12 Storage, handling, and use of Class II and Class III liquids heated at or above their flash point shall follow the requirements for Class I liquids, 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.) [30:9.3.129.3.11]

66.9.4.1* Only the following approved containers, intermediate bulk containers, and portable tanks shall be used for Class I, Class II, and Class IIIA liquids:

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 Title 49, Code of Federal Regulations, Parts 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, one or more of the following specifications:

(a) ASTM F852, Standard Specification for Portable Gasoline Containers for Consumer Use

(b) ASTM F976, Standard Specification for Portable Kerosene and Diesel Containers for Consumer Use

(3) Nonmetallic or metallic commercial/industrial safety cans meeting the requirements of, and used with the scope of, one or more of the following specifications:

(a) ANSI/UL 30, Standard for Metal Safety Cans

(b) ANSI/UL 1313, Standard for 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:
   
   
   (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 Title 49, Code of Federal Regulations, Parts 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 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 Title 49, Code of Federal Regulations, 49 CFR Chapter I, or by U.S. Department of Transportation exemption

(6) *Rigid nonmetallic intermediate bulk containers that meet requirements set by and contain products authorized by the following:
   
   (1) The U.S. Department of Transportation Hazardous Materials Regulations in Title 49, Code of Federal Regulations, Parts 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
   
   (2) 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 Title 49, Code of Federal Regulations, 49 CFR Parts 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 66.9.4.3 and in accordance with U.S. Department of Transportation Hazardous Materials Regulations in Title 49, Code of Federal Regulations, Parts 49 CFR 100–199

(8) Other nonmetallic intermediate bulk containers that comply with 66.9.4.1.1 [30:9.4.1]

66.9.4.1.1
For protected storage, rigid nonmetallic intermediate bulk containers, as described in 66.9.4.1(5), shall comply with table 66.9.4.3 and shall be subjected to a standard fire test that demonstrates acceptable inside storage fire performance and shall be listed and labeled in accordance with UL 2389, *Standard for Fire Exposure Testing of Intermediate Bulk Containers for Flammable and Combustible Liquids; FM Class 6020. Approval Standard for Intermediate Bulk Containers; of an equivalent test procedure.* [30:9.4.1.1]

**66.9.4.3**

The maximum allowable size of a container, intermediate bulk container, or metal portable tank for Class I, Class II, and Class IIIA liquids shall not exceed that specified in Table 66.9.4.3.

**Table 66.9.4.3 Maximum Allowable Size — Containers, Intermediate Bulk Containers (IBCs), and Portable Tanks**

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<th>Container Type</th>
<th>Flammable Liquids</th>
<th>Combustible Liquids</th>
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<tbody>
<tr>
<td><strong>Class IA</strong></td>
<td>1 pt (0.5 L)</td>
<td>1.3 gal (5 L)</td>
</tr>
<tr>
<td><strong>Class IB</strong></td>
<td>1 qt (1 L)</td>
<td>5.3 gal (20 L)</td>
</tr>
<tr>
<td><strong>Class IC</strong></td>
<td>1.3 gal (5 L)</td>
<td>5.3 gal (20 L)</td>
</tr>
<tr>
<td><strong>Class II</strong></td>
<td>1.3 gal (5 L)</td>
<td>5.3 gal (20 L)</td>
</tr>
<tr>
<td><strong>Class IIIA</strong></td>
<td>1.3 gal (5 L)</td>
<td>5.3 gal (20 L)</td>
</tr>
</tbody>
</table>

- **Glass**
- **Metal (other than drums) or approved plastic**
- **Safety cans**
- **Metal drum (e.g., UN 1A1/1A2)**
- **Approved metal portable tanks and IBCs**
- **Rigid plastic IBCs (UN 31H1 or 31H2) and composite IBCs with rigid inner receptacle (UN31HZ1)**
- **Composite IBCs with flexible inner receptacle (UN31HZ2), and DOT/UN-approved flexible IBCs, and NMFC/ISTA-compliant IBCs**
- **Non-bulk Bag-in-Boxbox**
- **Polyethylene UN1H1 and UN1H2, or as authorized by DOT exemption**
- **Fiber drum**

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 in accordance with 66.6.5.4.

*See 66.9.4.3.1. [30: Table 9.4.3]

†See 66.9.4.3.2

Exception: As provided for in 66.9.1, 66.9.4.3.1, 66.9.4.3.2, 66.9.4.3.3, and 66.9.4.3.4. [30:9.4.3]
Nonmetallic intermediate bulk containers shall be listed and labeled in accordance with UL 2368, Standard for 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. [30:9.4.3.2]

Class IA and Class IB 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. [30:9.4.3.3.2]

Leaking or damaged containers up to 60 gal (230 L) capacity shall be permitted to be stored temporarily in accordance with this section and Chapters 10 through 12 of NFPA 30, provided they are enclosed in overpack containers. [30:9.4.3.3.3]

To be considered protected storage as defined in 66.9.2.1 and in accordance with Section 66.16, an overpack container shall be constructed of the same material as the leaking or damaged container. [30:9.4.3.3.4]

Metal overpack containers shall be considered nonrelieving style containers. [30:9.4.3.3.4.2]

Storage cabinets that meet at least one of the following sets of requirements shall be acceptable for storage of 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 NFPA 251, Standard Methods of Tests of Fire Resistance of Building and Construction and Materials, 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.

(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.

(4) Listed storage cabinets that have been constructed and tested in accordance with UL 1275, Standard for Flammable Liquid Storage Cabinets; FM Class Number 6050, Approval Standard for Storage Cabinets (Flammable and Combustible Liquids); or equivalent shall be acceptable. [30:9.5.3]

66.9.5.4.1

If a storage cabinet is not ventilated, the vent openings shall be sealed with the bungs supplied with the cabinet or with bungs specified by the cabinet manufacturer. [30:9.5.4.1]

66.9.17.1

Except as provided for in 66.9.17.3, 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]

66.9.17.3

The following shall apply where oxidizers are in segregated storage with flammable and combustible liquids:

1. The oxidizer containers and flammable and combustible liquid containers shall be separated by at least 25 ft (7.6 m).

2. The separation shall be maintained by dikes, drains, or floor slopes to prevent flammable liquid leakage from encroaching on the separation. [400:15.2.12.13.1]

Flammable and combustible liquids shall be separated from oxidizers by at least 25 ft (7.6 m). [30:9.17.3]

66.14.4.8

Lockers shall include a spill containment system to prevent the flow of liquids from the structure locker under emergency conditions. [30:14.4.8]
Containers of liquid in their original shipping packages shall be permitted to be stored either palletized or solid piled within the locker. [30:14.6.1]

**66.16.2.1 Protected Storage.**
Flammable and combustible liquids storage that is protected in accordance with this section. [30:16.2.2]

**66.16.2.1 Protected.**
For the purposes of this chapter, this term shall apply to the storage of containers that meet the appropriate provisions of Chapter 16 or alternate provisions that have been approved by the authority having jurisdiction (see 16.3.5 and Section 16.9). [30:16.2.2]

**A.66.16.2.1**
The term *protected* indicates that the fire risk is managed so as to control the fire and prevent it from spreading beyond the design area of the automatic fire protection system. [30:A.16.2.2]

**66.16.2.2 Unprotected.**
For the purposes of this chapter, this term shall apply to the storage of containers that do not meet the criteria to be considered protected, as defined in 16.2.2. [30:16.2.3]

**A.66.16.2.2**
The term *unprotected* indicates that the growth of a fire might exceed the capabilities of the automatic fire protection system and extend beyond the design area of the system. In such cases, the total contents of the fire area might become involved in a fire, regardless of the protection features provided. [30:A.16.2.3]

**66.16.2.2* Relieving-Style Container.**
A metal container, a metal intermediate bulk container, or a metal portable tank that is equipped with at least one pressure-relieving mechanism at its top that is designed, sized, and arranged to relieve the internal pressure generated due to exposure to fire so that violent rupture is prevented. [30:16.2.4]

**A.66.16.2.2**
Table A.66.16.2.2 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.16.2.3 A.16.2.4]

**Table A.66.16.2.2 Common Relieving- and Nonrelieving-Style Metal Containers**

<table>
<thead>
<tr>
<th>Container Type</th>
<th>Relieving Style</th>
<th>Nonrelieving Style</th>
</tr>
</thead>
<tbody>
<tr>
<td>≤1 qt*</td>
<td>All</td>
<td>N/A</td>
</tr>
<tr>
<td>Container Type</td>
<td>Relieving Style</td>
<td>Nonrelieving Style</td>
</tr>
<tr>
<td>----------------</td>
<td>-----------------</td>
<td>--------------------</td>
</tr>
<tr>
<td>&gt;1 qt and ≤6 gal</td>
<td>Metal containers with plastic cap, or flexible or rigid plastic spout with plastic cap</td>
<td>Metal containers with steel spout and steel screw cap</td>
</tr>
<tr>
<td>≤1 gal, friction lid</td>
<td>Metal containers with metal friction-fit covers (e.g., paint can lid)</td>
<td>N/A</td>
</tr>
<tr>
<td>1 gal and ≤6 gal (lug cover)</td>
<td>Metal containers with metal covers held in place with a mechanical friction-fit (e.g., lug-type) closure mechanism</td>
<td>N/A</td>
</tr>
<tr>
<td>&gt;6 gal and ≤60 gal (drums)</td>
<td>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)</td>
<td>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</td>
</tr>
<tr>
<td>&gt;60 gal and ≤793 gal</td>
<td>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</td>
<td>N/A</td>
</tr>
</tbody>
</table>

For SI units, 1 gal = 3.8 L.
N/A: Not applicable.

*All containers ≤1 qt are considered relieving style because their failure is inconsequential.

*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.

*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.16.2.3]

A.16.2.4
66.16.2.3* Unsaturated Polyester Resin (UPR).
A resin that contains up to 50 percent by weight of Class IC, Class II, or Class III liquid, but no
Class IA or Class IB liquid. [30:16.2.416.2.5]

A.66.16.2.3
Unsaturated polyester resins (UPRs) are high molecular weight unsaturated polymers dissolved
in a reactive monomer, usually styrene, in concentrations of 50 percent or less by weight. UPRs
are combined with reinforcements such as fiberglass and/or fillers to produce a wide range of
products. Examples of such products include automobile parts, bathroom tubs and shower stalls,
cultured marble, and many products for architectural, recreational, construction, and corrosion-
resistant applications. UPRs are normally packaged in 55 gal (208 L) drums. The U.S.
Department of Transportation classification for UPRs is “UN 1866, Resin Solution”; however, it
should be noted that this classification includes many materials that are not unsaturated polyester
resins. [30:A.16.2.4 A.16.2.5]

66.16.2.4 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 is in the shaded portion of
Figure 66.16.2.4. [30:16.2.516.2.6]

Figure 66.16.2.4 Viscous Liquid: Viscosity Versus Weight Percent Flammable or Combustible
Component. [30: Figure 16.2.516.2.6]

66.16.2.5 Water-Miscible Liquid.
A liquid that mixes in all proportions with water without the use of chemical additives, such as
emulsifying agents. [30:16.2.416.2.5]

66.16.3.4
Viscous liquids, as defined in 66.16.2.4, shall be permitted to be protected using either of the
following, as applicable:

(1) For metal containers, the criteria for a Class IIIB liquid in accordance with Figure
66.16.4.1(a) or Figure 66.16.4.1(b)

(2) For nonmetallic containers, the criteria for Class IIIB liquids, as determined by Figure
16.4.1(b)

(3) For nonmetallic containers, the criteria for cartoned unexpanded Group A plastics in
accordance with NFPA 13, Standard for the Installation of Sprinkler Systems, as indicated
in Figure 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 subjected to a standard fire test that demonstrates acceptable inside storage fire performance and shall be listed and labeled in accordance with UL 2368, Standard for 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. [30:16.3.7]

66.16.5.1.6
Foam-water sprinkler systems shall be designed and installed in accordance with NFPA 16. [30:16.5.1.6]

Table 66.16.5.2.1 Design Criteria for Sprinkler Protection of Single- and Double-Row Rack Storage of Liquids in Metal Containers, Portable Tanks, and IBCs

<table>
<thead>
<tr>
<th>Containment Style and Capacity (gal)</th>
<th>Maximum Storage Height (ft)</th>
<th>Ceiling Sprinkler Protection</th>
<th>In-Rack Sprinkler Protection</th>
<th>Discharge Flow (gpm)</th>
<th>Layout (See 66.16.5.1.10)</th>
<th>Notes</th>
<th>Fire Test Ref. [See NFPA 30:Table D.2(a)]</th>
</tr>
</thead>
<tbody>
<tr>
<td>NONRELIEVING-STYLE CONTAINERS — LIQUID CLASSES IB, IC, II, IIIA</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>≤1</td>
<td>16</td>
<td>30</td>
<td>K≤11.2 QR (HT)</td>
<td>0.60</td>
<td>20</td>
<td>K≥5</td>
<td>QR(OT)</td>
</tr>
<tr>
<td>≥1</td>
<td>20</td>
<td>30</td>
<td>K≤11.2 SR or QR (HT)</td>
<td>0.60</td>
<td>20</td>
<td>K≥5</td>
<td>QR(OT)</td>
</tr>
<tr>
<td>≤5</td>
<td>25</td>
<td>30</td>
<td>K≤8.0 SR or QR (HT)</td>
<td>0.30</td>
<td>30</td>
<td>K≥5</td>
<td>QR(OT)</td>
</tr>
<tr>
<td>&gt;5 and ≤60</td>
<td>25</td>
<td>30</td>
<td>K≤11.2 SR (HT)</td>
<td>0.40</td>
<td>30</td>
<td>K≥5</td>
<td>QR or SR(OT)</td>
</tr>
</tbody>
</table>

NONRELIEVING-STYLE CONTAINERS — LIQUID CLASS IIIIB

| ≤5 | 40 | 50 | K≤8.0 SR or QR (HT) | 0.30 | 20 | K≥5 | QR(OT) | 30 | 4 | 1, 3, 7 | 4 |
| >5 and ≤60 | 40 | 50 | K≤8.0 SR (HT) | 0.30 | 30 | K≥5 | QR(OT) | 30 | 4 | 1, 3, 7 | 6 |

RELIEVING-STYLE CONTAINERS — LIQUID CLASSES IB, IC, II, IIIA

<p>| ≤5 | 14 | 18 | K≤11.2 pendant only | QR (HT) | 0.65 | 20 | No in-rack sprinklers required | 4 | 7 |</p>
<table>
<thead>
<tr>
<th>Container Style and Capacity (gal)</th>
<th>Maximum Storage Height (ft)</th>
<th>Maximum Ceiling Height (ft)</th>
<th>Ceiling Sprinkler Protection Type</th>
<th>Ceiling Sprinkler Protection Response (gpm/ft²)</th>
<th>Design Density Area (ft²)</th>
<th>In-Rack Sprinkler Protection Type</th>
<th>In-Rack Sprinkler Protection Response (gpm)</th>
<th>Layout (See NFPA 30: Table D.2(a))</th>
<th>Not es</th>
<th>Fire Test Ref.</th>
</tr>
</thead>
<tbody>
<tr>
<td>≤ 5 gal</td>
<td>40</td>
<td>50</td>
<td>K≥8.0</td>
<td>SR or QR (HT)</td>
<td>0.30</td>
<td>30</td>
<td>00</td>
<td>K≥5.6</td>
<td>QR(OT )</td>
<td>30 4, 7 1 9</td>
</tr>
<tr>
<td>&gt;5 and ≤60</td>
<td>25</td>
<td>30</td>
<td>K≥11.2</td>
<td>SR (HT)</td>
<td>0.60</td>
<td>30</td>
<td>00</td>
<td>K≥5.6</td>
<td>QR(OT )</td>
<td>30 6, 7 1 10</td>
</tr>
<tr>
<td>Portable tanks and IBCs</td>
<td>25</td>
<td>30</td>
<td>K≥11.2</td>
<td>SR (HT)</td>
<td>0.60</td>
<td>30</td>
<td>00</td>
<td>K≥5.6</td>
<td>QR or SR(OT)</td>
<td>30 5, 7 1 12</td>
</tr>
</tbody>
</table>

**RELIEVING-STYLE CONTAINERS — LIQUID CLASS IIIIB**

| ≤ 5 gal                           | 40                          | 50                         | K≥8.0                            | SR or QR (HT)                                 | 0.30                     | 20                              | 00                               | K≥5.6                                    | QR(OT ) | 30 4, 7 1 9  |
| >5 and ≤60                        | 40                          | 50                         | K≥8.0                            | SR (HT)                                       | 0.30                     | 30                              | 00                               | K≥5.6                                    | QR(OT ) | 30 4, 7 1 3 11 |
| Portable tanks and IBCs           | 40                          | 50                         | K≥8.0                            | SR (HT)                                       | 0.30                     | 30                              | 00                               | K≥5.6                                    | QR(OT ) | 30 4, 7 1 6 13 |

For SI units, 1 gal = 3.8 L, 1 ft = 0.3 m, 1 ft² = 0.09 m², 1 gpm/ft² = 40.7 L/min/m² = 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 8 most hydraulically remote sprinklers

(b) Where two levels of in-rack sprinklers are installed, the design shall include the 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 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 ft² 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.

66.16.6.1.4

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) In-rack sprinklers shall provide a minimum operating 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).

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 and where there is only one horizontal barrier, 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, six each (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).
66.16.6.3.3 In-rack sprinklers shall meet the following requirements:

1. In-rack sprinklers shall be ordinary temperature-rated, quick-response sprinklers. Sprinklers shall have a nominal K-factor equal to or greater than 8.0. An intermediate-temperature sprinkler shall be used where ambient conditions require.

2. In-rack sprinklers shall be installed below each barrier level.

3. In-rack sprinklers shall provide a minimum discharge flow of 30 gpm (110 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).

66.17.10.1 A facility shall be designed and operated to prevent the discharge of liquids to public waterways, public sewers, or adjoining property. Emergency drainage systems shall be provided to direct liquid leakage and fire protection water to a safe location. [30:17.10.1]

66.17.10.2 Emergency drainage systems shall be provided to direct liquid leakage and fire protection water to a safe location. Emergency drainage systems, if connected to public sewers or discharged into public waterways, shall be equipped with traps or separators. [30:17.10.2]

66.17.10.3 Emergency drainage systems, if connected to public sewers or discharged into public waterways, shall be equipped with traps or separators. A facility shall be designed and operated to prevent the discharge of liquids to public waterways, public sewers, or adjoining property. [30:17.10.3]

66.18.4.7 Listed flexible connectors shall be permitted to be used where vibration exists. Approved hose shall be permitted to be used at transfer stations. [30:18.4.7]

66.18.5.4 The quantity of liquid located outside of identified storage areas, such as storage cabinets, other inside liquid storage areas, general-purpose warehouses, or other specific processing areas that
are cut off from the general plant area by at least a 2-hour fire separation, shall meet the requirements of 66.18.5.4.1. The maximum allowable quantities (MAQs) of liquids in containers in use in incidental operations in a control area shall not exceed the greater of the following:

66.18.5.4.1

The maximum quantity of liquids permitted for incidental operations in a single fire 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 following quantities provided in Table 66.18.5.4

   (a) 25 gal (95 L) of Class IA liquids in containers
   (b) 120 gal (454 L) of Class IB, Class IC, Class II, or Class III liquids in containers
   (c) 1585 gal (6000 L) of any combination of the following:
      1. Class IB, IC, II, or IIIA liquids in metal portable tanks or metal intermediate bulk containers, each not exceeding 793 gal (3000 L)
      2. Class II or Class IIIA liquids in nonmetallic intermediate bulk containers, each not exceeding 793 gal (3000 L)
   (d) 20 portable tanks or intermediate bulk containers each not exceeding 793 gal (3000 L) of Class IIIB liquids

Table 66.18.5.4 MAQ of Flammable and Combustible Liquids Per Control Area for Incidental Operations

<table>
<thead>
<tr>
<th>Liquid Class(es)</th>
<th>Open Use</th>
<th>Use — Closed Containers</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>gal</td>
<td>L</td>
</tr>
<tr>
<td>IA</td>
<td>10</td>
<td>38</td>
</tr>
<tr>
<td>IB and IC</td>
<td>20</td>
<td>76</td>
</tr>
<tr>
<td>II</td>
<td>30</td>
<td>115</td>
</tr>
<tr>
<td>IIIA</td>
<td>80</td>
<td>300</td>
</tr>
<tr>
<td>IIIB</td>
<td>3,300</td>
<td>12,650</td>
</tr>
</tbody>
</table>

Notes:
(1) Quantities are permitted to be increased 100 percent where stored in approved flammable liquids storage cabinets or in safety cans. Where note (2) also applies, the increase for both notes is permitted to be applied cumulatively.
(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 cumulatively.

The intent of this requirement is to allow the quantities of flammable and combustible 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 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.

66.18.5.4.2
Control areas shall be in accordance with Section 66.9.

66.19.7.3.2.1
Tank supports: Tanks shall be secured to the tank and to the floor to prevent the tank from tipping over. For a flat-bottom tank resting directly on the floor, the tank shall be secured to the floor to prevent the tank from tipping over. [30:19.7.3.2.1]

A.66.19.7.3.2.1
Guidance on securing tanks from tipping over is provided by the manufacturer’s instructions in accordance with the tank listing. [30:A.19.7.3.2.1]

66.21.2 Definitions Specific to Section 66.21.
For the purpose of this section, the terms in this section shall have the definitions given following definitions shall apply. [30:21.2]

66.21.4.1 Materials of Construction.
Tanks shall be of steel or other approved noncombustible material and shall meet the applicable requirements of in accordance with 66.21.4.1.1 through 66.21.4.1.5, or of combustible materials in accordance with 66.21.4.1.1 and 66.21.4.1.3 through 66.21.4.1.5. [30:21.4.1]

66.21.4.1.2
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 liquid stored

3. Aboveground storage of Class IIIIB liquids in areas not exposed to a spill or leak of Class I or Class II liquid

4. Storage of Class IIIIB liquids inside a building protected by an approved automatic fire-extinguishing system

[30:21.4.1.2]
Unlined concrete tanks shall be permitted to be used for storing liquids that have a gravity of 40° API or heavier. Concrete tanks with special linings shall be permitted to be used for other liquids, provided they are designed and constructed in accordance with recognized engineering standards. [30:21.4.1.2]

66.21.4.1.4-3 Tanks shall be permitted to have combustible or noncombustible linings. The selection, specification, and type of lining material and its required thickness shall be based on the properties of the liquid to be stored. When there is a change in the characteristics of the liquid to be stored, the compatibility of the lining and the liquid shall be verified. [30:21.4.1.4-21.4.1.3]

66.21.4.1.5-4 An engineering evaluation shall be made if the specific gravity of the liquid to be stored exceeds that of water or if the tank is designed to contain liquids at a liquid temperature below 0°F (-18°C). [30:21.4.1.5-21.4.1.4]

66.21.4.1.5 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 liquid stored
3. Aboveground storage of Class IIIIB liquids in areas not exposed to a spill or leak of Class I or Class II liquid
4. Storage of Class IIIIB liquids inside a building protected by an approved automatic fire-extinguishing system [30: 21.4.1.5]

66.21.4.2.1.1* Atmospheric tanks shall be designed and constructed in accordance with 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 Steel Tanks for Oil Storage*
(5) UL 58, *Standard for Steel Underground Tanks for Flammable and Combustible Liquids*
(6) ANSI/UL 80, *Standard for Steel Tanks for Oil Burner Fuel*
(7) ANSI/UL 142, *Standard for Steel Aboveground Tanks for Flammable and Combustible Liquids*
(8) UL 1316, *Standard for Glass-Fiber Reinforced Plastic Underground Storage Tanks for Petroleum Products, Alcohols, and Alcohol-Gasoline Mixtures*
(9) ANSI/UL 1746, *Standard for External Corrosion Protection Systems for Steel Underground Storage Tanks*

(10) UL 2080, *Standard for Fire Resistant Tanks for Flammable and Combustible Liquids*

(11) ANSI/UL 2085, *Standard for Protected Aboveground Tanks for Flammable and Combustible Liquids*

[A.21.4.2.1.1]

**66.21.4.2.1.1**

Atmospheric tanks include tanks of compartmented design and tanks that incorporate secondary containment.

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*.

[A.21.4.2.1.2]

**66.21.4.2.1.2**

Except as provided for in 66.21.4.2.1.3 and 66.21.4.2.1.4, atmospheric tanks designed and constructed in accordance with Appendix F of API Standard 650, *Welded Steel Tanks for Oil Storage*, shall be permitted to operate at pressures from atmospheric to a gauge pressure of 1.0 psi (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. [30:21.4.2.1.2]

**66.21.4.2.1.3**

Atmospheric tanks that are not designed and constructed in accordance with Appendix F of API Standard 650, *Welded Steel 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. [30:21.4.2.1.3]

**66.21.4.2.2.1**

Low-pressure tanks shall be designed and constructed in accordance with recognized engineering standards. Low-pressure tanks that meet either of the following standards shall be deemed as meeting the requirements of 66.21.4.2.2:

1. API 620, *Recommended Rules for the Design and Construction of Large, Welded, Low-Pressure Storage Tanks*
2. ASME Code for Unfired Pressure Vessels, Section VIII, Division 1

[30:21.4.2.2.1]
Atmospheric storage tanks shall be vented so as not to prevent the development of vacuum or pressure above the tank’s design operating pressure or a gauge pressure of 1.0 psi (6.9 kPa) maximum operating pressure, whichever is less, and shall be vented to prevent the development of vacuum. [30:21.4.3.4]

A.21.4.3.4

Tanks intended for normal operation at pressures greater than a gauge pressure of 1.0 psi (6.9 kPa) are designed in accordance with 21.4.2.3. It is recognized that a slight vacuum is necessary to operate a vacuum vent. [30:A.21.4.3.4]

66.21.6.3 Management of Fire Hazards.
The extent of fire and explosion prevention and control procedures and measures provided for tank storage facilities shall be determined by an engineering evaluation of the installation and operation, followed by the application of recognized fire and explosion protection and process engineering principles. The evaluation shall include, but not be limited to, the following:

1. Analysis of fire and explosion hazards of the facility
2. Analysis of local conditions, such as exposure to and from adjacent properties, flood potential, or earthquake potential
3. Fire Facility, fire department or mutual aid response

[30:21.6.3]

66.21.6.5.5 Emergency procedures shall be kept available in an operating area. The procedures shall be reviewed and updated whenever conditions change in accordance with 66.6.4.2. [30:21.6.5.5]

66.21.7.4.3.1 General.

Underground tanks taken out of service or abandoned shall be emptied of liquid, rendered vapor-free, and safeguarded against trespassing in accordance with this section and in accordance with NFPA 326 or in accordance with the requirements of the AHJ. The procedures outlined in this section shall be followed when taking underground tanks temporarily out of service, closing them in place permanently, or removing them. (See Annex C of NFPA 30 for additional information.) [30:21.7.4.3.1]

Table 66.22.4.11(a) Location of Aboveground Storage Tanks Storing Stable Liquids — Internal Pressure Not to Exceed a Gauge Pressure of 2.5 psi (17 kPa)
<table>
<thead>
<tr>
<th>Type of Tank</th>
<th>Protection</th>
<th>Minimum Distance (ft) From Property Line That Is or Can Be Built Upon, Including the Opposite Side of a Public Way&lt;sup&gt;a&lt;/sup&gt;</th>
<th>Minimum Distance (ft) From Nearest Side of Any Public Way or from Nearest Important Building on the Same Property&lt;sup&gt;a&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>Floating roof</td>
<td>Protection for exposures&lt;sup&gt;b&lt;/sup&gt;</td>
<td>( \frac{\sqrt{2}}{16} \times \text{diameter of tank} )</td>
<td>( \frac{\sqrt{6}}{6} \times \text{diameter of tank} )</td>
</tr>
<tr>
<td></td>
<td>None</td>
<td>Diameter of tank but need not exceed 175 ft ( \frac{\sqrt{6}}{6} \times \text{diameter of tank} )</td>
<td></td>
</tr>
<tr>
<td>Vertical with weak roof-to-shell seam</td>
<td>Approved foam or inerting system&lt;sup&gt;c&lt;/sup&gt; on tanks not exceeding 150 ft in diameter&lt;sup&gt;d&lt;/sup&gt;</td>
<td>( \frac{\sqrt{2}}{16} \times \text{diameter of tank} )</td>
<td>( \frac{\sqrt{6}}{6} \times \text{diameter of tank} )</td>
</tr>
<tr>
<td></td>
<td>Protection for exposures&lt;sup&gt;b&lt;/sup&gt;</td>
<td>Diameter of tank ( \frac{\sqrt{6}}{6} \times \text{diameter of tank} )</td>
<td></td>
</tr>
<tr>
<td></td>
<td>None</td>
<td>2 ( \times \text{diameter of tank but need not exceed 350 ft} ) ( \frac{\sqrt{6}}{6} \times \text{diameter of tank} )</td>
<td></td>
</tr>
<tr>
<td>Horizontal and vertical tanks with emergency relief venting to limit pressures to 2.5 psi (gauge pressure of 17 kPa)</td>
<td>Approved inverting system&lt;sup&gt;9&lt;/sup&gt; on the tank or approved foam system on vertical tanks</td>
<td>( \frac{\sqrt{2}}{16} \times \text{value in Table 66.22.4.1.1(b)} )</td>
<td>( \frac{\sqrt{6}}{6} \times \text{value in Table 66.22.4.1.1(b)} )</td>
</tr>
<tr>
<td></td>
<td>Protection for exposures&lt;sup&gt;b&lt;/sup&gt;</td>
<td>Value in Table 66.22.4.1.1(b) ( \frac{\sqrt{6}}{6} \times \text{value in Table 66.22.4.1.1(b)} )</td>
<td></td>
</tr>
<tr>
<td></td>
<td>None</td>
<td>2 ( \times \text{value in Table 66.22.4.1.1(b)} ) ( \frac{\sqrt{6}}{6} \times \text{value in Table 66.22.4.1.1(b)} )</td>
<td></td>
</tr>
<tr>
<td>Protected aboveground tank</td>
<td>None</td>
<td>( \sqrt{6} \times \text{value in Table 66.22.4.1.1(b)} ) ( \frac{\sqrt{6}}{6} \times \text{value in Table 66.22.4.1.1(b)} )</td>
<td></td>
</tr>
</tbody>
</table>

For SI units, 1 ft = 0.3 m.

<sup>a</sup>The minimum distance cannot be less than 5 ft (1.5 m).

<sup>b</sup>See definition 3.3.46 of NFPA 30, Protection for Exposures.

<sup>c</sup>See NFPA 69, Standard on Explosion Prevention Systems.

<sup>d</sup>For tanks over 150 ft (45 m) in diameter, use “Protection for Exposures” or “None,” as applicable. [30: Table 22.4.1.1(a)]

**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 \( \frac{210}{10} \text{ ft (0.93 m)} \) away from the centerline of the wall of the diked area. [30:22.4.2.4.2]

**66.23:5 Reserved**

**66.24:5.4**
Storage tank buildings where Class IA liquids are stored shall be designed to direct flame, combustion gases, and pressure resulting from an explosion away from important buildings or occupied areas through the use of damage-limiting construction. The damage-limiting construction design shall be designed in accordance with NFPA 68 and shall be acceptable to the AHJ. [30:24.5.4]

66.25.6 Reserved.

66.25.8 Reserved.

66.27.5.2 Flexible Connectors.
Listed flexible connectors shall be permitted to be used and labeled in accordance with UL 2039, Standard for Flexible Connector Pipe for Fuels, and shall be where installed in accordance with 66.27.5.3. [30:27.5.2]

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 flammable liquids. [30:A.29.3.28]

Table A.66.29.3.28 Typical Fire Protection for Wharves and Marine Terminals

<table>
<thead>
<tr>
<th>Location</th>
<th>Water Demand (gpm)</th>
<th>Hydrant Monitors</th>
<th>Hose Reel</th>
<th>Fire Extinguisher</th>
<th>Foam Concentrate</th>
<th>Fire Boat Connection</th>
<th>Emergency Equipment Lockers</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>30</td>
<td>120</td>
<td>2</td>
<td>150 lb Dry Chemical</td>
<td>100 gal</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Barge terminals</td>
<td>500–1000</td>
<td>Two 500</td>
<td>Two 1¼</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tankers</td>
<td>1000–2000</td>
<td>Two 500</td>
<td>Two 1¼</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>20,000 DWT and under</td>
<td>2000</td>
<td>Two 1000</td>
<td>Four 1½</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>20,001–70,000 DWT</td>
<td>2000</td>
<td>Two 1000</td>
<td>Four 1½</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>70,001 DWT and over</td>
<td>2000</td>
<td>Two 1000</td>
<td>Four 1½</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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<table>
<thead>
<tr>
<th>Location</th>
<th>Water Deman (gpm)</th>
<th>Hydrant Hose (gpm)</th>
<th>Hose Reel</th>
<th>Dry Chemical</th>
<th>Fire Extinguisher</th>
<th>Monitors and Hose</th>
<th>Foam Concentrate (gal)</th>
<th>Fire Boat Connection</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sea Islands</td>
<td>2000–4000</td>
<td>Three</td>
<td>Four</td>
<td>4</td>
<td>150 lb</td>
<td>2</td>
<td>3</td>
<td>2</td>
</tr>
</tbody>
</table>

For SI units, 1 gpm = 3.8 L/min; 1 gal = 3.8 L; 1 lb = 0.45 kg.

NR: Not required.

A minimum of two 1½ in. (38 mm) hydrant outlets should be provided at each monitor riser.

This can be provided by onshore mobile equipment.

One hose reel at each berth should have foam capability.

The proximity of adjacent berths can reduce total required.

Under-dock systems are optional. Add water for under-dock system (0.16 × area).

Under-dock systems are optional. Add foam for under-dock system (0.16 × 0.3 × 30 × area). [30: Table A.29.3.28]

Revisions Dependent on NFPA 30 CC Meeting (Oct. 31)

Figure 66.16.4.1(a) Fire Protection Criteria Decision Tree for Miscible and Nonmiscible Flammable and Combustible Liquids in Metal Containers. [30: Figure 16.4.1(a)]

66.16.5.1 General

Subsections 66.16.5.2.1 through 66.16.5.2.12 and their related tables, Table 66.16.5.2.1 through Table 66.16.5.2.12 shall be used to determine the protection criteria and storage arrangement for the applicable liquid class, container type, and storage configuration, as described in 66.16.5.2.1 through 66.16.5.2.12 and subject to the provisions of 66.16.5.1. [30:16.5.1]

66.16.5.1.1

Table 66.16.5.2.1 through Table 66.16.5.2.12 shall apply only to stable liquids. [30:16.5.1.1]

66.16.5.1.1

The protection criteria in Table 66.16.5.2.1 through Table 66.16.5.2.12 shall only be used with ceilings having a pitch of 2 in 12 or less. [30:16.5.1.1]

66.16.5.1.11

The “Fire Test Ref.” number given for each entry in Table 66.16.5.2.1 through Table 66.16.5.2.12 shall be used to identify in Section D.2 or D.3 of NFPA 30 the
information on the fire tests on which the protection criteria for that entry are based. [30:16.5.1.11]

16.5.2.13
Table 16.5.2.13 shall apply to the following:
1. Automatic sprinkler protection or foam-water sprinkler protection
2. Single- and double-row rack storage
3. Class II and Class III nonmiscible and Class II and Class III miscible liquids
4. Relieving-style metal containers

Table 16.5.2.13 Design Criteria for Sprinkler Protection or Foam-Water Sprinkler Protection of Single- and Double-Row Rack Storage of Class II and Class III Liquids in Relieving-Style Metal Containers

<table>
<thead>
<tr>
<th>Capacity (gal)</th>
<th>Maximum Storage Height (ft)</th>
<th>Maximum Ceiling Height (ft)</th>
<th>Sprinkler Protection</th>
<th>Notes</th>
<th>Fire Test Ref.</th>
</tr>
</thead>
<tbody>
<tr>
<td>&gt;5 and ≤60</td>
<td>Unlimited</td>
<td>Unlimited</td>
<td>See 16.6.4, Fire Protection System Design Scheme “E”</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>See 16.6.4, Fire Protection System Design Scheme “E”</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

For SI units, 1 gal = 3.8 L, 1 ft = 0.3 m.

Notes:
(1) Minimum aisle width in all cases is 6 ft (1.8 m).
(2) Maximum rack depth in all cases is 9 ft (2.7 m).

16.6.4 Fire Protection System Design Scheme “E”

16.6.4.1
Sprinklers and horizontal barriers shall be installed in accordance with Figure 16.6.4.1(a) or Figure 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. All liquid storage shall be located beneath a barrier.
Figure 16.6.4.1(a) Single-Row Rack Sprinkler Layout for Design Scheme "E."
Figure 16.6.4.1(b) Double-Row Rack Sprinkler Layout for Design Scheme "E."

Notes: (1) For SI units, 1 in. = 25 mm; 1 ft = 0.3 m.
(2) Denotes K-25-2 extended coverage pendant CMA storage sprinkler

16.6.4.2
Vertical baffles shall not be installed between in-rack sprinklers.

16.6.4.3

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 and shall be listed as extended coverage control mode density/area storage sprinklers.
2. In-rack sprinklers shall be positioned in a transverse flue below each barrier level.
3. In-rack sprinklers shall not be positioned within 3.5 ft (1 m) of a rack upright.
4. The minimum in-rack sprinkler discharge pressure shall not be less than a gauge pressure of 30 psi (207 kPa).
5. Where one level of in-rack sprinklers is installed, the design shall include the 3 most hydraulically remote sprinklers on a single line.
6. Where two levels of in-rack sprinklers are installed, the design shall include the 3 most hydraulically remote sprinklers on a single line, and the 2 most hydraulically remote sprinklers on the next adjacent level.
7. Where three or more levels of in-rack sprinklers are installed, the design shall include the 3 most hydraulically remote sprinklers on a single line, and the 2 most hydraulically remote sprinklers on the next two adjacent levels.
8. 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.

16.6.4.4

If there are adjacent bays of in-rack arrays that are not dedicated to storage of liquids, the barrier and in-rack sprinkler protection shall be extended at least 6 ft (1.8 m) beyond the area devoted to liquid storage.

16.6.4.5

Ceiling sprinkler demand shall not be included in the hydraulic calculations for in-rack sprinklers.

16.6.4.6

Water demand at point of supply shall be calculated separately for in-rack and ceiling sprinklers and shall be based on the greater demand.

16.6.4.7

Ceiling sprinklers shall meet the following requirements:
Ceiling sprinkler protection shall be designed to protect the surrounding occupancy.

Any sprinkler type shall be acceptable.

If standard spray sprinklers are used, they shall be capable of providing not less than 0.30 gpm/ft² (8 mm/min over 270 m²) when supplied with water. Design area can be reduced to 2000 ft² when using a preprimed foam-water system installed in accordance with NFPA 16 and maintained in accordance with NFPA 25.

If the 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.

A 500 gpm (1900 L/min) hose stream allowance shall be provided.

In-Rack Sprinkler Layouts for Table 66.16.5.2.8.

Where indicated in Table 66.16.5.2.8, in-rack sprinklers shall be installed as follows:

1. Where Layout 7 is required, in-rack sprinklers shall be installed in accordance with Figure 66.16.6.4(a).

2. Where Layout 8 is required, in-rack sprinklers shall be installed in accordance with Figure 66.16.6.4(b) or Figure 66.16.6.4(c).

3. Where Layout 9 is required, in-rack sprinklers shall be installed in accordance with Figure 66.16.6.4(d), or Figure 66.16.6.4(e), whichever is applicable.

Figure 66.16.6.4(a) Double-Row Rack Sprinkler Layout G. [30: Figure 16.6.4(a) 16.6.5(a)]

Figure 66.16.6.4(b) Double-Row Rack Sprinkler Layout I — Option #1. [30: Figure 16.6.4(b) 16.6.5(b)]

Figure 66.16.6.4(c) Double-Row Rack Sprinkler Layout I — Option #2. [30: Figure 16.6.4(c) 16.6.5(c)]

Figure 66.16.6.4(d) Double-Row Rack Sprinkler Layout H — Option #1. [30: Figure 16.6.4(d) 16.6.5(d)]

Figure 66.16.6.4(e) Double-Row Rack Sprinkler Layout H — Option #2. [30: Figure 16.6.4(e) 16.6.5(e)]
Nonmetallic cooking oil storage tanks shall be listed in accordance with UL 2152, Outline of Investigation for Special Purpose Nonmetallic Containers and Tanks for Specific Combustible or Noncombustible Liquids, and shall not exceed 200 gal (757 L) per tank, meet the following requirements:

1. Tanks shall be listed for use with cooking oil, unless otherwise approved.
2. Tanks shall not exceed 200 gal (757 L) per tank.

[30:19.7.2.2.2]
**Second Revision No. 50-NFPA 1-2016 [ Global Comment ]**


### Supplemental Information

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<th>Description</th>
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<td>Extract_update_NFPA_101_Annex_Final.docx</td>
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### Submitter Information Verification

- **Submitter Full Name:** Kristin Bigda
- **Organization:** National Fire Protection Assoc
- **Street Address:**
- **City:**
- **State:**
- **Zip:**
- **Submittal Date:** Wed Oct 12 12:14:34 EDT 2016

### Committee Statement

- **Committee Statement:** Extract update.
- **Response Message:**

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National Fire Protection Association Report

http://submittals.nfpa.org/TerraViewWeb/ContentFetcher?commentPara...
3.3.103* Exit.
That portion of a means of egress that is separated from all other spaces of the building or structure by construction, location, or equipment as required to provide a protected way of travel to the exit discharge. [101, 2018]

3.3.129 Flame Spread Index.
A comparative measure, expressed as a dimensionless number, derived from visual measurements of the spread of flame versus time for a material tested in accordance with ASTM E84, Standard Test Method for Surface Burning Characteristics of Building Materials, or ANSI/UL 723, Standard for Test for Surface Burning Characteristics of Building Materials. [101, 2018]

3.3.185.1* Ambulatory Health Care Occupancy.
An occupancy used to provide services or treatment simultaneously to four or more patients that provides, on an outpatient basis, one or more of the following: (1) treatment for patients that renders the patients incapable of taking action for self-preservation under emergency conditions without the assistance of others; (2) anesthesia that renders the patients incapable of taking action for self-preservation under emergency conditions without the assistance of others; (3) emergency or urgent care treatment for patients who, due to the nature of their injury or illness, are incapable of taking action for self-preservation under emergency conditions without the assistance of others [101, 2018]

3.3.185.1.1 Class A Mercantile Occupancy.
All mercantile occupancies having an aggregate gross area of more than 30,000 ft² (2800 m²) or occupying more than three stories for sales purposes. [101, 2018] [101:37.1.2.2.1(1)]

3.3.185.1.2 Class B Mercantile Occupancy.
All mercantile occupancies of more than 3000 ft² (280 m²), but not more than 30,000 ft² (2800 m²), aggregate gross area and occupying not more than three stories for sales purposes. Class B also includes all mercantile occupancies of not more than 3000 ft² (280 m²) gross area and occupying two or three stories for sales purposes. [101, 2018] [101:37.1.2.2.1(2)(a), 37.1.2.2.1(2)(b)]

3.3.185.1.3 Class C Mercantile Occupancy.
All mercantile occupancies of not more than 3000 ft² (280 m²) gross area and used for sales purposes occupying one story only excluding mezzanines. [101, 2018] [101:37.1.2.2.1(3)]

6.1.8.1.1* Definition — One- and Two-Family Dwelling Unit.
A building that contains not more than two dwelling units, each dwelling unit occupied by members of a single family with independent cooking and bathroom facilities, not more than three outsiders, if any, accommodated in rented rooms. [101:6.1.8.1.1]
6.1.14.2.3 Separated Occupancy.
A multiple occupancy where the occupancies are separated by fire barriers—resistance–rated assemblies. [101:6.1.14.2.3]

6.1.14.4.1 Where separated occupancies are provided, each part of the building comprising a distinct occupancy, as described in this chapter, shall be completely separated from other occupancies by fire barriers—resistance–rated assemblies as specified in 6.1.14.4.2, 6.1.14.4.3, and Table 6.1.14.4.1(a) and Table 6.1.14.4.1(b), unless separation is provided by approved existing separations or as otherwise permitted by 6.1.14.4.6. [101:6.1.14.4.1]

6.1.14.4.2 Occupancy separation fire barriers separations shall be classified as 3-hour fire resistance–rated, 2-hour fire resistance–rated, or 1-hour fire resistance–rated and shall meet the requirements of Chapter 8 of NFPA 101. [101:6.1.14.4.2]

6.1.14.4.3 The fire barrier minimum fire resistance rating specified in Table 6.1.14.4.1(a) and Table 6.1.14.4.1(b) shall be permitted to be reduced by 1 hour, but in no case shall it be reduced to less than 1 hour, where the building is protected throughout by an approved automatic sprinkler system in accordance with NFPA 13 and supervised in accordance with 13.3.1.8, unless prohibited by the double-dagger footnote entries in the tables. [101:6.1.14.4.3]

6.1.14.4.4 Occupancy separation fire barriers separations shall be vertical, horizontal, or both or, when necessary, of such other form as required to provide complete separation between occupancy divisions in the building. [101:6.1.14.4.4]

10.8.2.1* Emergency action plans shall include the following:

1. Procedures for reporting of emergencies
2. Occitan and staff response to emergencies
3. *Evacuation, relocation and shelter-in-place procedures appropriate to the building, its occupancy, emergencies, and hazards
4. Appropriateness of the use of elevators
5. Design and conduct of fire drills
6. Type and coverage of building fire protection systems
7. Other items required by the AHJ

[101:4.8.2.1]
10.11.3.1.8
The signage shall be in a position that is visible from within the stair enclosure when the door is in the open or closed position. [101:7.2.2.5.4.1(H)]

10.11.3.1.10
The floor level designation shall also be tactile in accordance with ICC/ANSI A117.1, American National Standard for Accessible and Usable Buildings and Facilities. [101:7.2.2.5.4.1(J)]

10.11.3.2
Wherever an enclosed stair requires travel in an upward direction to reach the level of exit discharge, special signs with directional indicators showing the direction to the level of exit discharge shall be provided at each floor level landing from which upward direction of travel is required, unless otherwise provided in 10.11.3.2.1 and 10.11.3.2.2, and both of the following also shall apply:

2. Such signage shall be visible when the door leaf is in the open or closed position. [101:7.2.2.5.4.2]

10.14.3.1 General. Where a life safety evaluation is required by other provisions of the Code, it shall comply with all of the following:
1. The life safety evaluation shall be performed by persons acceptable to the AHJ.
2. The life safety evaluation shall include a written assessment of safety measures for conditions listed in 10.14.3.2 and of the building systems and facility management in accordance with 10.14.3.3.
3. The life safety evaluation shall be approved annually by the AHJ and shall be updated for special or unusual conditions in accordance with the provisions of 13.4.1 of NFPA 101 for existing assembly occupancies. [101:12.4.1.1]

10.14.3.2 Conditions to be Assessed.
Life safety evaluations shall include an assessment of all of the following conditions and related appropriate safety measures:

1. Nature of the events and the participants and attendees
2. Access and egress movement, including crowd density problems
3. Medical emergencies
4. Fire hazards
5. Permanent and temporary structural systems
6. Severe weather conditions
7. Earthquakes
8. Civil or other disturbances
9. Hazardous materials incidents within and near the facility
10. Relationships among facility management, event participants, emergency response agencies, and others having a role in the events accommodated in the facility

10.14.3.3* Building Systems and Facility Management Assessments.
Life safety evaluations shall include assessments of both building systems and facility management upon which reliance is placed for the safety of facility occupants, and such assessments shall consider scenarios appropriate to the facility. [101:12.4.1.3]

10.14.3.3.1 Building Systems.
Prior to issuance of the building permit, the design team shall provide the AHJ with building systems documentation in accordance with 10.14.3.4. [101:12.4.1.3.1]

10.14.3.3.2 Facility Management.
Prior to issuance of the certificate of occupancy, the facility management shall provide the AHJ with facility management documentation in accordance with 10.14.3.5. [101:12.4.1.3.2]

10.14.3.3.3 Life Safety Evaluation.
10.14.3.3.3.1 Prior to issuance of the building permit, the persons performing the life safety evaluation shall confirm that the building systems provide safety measures. [101:12.4.1.3.3.1]

10.14.3.3.3.2 Prior to issuance of the certificate of occupancy, the persons performing the life safety evaluation owner shall confirm that the facility management and operational plans provide appropriate safety measures. [101:12.4.1.3.3.2]

10.14.3.3.3.3 The AHJ shall determine the acceptable persons performing the life safety evaluation in a timely manner to enable the design team and facility management to resolve concerns to the satisfaction of the persons performing the life safety evaluation prior to their submission shall be performed by persons acceptable to the authority having jurisdiction. [101:12.4.1.3.3.3]

10.14.3.4.2 Life Safety Narrative.
A life safety narrative shall be provided describing the following, as applicable:

1. Building occupancy, construction type, and intended uses and events
2. Building area and population capacity of the proposed facility
3. Principal fire and life safety features/strategies for the building, including the following, as applicable:
   1. Egress
   2. Access control
   3. Fire barriers, smoke barriers, and smoke partitions
   4. Fire suppression systems
1. Sprinkler protection
2. Smoke control and protection
3. Fire detection and alarm - visual and audible
4. PA system
5. Fire department access
6. Provisions for patrons with disabilities
7. Fire/Emergency emergency command center
8. Emergency elevator operation
9. Emergency power and lighting

10. Exterior construction design parameters used/applied [101: 12.4.1.4.2]

10.14.3.4.3 Life Safety Floor Plans.

Life safety floor plans of each level shall be provided, as applicable, with the following:

1. Occupant load, exit location, egress exit capacity, main entrance/exit/entry, horizontal exits, travel distance, and exit discharge
2. Fire barriers, smoke barriers, and smoke partitions
3. Areas of smoke protected assembly occupancy
4. Separate smoke protected areas or zones if applicable
5. Areas of other occupancy type and separations if required
6. Unprotected vertical openings, including atriums, communicating spaces, and convenience openings
7. Event plans for each anticipated type of event depicting the following:
   1. Seating configuration
   2. Exhibit booth layout
   3. Stage location
   4. Occupant load, egress exit capacity required, exits provided and travel distance
   5. Any floor or stage use restrictions
   6. Plan and/or section drawing indicating areas where the roof construction is more than 50 feet and limits of sprinkler protection is omitted.
   7. Areas of refuge — interior and exterior [101: 12.4.1.4.3]

10.14.3.4.4 Engineering Analysis and Calculations.

An engineering analysis and calculations shall be provided and shall include the following, as applicable:

1. Smoke protection calculations to substitute the use of smoke-protected assembly seating as follows:
   1. Performance-based design methods approved by the AHJ
   2. Smoke exhaust and fresh air control requirements per NFPA 92
   3. Smoke maintained at a level six ft above the floor of the means of egress
3. Smoke control assumptions, such as fire scenario description, fire size quantification, and smoke development/smoke movement analysis

2.4. Proposed testing protocol for smoke control system and pass/fail criteria

Calculations for performance-based design methods accepted by the AHJ

2. Smoke and fire modeling

4. Timed egress analysis

3.5. Assumed flow rates and travel speeds

2. Sprinkler protection calculations, including an engineering analysis substantiating locations in accordance with [101:12.4.1.4.4] where sprinkler protection would be ineffective due to height and combustible loading

3. Load diagram of rigging/load capacity of gridiron, fly loft, or long-span roof structure used for hanging overhead objects

10.14.3.5.2 Facility Management and Operational Plans.

Facility management and operational plans shall address the following, as applicable:

1. Best practices adopted or recognized
2. Emergency plans
3. Evacuation plans
4. Shelter-in-place plans, including capacities and protection considerations
5. Crowd management training plans
6. Safety plans, which include the following:
   1. Training plans
   2. Safety equipment plans
7. Fire alarm, smoke control system protocol, and testing plans
8. First aid or medical treatment plans, which include the following:
   1. Defined levels of service
   2. Standing orders adopted
   3. Supply and equipment plan
9. Housekeeping plans — biological, medical, hazardous materials cleaning
10. Emergency communication plans, which include the following:
   1. Chain of authority and incident command system employed
   2. Contact information for the following:
      1. Venue personnel
      2. Emergency management and response organizations (e.g., such as fire, police, medical, utility, transportation, and key stakeholders)
   3. Communication systems
   4. Standard announcement for incidents or emergency situations
11. Risk and threat assessment for venue and surrounding area for the following:
   1. Severe weather
   2. Hazardous materials
   3. Terrorism
4. Hostile intruder
12. Operating procedures and protocols for risks, such as the following:
   1. Severe weather preparedness and monitoring plans
   2. Hazardous materials incidence response plans
   3. Terrorism response plans
   4. Hostile intruder response plans
13. First responder response/arrival routes plans
14. Alcohol management plans
15. Food safety plans
16. Rigging and temporary performance structure, which includes the following:
   1. Design and safety review plans
   2. Emergency action plans
17. Chemical and hazardous materials information and data
18. Barrier and wall protection plans for motor sports or similar events

[101:12.4.1.5.2]

10.14.3.5.3 Records.
Records of the facility management plans, including procedures and location, shall be maintained, for the following:

1. Crowd management training
2. Safety training
3. First aid or medical treatment and regulation compliance

[101:12.4.1.5.3]

10.14.3.5.4.3 The life safety building systems document in accordance with 10.14.3.12.4.1.4 shall be permitted to be used, but additionally the life safety building systems reference guide shall include the following, as applicable:

1. Occupant capacity of every space/room
2. Egress flow diagrams, including assumed flow rates, and capacities of all aisles and hallways, including public and non-public/nonpublic areas
3. Capacities of all exterior doors and/or choke points in immediate perimeter areas
4. Limitations or assumptions for ingress control that could be in place during an emergency egress/evacuation, including control gates, queuing barriers, and turnstiles
5. Capacities of immediate perimeter exterior walkways, including assumed flow rates for exterior areas
6. Assumed egress paths for normal conditions — transportation modes
7. Management-level (lay) sequencing charts for alarm and emergency communication systems, the manual, or override options/instructions that include the following:
   1. List of codes or alarm signals
2. Location of manual overrides
3. Description of what exactly happens (sequence of operations) during an alarm, such as exhaust fans operate or doors open
8. Principal fire and life safety features/strategies, such as sprinklers, smoke control, fire alarm notifications, PA system, emergency power, and fire department access.
9. Assumptions when developing occupancy plans for venue floor, open areas, and non-event spaces, such as the following:
   1. Event floor plans/setup diagrams for each typical event/activity
   2. Fire sprinkler and smoke protection capabilities
10. Severe weather shelter areas, locations, structure considerations (limitations), capacities (occupancy and density factor).
11. Command center, which includes the following:
    1. Location (formal or informal)
    2. Structural integrity considerations
    3. Redundant locations and/or capabilities
    4. Jurisdictional rights — assumed and/or applied
12. Locations and capacities of wheelchair and mobility-impaired seating
13. Locations and capacities of "Safe Haven" areas of refuge and other safe areas
14. Rigging or structural load capacities of grids, truss structure, fly lofts, ceilings, floors, ramps, and staging, etc.
15. List of locations of emergency equipment (i.e., such as fire extinguishers, fire hose cabinets, fire hydrants, and AEDs, etc.)
16. Sequencing of electrical service, such as the following:
    1. Emergency generators and charts of all areas illuminated during power outages
    2. Multiple electrical feed capabilities
17. List of mechanical, movable equipment in the facility.
18. Potential hazards in the surrounding neighborhood, including train tracks and propane stations.
19. Assumptions or accommodations considered and used in design.

10.14.3.5.6 Facility management and operational plans shall be reviewed by submitted to the AHJ annually.

10.14.3.5.7 For events and activities at the venue that are outside the normal operating conditions or vary from the normal facility management plans, the following shall apply:

1. Facility management shall perform an event/activity-specific facility management plan for the AHJ to review.
2. The AHJ shall provide guidance as needed, but approval of the AHJ for the specific facility management plan shall occur prior to such event.
11.3.1.1

11.3.1.2
All existing elevators having a travel distance of 25 ft (7620 mm) or more above or below the level that best serves the needs of emergency personnel for fire-fighting or rescue purposes shall conform to the *Fire Fighters’ Emergency Operations* requirements of ASME A17.3, *Safety Code for Existing Elevators and Escalators.*

12.5.2.1
Classification of interior finish materials shall be in accordance with tests made under conditions simulating actual installations, provided that the AHJ is permitted to establish the classification of any material on which classification by a standard test is not available, unless otherwise provided in 12.5.2.2 or 12.5.2.4.

12.5.2.2
The provisions of 12.5.2.1 shall not apply to materials having a total thickness of less than 1/28 in. (0.9 mm) that are applied directly to the surface of walls and ceilings where both of the following conditions are met:

1. The wall or ceiling surface is a noncombustible or limited combustible material.
2. The materials applied meet the requirements of Class A interior wall or ceiling finish when tested in accordance with 12.5.4 using fiber cement board as the substrate material.

12.5.2.3
If a material having a total thickness of less than 1/28 in. (0.9 mm) is applied to a surface that is not noncombustible or not limited combustible, the provisions of 12.5.2.1 shall apply.

12.5.2.4
Approved existing installations of materials applied directly to the surface of walls and ceilings in a total thickness of less than 1/28 in. (0.9 mm) shall be permitted to remain in use, and the provisions of 12.5.2.3 through 12.5.4.7.2 shall not apply.

12.5.2.5
Fixed or movable walls and partitions, paneling, wall pads, and crash pads applied structurally or for decoration, acoustical correction, surface insulation, or other purposes shall be considered interior finish and shall not be considered decorations or furnishings.
Lockers constructed of combustible materials shall be considered interior finish. [101:10.2.1.6]

12.5.3.1 Requirements for interior wall and ceiling finish shall apply as follows:
1. Where specified elsewhere in this Code for specific occupancies in Chapter 20 and NFPA 101 (see Chapter 7 and Chapter 11 through Chapter 43 of NFPA 101)
2. As specified in 12.5.4 through 12.5.7. [101:10.2.2.1]

12.5.3.2 Interior floor finish shall comply with 12.5.8 under any of the following conditions:
1. Where floor finish requirements are specified elsewhere in the Code
2. Where the fire performance of the floor finish cannot be demonstrated to be equivalent to floor finishes with a critical radiant flux of at least 0.1 W/cm² [101:10.2.2.2]

12.5.4 Interior Wall or Ceiling Finish Testing and Classification
Interior wall or ceiling finish that is required elsewhere in this Code to be Class A, Class B, or Class C shall be classified based on test results from ASTM E84, Standard Test Method for Surface Burning Characteristics of Building Materials, or ANSI/UL 723, Standard for Test of Surface Burning Characteristics of Building Materials, except as indicated in 12.5.4.1 or 12.5.4.2. [101:10.2.3]

12.5.4.1 Exposed portions of structural members complying with the requirements for Type IV (2HII) construction in accordance with NFPA 220 or with the building code shall be exempt from testing and classification in accordance with ASTM E84, or ANSI/UL 723. [101:10.2.3.1]

12.5.4.2 Interior wall and ceiling finish tested in accordance with NFPA 286 and meeting the conditions of 12.5.4.7.2 shall be permitted to be used where interior wall and ceiling finish is required to be Class A in accordance with ASTM E84 or ANSI/UL 723. [101:10.2.3.2]

12.5.4.3 For fire retardant coatings, see 12.5.7. [101:10.2.3.3]

12.5.4.4 Products required to be tested in accordance with ASTM E84 or ANSI/UL 723 shall be grouped in the classes described in 12.5.4.4.1 through 12.5.4.4.3 according to their flame spread and smoke development, except as indicated in 12.5.4.4.4. [101:10.2.3.4]

12.5.4.4.1 Class A Interior Wall and Ceiling Finish
Class A interior wall and ceiling finishes shall be those finishes with a flame spread index of 0–25 and a smoke developed index of 0–450 and shall include any material classified at 25 or less on the flame spread index test scale and 450 or less on the smoke developed index test scale. [101:10.2.3.4.1]
12.5.4.4.2 Class B Interior Wall and Ceiling Finish.
Class B interior wall and ceiling finishes shall be those finishes with a flame spread index of 26–75 and a smoke developed index of 0–450 and shall include any material classified at more than 25 but not more than 75 on the flame spread index test scale and 450 or less on the smoke developed index test scale. [101:10.2.3.4.2]

12.5.4.4.3 Class C Interior Wall and Ceiling Finish.
Class C interior wall and ceiling finishes shall be those finishes with a flame spread index of 76–200 and a smoke developed index of 0–450 and shall include any material classified at more than 75 but not more than 200 on the flame spread index test scale and 450 or less on the smoke developed index test scale. [101:10.2.3.4.3]

12.5.4.4.4 Existing interior finish shall be exempt from the smoke developed index criteria of 12.5.4.4.1 through 12.5.4.4.3. [101:10.2.3.4.4]

12.5.4.5 The classification of interior finish specified in 12.5.4.4 shall be that of the basic material used by itself or in combination with other materials. [101:10.2.3.5]

12.5.4.6 Wherever the use of Class C interior wall and ceiling finish is required, Class A or Class B shall be permitted. Where Class B interior wall and ceiling finish is required, Class A shall be permitted. [101:10.2.3.6]

12.5.4.7 Products tested in accordance with NFPA 265 shall comply with the criteria of 12.5.4.7.1. Products tested in accordance with NFPA 286 shall comply with the criteria of 12.5.4.7.2. [101:10.2.3.7]

12.5.4.7.1 The interior finish shall comply with all of the following when tested using method B of the test protocol of NFPA 265:
1. During the 40 kW exposure, flames shall not spread to the ceiling.
2. The flame shall not spread to the outer extremities of the samples on the 8 ft × 12 ft (2440 mm × 3660 mm) walls.
3. Flashover, as described in NFPA 265, shall not occur.
4. For new installations, the total smoke released throughout the test shall not exceed 1000 m2. [101:10.2.3.7.1]

12.5.4.7.2 The interior finish shall comply with all of the following when tested using the test protocol of NFPA 286:
1. During the 40 kW exposure, flames shall not spread to the ceiling.
2. The flame shall not spread to the outer extremity of the sample on any wall or ceiling.
3. Flashover, as described in NFPA 286, shall not occur.
4. The peak heat release rate throughout the test shall not exceed 800 kW.
5. For new installations, the total smoke released throughout the test shall not exceed 1000 m².

12.5.5.1* Textile Wall and Textile Ceiling Materials.
The use of textile materials on walls or ceilings shall comply with one of the following conditions:
1. Textile materials meeting the requirements of Class A when tested in accordance with ASTM E84, Standard Test Method for Surface Burning Characteristics of Building Materials, or ANSI/UL 723, Standard for Test for Surface Burning Characteristics of Building Materials, using the specimen preparation and mounting method of ASTM E2404, Standard Practice for Specimen Preparation and Mounting of Textile, Paper, or Polymeric (Including Vinyl) Wall or Ceiling Coverings and of Facings and Wood Veneers Intended to be Applied on Site Over a Wood Substrate, to Assess Surface Burning Characteristics (see 12.5.4.4), shall be permitted on the walls or ceilings of rooms or areas protected by an approved automatic sprinkler system.
2. Textile materials meeting the requirements of Class A when tested in accordance with ASTM E84 or ANSI/UL 723, using the specimen preparation and mounting method of ASTM E2404 (see 12.5.4.4), shall be permitted on partitions that do not exceed three-quarters of the floor-to-ceiling height or do not exceed 8 ft (2440 mm) in height, whichever is less.
3. Textile materials meeting the requirements of Class A when tested in accordance with ASTM E84 or ANSI/UL 723, using the specimen preparation and mounting method of ASTM E2404 (see 12.5.4.4), shall be permitted to extend not more than 48 in. (1220 mm) above the finished floor on ceiling-height walls and ceiling-height partitions.
4. Previously approved existing installations of textile material meeting the requirements of Class A when tested in accordance with ASTM E84 or ANSI/UL 723 (see 12.5.4.4) shall be permitted to be continued to be used.
5. Textile materials shall be permitted on walls and partitions where tested in accordance with NFPA 265. (See 12.5.4.7.)
6. Textile materials shall be permitted on walls, partitions, and ceilings where tested in accordance with NFPA 286. (See 12.5.4.7.)

12.5.5.2* Expanded Vinyl Wall and Expanded Vinyl Ceiling Materials.
The use of expanded vinyl wall or expanded vinyl ceiling materials shall comply with one of the following conditions:
1. Materials meeting the requirements of Class A when tested in accordance with ASTM E84, Standard Test Method for Surface Burning Characteristics of Building Materials, or ANSI/UL 723, Standard for Test for Surface Burning Characteristics of Building Materials, using the specimen preparation and mounting method of ASTM E2404, Standard Practice for Specimen Preparation and Mounting of Textile, Paper, or Polymeric (Including Vinyl) Wall or Ceiling Coverings and of Facings and Wood Veneers Intended to be Applied on Site Over a Wood Substrate, to Assess Surface Burning Characteristics (see 12.5.4.4), shall be permitted on the walls or ceilings of rooms or areas protected by an approved automatic sprinkler system.
2. Materials meeting the requirements of Class A when tested in accordance with ASTM E84 or ANSI/UL 723, using the specimen preparation and mounting method of ASTM E2404
shall be permitted on partitions that do not exceed three-quarters of the floor-to-ceiling height or do not exceed 8 ft (2440 mm) in height, whichever is less.

3. Materials meeting the requirements of Class A when tested in accordance with ASTM E84 or ANSI/UL 723, using the specimen preparation and mounting method of ASTM E2404 (see 12.5.4.4), shall be permitted to extend not more than 48 in. (1220 mm) above the finished floor on ceiling-height walls and ceiling-height partitions.

4. Previously approved existing installations of materials meeting the requirements for the occupancy involved, when tested in accordance with ASTM E84 or ANSI/UL 723 (see 12.5.4.4), shall be permitted to be continued to be used.

5. Materials shall be permitted on walls and partitions where tested in accordance with NFPA 265. (See 12.5.4.7.)

6. Materials shall be permitted on walls, partitions, and ceilings where tested in accordance with NFPA 286. (See 12.5.4.7.)

12.5.5.3  Cellular or Foamed Plastic.

Cellular or foamed plastic materials shall not be used as interior wall and ceiling finish unless specifically permitted by 12.5.5.3.1 or 12.5.5.3.2. The requirements of 12.5.5.3 through 12.5.5.3.2 shall apply both to exposed foamed plastics and to foamed plastics used in conjunction with a textile or vinyl facing or cover. [101:10.2.4.2]

12.5.5.3.1*

Cellular or foamed plastic materials shall be permitted where subjected to large-scale fire tests that substantiate their combustibility and smoke release characteristics for the use intended under actual fire conditions. [101:10.2.4.3.1]

12.5.5.3.1.1

One of the following fire tests shall be used for assessing the combustibility of cellular or foamed plastic materials as interior finish:

1. NFPA 286 with the acceptance criteria of 12.5.4.7.2.
2. ANSI/UL 1715, Standard for Fire Test of Interior Finish Material (including smoke measurements, with total smoke release not to exceed 1000 m³)
3. ANSI/UL 1040, Standard for Fire Test of Insulated Wall Construction

12.5.5.3.1.2*

The tests shall be performed on a finished foamed plastic assembly related to the actual end-use configuration, including any cover or facing, and at the maximum thickness intended for use. [101:10.2.4.3.1.2]

12.5.5.3.2

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New installations of cellular or foamed plastic materials tested in accordance with ANSI/UL 1040, Standard for Fire Test of Insulated Wall Construction, or ANSI/UL 4880, American National Standard for Evaluating Insulated Wall or Wall and Roof/Ceiling Panels, Plastic Interior-Finish Materials, Plastic Exterior Building Panels, Wall/Ceiling Coating Systems, Interior or Exterior Finish Systems, shall also be tested for smoke release using NFPA 286 with the acceptance criterion of 12.5.4.7.2.\[101:10.2.4.3.1.3\]

12.5.5.3.2 Cellular or foamed plastic shall be permitted for trim not in excess of 10 percent of the specific wall or ceiling area to which it is applied, provided that it is not less than 20 lb/ft\(^2\) (320 kg/m\(^2\)) in density, is limited to 1/2 in. (13 mm) in thickness and 4 in. (100 mm) in width, and complies with the requirements for Class A or Class B interior wall and ceiling finish as described in 12.5.4.4; however, the smoke developed index shall not be limited.\[101:10.2.4.3.2\]

12.5.5.4* Light-Transmitting Plastics. Light-transmitting plastics shall be permitted to be used as interior wall and ceiling finish if approved by the AHJ.\[101:10.2.4.4\]

12.5.5.5 Decorations and Furnishings. Decorations and furnishings that do not meet the definition of interior finish, as defined in 3.3.113.2, shall be regulated by the provisions of Section 12.6.\[101:10.2.4.5\]

12.5.5.6 Metal Ceiling and Wall Panels. Listed factory finished metal ceiling and wall panels meeting the requirements of Class A when tested in accordance with ASTM E84, Standard Test Method for Surface Burning Characteristics of Building Materials, or ANSI/UL 723, Standard for Test for Surface Burning Characteristics of Building Materials (see 12.5.4.4), shall be permitted to be finished with one additional application of paint. Such painted panels shall be permitted for use in areas where Class A interior finishes are required. The total paint thickness shall not exceed 1/28 in. (0.9 mm).\[101:10.2.4.6\]

12.5.5.7 Polypropylene (PP) and High-Density Polyethylene (HDPE). Polypropylene and high density polyethylene materials shall not be permitted as interior wall or ceiling finish unless the material complies with the requirements of 12.5.4.7.2. The tests shall be performed on a finished assembly and on the maximum thickness intended for use.\[101:10.2.4.7\]

12.5.5.8 Site-Fabricated Stretch Systems. For new installations, site-fabricated stretch systems containing all three components described in the definition in Chapter 3 of NFPA 101 shall be tested in the manner intended for use and shall comply with the requirements of 12.5.4 or 12.5.4.2. If the materials are tested in accordance with ASTM E84, Standard Test Method for Surface Burning Characteristics of Building Materials, or ANSI/UL 723, Standard for Test for Surface Burning Characteristics of Building Materials, specimen preparation and mounting shall be in accordance with ASTM E2573, Standard Practice for Specimen Preparation and Mounting of Site-Fabricated Stretch Systems to Assess Surface Burning Characteristics.\[101:10.2.4.8\]

12.5.5.9 Reflective Insulation Materials.
Reflective insulation materials shall be tested in the manner intended for use and shall comply with the requirements of 10.2.3 of NFPA 101. If the materials are tested in accordance with ASTM E84, Standard Test Method for Surface Burning Characteristics of Building Materials, or ANSI/UL 723, Standard Test for Surface Burning Characteristics of Building Materials, specimen preparation and mounting shall be in accordance with ASTM E2599, Standard Practice for Specimen Preparation and Mounting of Reflective Insulation, Radiant Barrier, and Vinyl Stretch Ceiling Materials for Building Applications to Assess Surface Burning Characteristics. [101:10.2.4.9]

12.5.6.1 General.
Interior wall and ceiling trim and incidental finish, other than wall base in accordance with 12.5.6.2 and bulletin boards, posters, and paper in accordance with 12.5.6.3, not in excess of 10 percent of the specific wall and ceiling areas of any room or space to which it is applied shall be permitted to be Class C materials in occupancies where interior wall and ceiling finish of Class A or Class B is required. [101:10.2.5.1]

12.5.6.2 Wall Base.
Interior floor trim material used at the junction of the wall and the floor to provide a functional or decorative border, and not exceeding 6 in. (150 mm) in height, shall meet the requirements for interior wall finish for its location or the requirements for Class II interior floor finish as described in 12.5.8.4 using the test described in 12.5.8.3. If a Class I floor finish is required, the interior floor trim shall be Class I. [101:10.2.5.2]

12.5.6.3 Bulletin boards, posters, and paper attached directly to the wall shall not exceed 20 percent of the aggregate wall area to which they are applied. [101:10.2.5.3.1]

12.5.6.3.2 The provision of 12.5.6.3.1 shall not apply to artwork and teaching materials in sprinklered educational or day-care occupancies in accordance with 20.2.4.4.3 and 20.3.4.2.3.5.3. [101:10.2.5.3.2]

12.5.7.1 The required flame spread or smoke development classification of existing surfaces of walls, partitions, columns, and ceilings shall be permitted to be secured by applying approved fire-retardant coatings to surfaces having higher flame spread ratings than permitted. Such treatments shall be tested, or shall be listed and labeled for application to the material to which they are applied, and shall comply with the requirements of NFPA 703. [101:10.2.6.1]

12.5.7.2 Surfaces of walls, partitions, columns, and ceilings shall be permitted to be finished with factory-applied fire-retardant coated products that have been listed and labeled to demonstrate compliance with the requirements of ASTM E2768, Standard Test Method for Extended Duration Surface Burning Characteristics of Building Materials, on the coated surface. [101:10.2.6.2]
Fire-retardant coatings or factory-applied fire-retardant coated assemblies shall possess the desired degree of permanency and shall be maintained so as to retain the effectiveness of the treatment under the service conditions encountered in actual use. [101:10.2.6.3]

12.5.8.15
Carpet and carpet-like interior floor finishes shall comply with ASTM D2859, Standard Test Method for Ignition Characteristics of Finished Textile Floor Covering Materials. [101:10.2.7.1]

12.5.8.24
Floor coverings, other than carpet for which 12.5.3.2 establishes requirements for fire performance, shall have a minimum critical radiant flux of 0.1 W/cm². [101:10.2.7.2]

12.5.8.34
Interior floor finishes shall be classified in accordance with 12.5.8.4.1, based on test results from NFPA 253 or ASTM E648, Standard Test Method for Critical Radiant Flux of Floor Covering Systems Using a Radiant Heat Energy Source. [101:10.2.7.3]

12.5.8.4
Interior floor finishes shall be grouped in the classes specified in 12.5.8.4.1 and 12.5.8.4.2 in accordance with the critical radiant flux requirements. [101:10.2.7.4]

12.5.8.4.1 Class I Interior Floor Finish.
Class I interior floor finish shall have a critical radiant flux of not less than 0.45 W/cm², as determined by the test described in 12.5.8.3. [101:10.2.7.4.1]

12.5.8.4.2 Class II Interior Floor Finish.
Class II interior floor finish shall have a critical radiant flux of not less than 0.22 W/cm², but less than 0.45 W/cm², as determined by the test described in 12.5.8.3. [101:10.2.7.4.2]

Wherever the use of Class II interior floor finish is required, Class I interior floor finish shall be permitted. [101:10.2.7.5]

12.5.9.1
Other than as required in 12.5.5, where an approved automatic sprinkler system is installed in accordance with Section 13.3, Class C interior wall and ceiling finish materials shall be permitted in any location where Class B is required, and Class B interior wall and ceiling finish materials shall be permitted in any location where Class A is required. [101:10.2.8.1]

12.5.9.2
Where an approved automatic sprinkler system is installed in accordance with Section 13.3, throughout the fire compartment or smoke compartment containing the interior floor finish, Class II interior floor finish shall be permitted in any location where Class I interior floor finish is required, and where Class II is required, the provisions of 12.5.8.2 shall apply. [101:10.2.8.2]
Where required by the applicable provisions of this Code, draperies, curtains, and other similar loosely hanging furnishings and decorations shall meet the flame propagation performance criteria contained in Test Method 1 or Test Method 2, as appropriate, of NFPA 701. [101:10.3.1]

12.6.3.1* Upholstered Furniture.
Newly introduced upholstered furniture, except as otherwise permitted by Chapter 20, shall be resistant to a cigarette ignition (i.e., smoldering) in accordance with one of the following:
1. The components of the upholstered furniture shall meet the requirements for Class I when tested in accordance with NFPA 260.
2. Mocked-up composites of the upholstered furniture shall have a char length not exceeding 1/2 in. (38 mm) when tested in accordance with NFPA 261. [101:10.3.2.1]

12.6.3.2* Mattresses.
Newly introduced mattresses, except as otherwise permitted by Chapter 20, shall have a char length not exceeding 2 in. (51 mm) when tested in accordance with 16 CFR 1632, “Standard for the Flammability of Mattresses and Mattress Pads” (FF 4-72). [101:10.3.2.2]

12.6.3.2.1* Where required by the applicable provisions of this Code, upholstered furniture, unless the furniture is located in a building protected throughout by an approved automatic sprinkler system, shall have limited rates of heat release when tested in accordance with ASTM E1537, Standard Test Method for Fire Testing of Upholstered Furniture, as follows:
1. The peak rate of heat release for the single upholstered furniture item shall not exceed 80 kW.
2. The total heat released by the single upholstered furniture item during the first 10 minutes of the test shall not exceed 25 MJ. [101:10.3.3]

12.6.3.2.2* Where required by the applicable provisions of this Code, mattresses, unless the mattress is located in a building protected throughout by an approved automatic sprinkler system, shall have limited rates of heat release when tested in accordance with ASTM E1590, Standard Test Method for Fire Testing of Mattresses, as follows:
1. The peak rate of heat release for the mattress shall not exceed 100 kW.
2. The total heat released by the mattress during the first 10 minutes of the test shall not exceed 25 MJ. [101:10.3.4]

12.6.4 Furnishings or decorations of an explosive or highly flammable character shall not be used. [101:10.3.5]

12.6.5 Fire-retardant coatings shall be maintained to retain the effectiveness of the treatment under service conditions encountered in actual use. [101:10.3.6]
12.6.7.1 Combustible Lockers.
Where lockers constructed of combustible materials other than wood are used, the lockers shall be considered interior finish and shall comply with Section 12.5, except as permitted by 12.6.7.2. [101:10.3.8.1]

12.6.7.2 Wood Lockers.
Lockers constructed entirely of wood and of noncombustible materials shall be permitted to be used in any location where interior finish materials are required to meet a Class C classification in accordance with 12.5.4. [101:10.3.8.2]

Where required by the applicable provisions of this Code, furnishings and contents made with foamed plastic materials that are unprotected from ignition shall have a heat release rate not exceeding 100 kW when tested in accordance with UL 1975, Standard for Fire Tests for Foamed Plastics Used for Decorative Purposes, or when tested in accordance with NFPA 289 using the 20 kW ignition source. [101:10.3.7]

12.5.2 Classification of interior finish materials shall be in accordance with tests made under conditions simulating actual installations, provided that the authority having jurisdiction is permitted to establish the classification of any material for which classification by a standard test is not available. [101:10.2.1.1]

12.5.2.2 Fixed or movable walls and partitions, paneling, wall pads, and crash pads applied structurally or for decoration, acoustical correction, surface insulation, or other purposes shall be considered interior finish and shall not be considered decorations or furnishings. [101:10.2.1.2]

12.5.2.3 Lockers shall be considered interior finish. [101:10.2.1.3]

12.5.2.4 Washroom water closet partitions shall be considered interior finish. [101:10.2.1.4]

12.5.2.5 Fire-retardant coatings shall be in accordance with 12.5.7. [101:10.2.1.5]

12.5.3 Use of Interior Finishes. [101:10.2.2]

12.5.3.1 Requirements for interior wall and ceiling finish shall apply as follows:

1. Where specified elsewhere in this Code for specific occupancies (see Chapter 7 and Chapters 11 through 43 of NFPA 101)
2. As specified in 12.5.4 through 12.5.7.

[101:10.2.2.1]

12.5.3.2* Interior floor finish shall comply with 12.5.8 under any of the following conditions:

1. Where floor finish requirements are specified elsewhere in the Code
2. Where the fire performance of the floor finish cannot be demonstrated to be equivalent to floor finishes with a critical radiant flux of at least 0.1 W/cm²

[101:10.2.2.2]

12.5.4* Interior Wall or Ceiling Finish Testing and Classification.

Where interior wall or ceiling finish is required elsewhere in this Code to be classified for fire performance and smoke development, it shall be classified in accordance with 12.5.4.1 or 12.5.4.3, except as indicated in sections 12.5.5. [101:10.2.3]

12.5.4.1 Interior Wall and Ceiling Finish Materials Tested in Accordance with NFPA 286.

[101:10.2.3.1]

12.5.4.1.1 Interior wall and ceiling finish materials shall be classified in accordance with NFPA 286 and comply with 12.5.4.2. [101:10.2.3.1.1]

12.5.4.1.2 Materials tested in accordance with 12.5.4.1.1 and complying with 12.5.4.2 shall be considered also to comply with the requirements of a Class A, Class B, or Class C in accordance with 12.5.4.3. [101:10.2.3.1.2]

12.5.4.2 Acceptance Criteria for NFPA 286.

The interior finish shall comply with the following:

1. During the 40 kW exposure, flames shall not spread to the ceiling.
2. The flame shall not spread to the outer extremity of the sample on any wall or ceiling.
3. Flashover, as described in NFPA 286, shall not occur.
4. The peak heat release rate throughout the test shall not exceed 800 kW.
5. For new installations, the total smoke released throughout the test shall not exceed 1000 m².

[101:10.2.3.2]
12.5.4.3* Interior Wall and Ceiling Finish Materials Tested in Accordance with ASTM E84 or ANSI/UL 723.

Interior wall and ceiling finish materials shall be classified in accordance with ASTM E84, Standard Test Method for Surface Burning Characteristics of Building Materials, or ANSI/UL 723, Standard Test Method for Surface Burning Characteristics of Building Materials, except as indicated in 12.5.4.4 and 12.5.4.5, and shall be grouped in the following classes in accordance with their flame spread and smoke developed indexes.

Class A: Flame spread index 0–25; smoke developed index 0–450.
Class B: Flame spread index 26–75; smoke developed index 0–450.
Class C: Flame spread index 76–200; smoke developed index 0–450.

12.5.4.3.1 Existing interior finish shall be exempt from the smoke developed index criteria of 12.5.4.3.

12.5.4.3.2 The classification of interior finish specified in 12.5.4.3 shall be that of the basic material used by itself or in combination with other materials.

12.5.4.3.3 Wherever the use of Class C interior wall and ceiling finish is required, Class A or Class B shall be permitted, and where Class B interior wall and ceiling finish is required, Class A shall be permitted.

12.5.4.4 Materials complying with the requirements of 12.5.4.1 shall not be required to be tested in accordance with 12.5.4.3.

12.5.4.5 Materials described in 12.5.5 shall be tested as described in the corresponding sections.

12.5.5* Interior Wall and Ceiling Finish Materials with Special Requirements.

The materials indicated in 12.5.5.1 through 12.5.5.16 shall be tested as indicated in the corresponding sections.

12.5.5.1 Thickness Exemption.
The provisions of 12.5.4 shall not apply to materials having a total thickness of less than 1⁄28 in. (0.9 mm) that are applied directly to the surface of walls and ceilings where both of the following conditions are met:

1. The wall or ceiling surface is a noncombustible or limited combustible material.
2. The materials applied meet the requirements of Class A interior wall or ceiling finish when tested in accordance with 12.5.4, using fiber cement board as the substrate material.

[101:10.2.4.1]

12.5.5.1.1 If a material having a total thickness of less than 1⁄28 in. (0.9 mm) is applied to a surface that is not noncombustible or not limited-combustible, the provisions of 12.5.4 shall apply. [101:10.2.4.1.1]

12.5.5.1.2 Approved existing installations of materials applied directly to the surface of walls and ceilings in a total thickness of less than 1⁄28 in. (0.9 mm) shall be permitted to remain in use, and the provisions of 12.5.4 shall not apply. [101:10.2.4.1.2]

12.5.5.2* Exposed Portions of Structural Members.
In other than new interior exit stairways, new interior exit ramps, and new exit passageways, exposed portions of structural members complying with the requirements for Type IV (2HH) construction in accordance with NFPA 220 or with the building code shall be exempt from testing and classification in accordance with 12.5.4. [101:10.2.4.2]

12.5.5.3 Cellular or Foamed Plastic.

12.5.5.3.1 Cellular or foamed plastic materials shall not be used as interior wall and ceiling finish unless specifically permitted by 12.5.5.3.2 or 12.5.5.3.4. [101:10.2.4.3.1]

12.5.5.3.2 The requirements of 12.5.5.3 shall apply both to exposed foamed plastics and to foamed plastics used in conjunction with a textile or vinyl facing or cover. [101:10.2.4.3.2]

12.5.5.3.3* Cellular or foamed plastic materials shall be permitted where subjected to large-scale fire tests that substantiate their combustibility and smoke release characteristics for the use intended under actual fire conditions. [101:10.2.4.3.3]

12.5.5.3.3.1
One of the following fire tests shall be used for assessing the combustibility of cellular or foamed plastic materials as interior finish:

1. NFPA 286, *Standard Methods of Fire Tests for Evaluating Contribution of Wall and Ceiling Interior Finish to Room Fire Growth*, with the acceptance criteria of 12.5.4.2
2. ANSI/UL 1715, *Standard for Fire Test of Interior Finish Material* (including smoke measurements, with total smoke release not to exceed 1000 m²)
3. ANSI/UL 1040, *Standard for Fire Test of Insulated Wall Construction*
4. ANSI/FM Approval 4880, *Approval Standard for Class 1 Rating of Insulated Wall or Wall and Roof/Ceiling Panels, Interior Finish Materials or Coatings, and Exterior Wall Systems*

101:10.2.4.3.1

12.5.3.3.2*
The tests shall be performed on a finished foamed plastic assembly related to the actual end-use configuration, including any cover or facing, and at the maximum thickness intended for use. 101:10.2.4.3.2

12.5.3.4
Cellular or foamed plastic shall be permitted for trim not in excess of 10 percent of the specific wall or ceiling area to which it is applied, provided that it is not less than 20 lb/ft³ (320 kg/m³) in density, is limited to 1/2 in. (13 mm) in thickness and 4 in. (100 mm) in width, and complies with the requirements for Class A or Class B interior wall and ceiling finish as described in 12.5.4.3; however, the smoke developed index shall not be limited. 101:10.2.4.3.4

12.5.4* Textile Wall Coverings

Where used as interior wall finish materials, textile materials shall be tested in the manner intended for use, using the product mounting system, including adhesive, and shall comply with the requirements of either, 12.5.4.1, 12.5.5.4.1, or 12.5.5.4.3. 101:10.2.4.4

12.5.4.1*
Products tested in accordance with NFPA 265 shall comply with the criteria of 12.5.5.4.2. 101:10.2.4.4.1

12.5.5.4.2*
The interior finish shall comply with all of the following when tested using method B of the test protocol of NFPA 265:

1. During the 40 kW exposure, flames shall not spread to the ceiling.
2. The flame shall not spread to the outer extremities of the samples on the 8 ft × 12 ft (2440 mm × 3660 mm) walls.
3. Flashover, as described in NFPA 265, shall not occur.
4. For new installations, the total smoke released throughout the test shall not exceed 1000 m².

[101:10.2.4.4.2]

12.5.5.4.3 Textile materials meeting the requirements of Class A when tested in accordance with ASTM E84, Standard Test Method for Surface Burning Characteristics of Building Materials, or ANSI/UL 723, Standard Test Method for Surface Burning Characteristics of Building Materials, using the specimen preparation and mounting method of ASTM E2404, Standard Practice for Specimen Preparation and Mounting of Textile, Paper or Polymeric (Including Vinyl) and Wood Wall or Ceiling Coverings, Facings and Veneers, to Assess Surface Burning Characteristics, shall be permitted as follows:

1. On the walls of rooms or areas protected by an approved automatic sprinkler system.
2. On partitions that do not exceed three-quarters of the floor-to-ceiling height or do not exceed 8 ft (2440 mm) in height, whichever is less.
3. On the lower 48 in. (1220 mm) above the finished floor on ceiling-height walls and ceiling-height partitions.
4. Previously approved existing installations of textile material meeting the requirements of Class A when tested in accordance with ASTM E84, Standard Test Method for Surface Burning Characteristics of Building Materials or ANSI/UL 723, Standard Test Method for Surface Burning Characteristics of Building Materials, shall be permitted to be continued to be used.

[101:10.2.4.4.3]

12.5.5.5* Expanded Vinyl Wall Coverings. Where used as interior wall finish materials, expanded vinyl wall coverings shall be tested in the manner intended for use, using the product mounting system, including adhesive, and shall comply with the requirements of either 12.5.4.1, 12.5.5.4.1, or 12.5.5.4.3. [101:10.2.4.5]

12.5.5.6 Textile Ceiling Coverings. Where used as interior ceiling finish materials, textile materials shall be tested in the manner intended for use, using the product mounting system, including adhesive, and shall meet one of the following:

1. Comply with the requirements of 12.5.4.1
Specimen Preparation and Mounting of Textile, Paper or Polymeric (Including Vinyl) and Wood Wall or Ceiling Coverings, Facings and Veneers, to Assess Surface Burning Characteristics, and used on the ceilings of rooms or areas protected by an approved automatic sprinkler system

[101:1.2.4.6]

12.5.5.7 Expanded Vinyl Ceiling Coverings. Where used as interior ceiling finish materials, expanded vinyl materials shall be tested in the manner intended for use, using the product mounting system, including adhesive, and shall meet one of the following:

1. Comply with the requirements of 12.5.4.1
2. Meet the requirements of Class A when tested in accordance with ASTM E84, Standard Test Method for Surface Burning Characteristics of Building Materials or ANSI/UL 723, Standard Test Method for Surface Burning Characteristics of Building Materials, using the specimen preparation and mounting method of ASTM E2404, Standard Practice for Specimen Preparation and Mounting of Textile, Paper or Polymeric (Including Vinyl) and Wood Wall or Ceiling Coverings, Facings and Veneers, to Assess Surface Burning Characteristics, and used on the ceilings of rooms or areas protected by an approved automatic sprinkler system

[101:1.2.4.7]

12.5.5.8 Lockers.

12.5.5.8.1 Combustible Lockers. Where lockers constructed of combustible materials other than wood are used, the lockers shall be considered interior finish and shall comply with 12.5.4, except as permitted by 12.5.5.8.2.

[101:1.2.4.8.1]

12.5.5.8.2 Wood Lockers. Lockers constructed entirely of wood and of noncombustible materials shall be permitted to be used in any location where interior finish materials are required to meet a Class C classification in accordance with 12.5.4. [101:1.2.4.8.2]

12.5.5.9 Solid Thermoplastics.

12.5.5.9.1 Solid thermoplastics including, but not limited to, polypropylene, high-density polyethylene (HDPE), solid polycarbonate, solid polystyrene, and solid acrylic materials that melt and drip
when exposed to flame shall not be permitted as interior wall or ceiling finish unless the material complies with the requirements of 12.5.4.1. [101:10.2.4.9.1]

12.5.5.9.2
The tests shall be performed on a finished assembly and on the maximum thickness intended for use. [101:10.2.4.9.2]

12.5.5.10 Site-Fabricated Stretch Systems.

12.5.5.10.1
For new installations, site-fabricated stretch systems containing all three components described in the definition in Chapter 3 shall be tested in the manner intended for use and shall comply with the requirements of 12.5.4.1 or 12.6.7. [101:10.2.4.10.1]

12.5.5.10.2
If the materials are tested in accordance with ASTM E84, Standard Test Method for Surface Burning Characteristics of Building Materials, or ANSI/UL 723, Standard for Test for Surface Burning Characteristics of Building Materials, specimen preparation and mounting shall be in accordance with ASTM E2573, Standard Practice for Specimen Preparation and Mounting of Site-Fabricated Stretch Systems to Assess Surface Burning Characteristics. [101:10.2.4.10.2]

12.5.5.11 Reflective Insulation Materials.

12.5.5.11.1
Reflective insulation materials shall be tested in the manner intended for use and shall comply with the requirements of 12.5.4 or 12.5.4.3. [101:10.2.4.11.1]

12.5.5.11.2
If the materials are tested in accordance with ASTM E84, Standard Test Method for Surface Burning Characteristics of Building Materials, or ANSI/UL 723, specimen preparation and mounting shall be in accordance with ASTM E2599, Standard Practice for Specimen Preparation and Mounting of Reflective Insulation, Radiant Barrier, and Vinyl Stretch Ceiling Materials for Building Applications to Assess Surface Burning Characteristics. [101:10.2.4.11.2]

12.5.5.12 Metal Ceiling and Wall Panels.

12.5.5.12.1
Listed factory finished metal ceiling and wall panels meeting the requirements of Class A in accordance with 12.5.4, shall be permitted to be finished with one additional application of paint. [101:10.2.4.12.1]
Such painted panels shall be permitted for use in areas where Class A interior finishes are required. The total paint thickness shall not exceed 1/28 in. (0.9 mm). [101:10.2.4.12.2]

12.5.5.13  Laminated Products Factory Produced with a Wood Substrate.

12.5.5.13.1 Laminated products factory produced with a wood substrate shall be tested in the manner intended for use and shall comply with the requirements of 12.5.4.1 or 12.5.4.3. [101:10.2.4.13.1]

12.5.5.13.2 If the materials are tested in accordance with ASTM E84, Standard Test Method for Surface Burning Characteristics of Building Materials, or ANSI/UL 723, Standard for Test for Surface Burning Characteristics of Building Materials, specimen preparation and mounting shall be in accordance with ASTM E2579, Standard Practice for Specimen Preparation and Mounting of Wood Products to Assess Surface Burning Characteristics, using the product-mounting system, including adhesive, of actual use. [101:10.2.4.13.2]

12.5.5.14  Facings or Wood Veneers Intended to be Applied on Site over a Wood Substrate.

12.5.5.14.1 Facings or veneers intended to be applied on site over a wood substrate shall be tested in the manner intended for use and shall comply with the requirements of 12.5.4.1 or 12.5.4.3. [101:10.2.4.14.1]

12.5.5.14.2 If the materials are tested in accordance with NFPA 286 they shall use the product-mounting system, including adhesive, described in Section 5.8.9 of NFPA 286. [101:10.2.4.14.2]

12.5.5.14.3 If the materials are tested in accordance with ASTM E84, Standard Test Method for Surface Burning Characteristics of Building Materials, or ANSI/UL 723, Standard for Test for Surface Burning Characteristics of Building Materials, specimen preparation and mounting shall be in accordance with ASTM E2404, Standard Practice for Specimen Preparation and Mounting of Textile, Paper or Polymeric (Including Vinyl) and Wood Wall or Ceiling Coverings, Facings and Veneers, to Assess Surface Burning Characteristics. [101:10.2.4.14.3]

12.5.5.15*  Light-Transmitting Plastics.

Light-transmitting plastics shall be permitted to be used as interior wall and ceiling finish shall be permitted based on large-scale fire tests per 12.5.5.3.3.1, which substantiate the combustibility characteristics of the plastics for the use intended under actual fire conditions. [101:10.2.4.15]

12.5.5.16  Decorations and Furnishings.
Decorations and furnishings that do not meet the definition of interior finish, as defined in 3.3.113.2, shall be regulated by the provisions of Section 12.6. [101:10.2.4.16]

12.5.6 Trim and Incidental Finish

12.5.6.1 General.
Interior wall and ceiling trim and incidental finish, other than wall base in accordance with 12.5.6.2 and bulletin boards, posters, and paper in accordance with 12.5.6.3, not in excess of 10 percent of the specific wall and ceiling areas of any room or space to which it is applied shall be permitted to be Class C materials in occupancies where interior wall and ceiling finish of Class A or Class B is required. [101:10.2.5.1]

12.5.6.2 Wall Base.
Interior floor trim material used at the junction of the wall and the floor to provide a functional or decorative border, and not exceeding 6 in. (150 mm) in height, shall meet the requirements for interior wall finish for its location or the requirements for Class II interior floor finish as described in 12.5.8.4 using the test described in 12.5.8.3. [101:10.2.5.2]

12.5.6.2.1 If a Class I floor finish is required, the interior floor trim shall be Class I. [101:10.2.5.2.1]

12.5.6.3 Bulletin Boards, Posters, and Paper.

12.5.6.3.1 Bulletin boards, posters, and paper attached directly to the wall shall not exceed 20 percent of the aggregate wall area to which they are applied. [101:10.2.5.3.1]

12.5.6.3.2 The provision of 12.5.6.3.1 shall not apply to artwork and teaching materials in sprinklered educational or day-care occupancies in accordance with 20.2.4.4.3 and 20.3.4.2.3.5.3. [101:10.2.5.3.2]

12.5.7 Fire-Retardant Coatings.

12.5.7.1*

The required flame spread index or smoke developed index of existing surfaces of walls, partitions, columns, and ceilings shall be permitted to be secured by applying approved fire-retardant coatings to surfaces having higher flame spread index values than permitted. [101:10.2.6.1]

12.5.7.1.1
Such treatments shall be tested, or shall be listed and labeled for application to the material to which they are applied, and shall comply with the requirements of NFPA 703. [101:10.2.6.1.1]

12.5.7.2*
Surfaces of walls, partitions, columns, and ceilings shall be permitted to be finished with factory-applied fire-retardant-coated products that have been listed and labeled to demonstrate compliance with the requirements of ASTM E2768, Standard Test Method for Extended Duration Surface Burning Characteristics of Building Materials, on the coated surface. [101:10.2.6.2]

12.5.7.3
Fire-retardant coatings or factory-applied fire-retardant-coated assemblies shall possess the desired degree of permanency and shall be maintained so as to retain the effectiveness of the treatment under the service conditions encountered in actual use. [101:10.2.6.3]

12.5.8* Interior Floor Finish Testing and Classification.

12.5.8.1*
Carpet and carpet-like interior floor finishes shall comply with ASTM D2859, Standard Test Method for Ignition Characteristics of Finished Textile Floor Covering Materials. [101:10.2.7.1]

12.5.8.2*
Floor coverings, other than carpet for which 12.5.3.2 establishes requirements for fire performance, shall have a minimum critical radiant flux of 0.1 W/cm². [101:10.2.7.2]

12.5.8.3*
Interior floor finishes shall be classified in accordance with 12.5.8.4, based on test results from NFPA 253 or ASTM E648, Standard Test Method for Critical Radiant Flux of Floor Covering Systems Using a Radiant Heat Energy Source. [101:10.2.7.3]

12.5.8.4

Interior floor finishes shall be grouped in the classes specified in 12.5.8.4.1 and 12.5.8.4.2 in accordance with the critical radiant flux requirements. [101:10.2.7.4]

12.5.8.4.1 Class I Interior Floor Finish.
Class I interior floor finish shall have a critical radiant flux of not less than 0.45 W/cm², as determined by the test described in 12.5.8.3. [101:10.2.7.4.1]

12.5.8.4.2 Class II Interior Floor Finish.
Class II interior floor finish shall have a critical radiant flux of not less than 0.22 W/cm², but less than 0.45 W/cm², as determined by the test described in 12.5.8.3. [101:10.2.7.4.2]
12.5.8.5  
Wherever the use of Class II interior floor finish is required, Class I interior floor finish shall be permitted. [101:10.2.7.5]

12.5.9  Automatic Sprinklers.

12.5.9.1  
Other than as required in 12.5.5, where an approved automatic sprinkler system is installed in accordance with Section 9.7, Class C interior wall and ceiling finish materials shall be permitted in any location where Class B is required, and Class B interior wall and ceiling finish materials shall be permitted in any location where Class A is required. [101:10.2.8.1]

12.5.9.2  
Where an approved automatic sprinkler system is installed in accordance with Section 9.7, throughout the fire compartment or smoke compartment containing the interior floor finish, Class II interior floor finish shall be permitted in any location where Class I interior floor finish is required, and where Class II is required, the provisions of 12.5.8.2 shall apply. [101:10.2.8.2]

12.6  Contents and Furnishings.

12.6.1*  
Where required by the applicable provisions of this Code, draperies, curtains, and other similar loosely hanging furnishings and decorations shall meet the flame propagation performance criteria contained in Test Method 1 or Test Method 2, as appropriate, of NFPA 701. [101:10.3.1]

12.6.2  Smoldering Ignition of Upholstered Furniture and Mattresses.

12.6.2.1*  Upholstered Furniture.
Newly introduced upholstered furniture, except as otherwise permitted by Chapters 11 through 43 of NFPA 101, shall be resistant to a cigarette ignition (i.e., smoldering) in accordance with one of the following:

1. The components of the upholstered furniture shall meet the requirements for Class I when tested in accordance with NFPA 260.
2. Mocked-up composites of the upholstered furniture shall have a char length not exceeding 11/2 in. (38 mm) when tested in accordance with NFPA 261.

[101:10.3.2.1]

12.6.2.2*  Mattresses.
Newly introduced mattresses, except as otherwise permitted by Chapters 11 through 43, shall have a char length not exceeding 2 in. (51 mm) when tested in accordance with 16 CFR 1632, “Standard for the Flammability of Mattresses and Mattress Pads” (FF 4-72). [101:10.3.2.2]
12.6.3*  Rate of Heat Release Testing of Upholstered Furniture and Mattresses.

12.6.3.1  Where required by the applicable provisions of this Code, upholstered furniture and other seating furniture, unless the furniture is located in a building protected throughout by an approved automatic sprinkler system, shall have limited rates of heat release when tested in accordance with ASTM E1537, Standard Test Method for Fire Testing of Upholstered Furniture, as follows:

1. The peak rate of heat release for the single furniture item shall not exceed 80 kW.
2. The total heat released by the single furniture item during the first 10 minutes of the test shall not exceed 25 MJ.

12.6.3.2*  Where required by the applicable provisions of this Code, mattresses shall comply with 12.6.3.2.1 or 12.6.3.2.2, unless the mattress is located in a building protected throughout by an approved automatic sprinkler system. [101:10.3.3.2]

12.6.3.2.1  The mattress shall have limited rates of heat release when tested in accordance with ASTM E1590, Standard Test Method for Fire Testing of Mattresses, as follows:

1. The peak rate of heat release for the mattress shall not exceed 100 kW.
2. The total heat released by the mattress during the first 10 minutes of the test shall not exceed 25 MJ.

12.6.3.2.2  The mattress shall have a mass loss not exceeding 15 percent when tested in accordance with the fire test in Appendix A3 of ASTM F1085, Standard Specification for Mattress and Box Springs for Use in Berths and Marine Vessels. [101:10.3.3.2.2]

12.6.4*  Furnishings or decorations of an explosive or highly flammable character shall not be used. [101:10.3.4]
Fire-retardant coatings shall be maintained to retain the effectiveness of the treatment under service conditions encountered in actual use. [101:10.3.5]

12.6.6*
Where required by the applicable provisions of this Code, furnishings and contents made with foamed plastic materials that are unprotected from ignition shall have a heat release rate not exceeding 100 kW when tested in accordance with ANSI/UL 1975, Standard for Fire Tests for Foamed Plastics Used for Decorative Purposes, or when tested in accordance with NFPA 289 using the 20 kW ignition source. [101:10.3.6]

12.6.7 Lockers

12.6.7.1 Combustible Lockers.
Where lockers constructed of combustible materials other than wood are used, the lockers shall be considered interior finish and shall comply with Section 12.5, except as permitted by 12.6.7.2. [101:10.3.7.1]

12.6.7.2 Wood Lockers.
Lockers constructed entirely of wood and of noncombustible materials shall be permitted to be used in any location where interior finish materials are required to meet a Class C classification in accordance with 12.5.3. [101:10.3.7.2]

12.6.8 Containers for Waste, or Linen.

12.6.8.1 Where required by Chapters 11 through 43 of NFPA 101, newly introduced containers for waste or linen, with a capacity of 20 gal (75.7 L) or more, shall meet both of the following:

1. Such containers shall be provided with lids.
2. Such containers and their lids shall be constructed of noncombustible materials or of materials that meet a peak rate of heat release not exceeding 300 kW/m² when tested at an incident heat flux of 50 kW/m² in the horizontal orientation and at a thickness as used in the container but not less than 1/4 in. (6.3 mm), in accordance with ASTM E1354, Standard Test Method for Heat and Visible Smoke Release Rates for Materials and Products Using an Oxygen Consumption Calorimeter. [101:10.3.8.1]

12.6.8.2 Where required by Chapters 11 through 43 of NFPA 101, newly introduced metal wastebaskets and other metal waste, or linen containers with a capacity of 20 gal (75.7 L) or more shall be listed in accordance with ANSI/UL 1315, Standard for Safety for Metal Waste Paper Containers, and shall be provided with a noncombustible lid. [101:10.3.8.2]
12.8.2 Continuity.

The following shall apply to smoke partitions shall comply with the following:

1. They shall extend from the floor to the underside of the floor or roof deck above, through any concealed spaces, such as those above suspended ceilings, and through interstitial structural and mechanical spaces.

2. *They shall be permitted to extend from the floor to the underside of a monolithic or suspended ceiling system where all of the following conditions are met:
   1. The ceiling system forms a continuous membrane.
   2. A smoke-tight joint is provided between the top of the smoke partition and the bottom of the suspended ceiling.
   3. The space above the ceiling is not used as a plenum.

3. Smoke partitions enclosing hazardous areas shall be permitted to terminate at the underside of a monolithic or suspended ceiling system where all of the following conditions are met:
   1. The ceiling system forms a continuous membrane.
   2. A smoke-tight joint is provided between the top of the smoke partition and the bottom of the suspended ceiling.
   3. Where the space above the ceiling is used as a plenum, return grilles from the hazardous area into the plenums are not permitted.

[101:8.4.2]

12.8.4.2 Vibration Isolation Equipment or Systems.

Where vibration isolation of equipment or systems is employed, the vibration restraint(s) shall be located outside of the partition, wall or floor assembly for which the equipment or systems pass through. [101:8.4.4.2]

12.9.6.5 Where the penetrating item uses a sleeve to penetrate the smoke barrier, the sleeve shall be securely set in the smoke barrier, and the space between the item and the sleeve shall be filled with a listed system or with a material capable of restricting the transfer of smoke. [101:8.5.6.56]

12.9.6.6 Vibration Isolation Equipment or Systems.

Where vibration isolation of equipment or systems is employed, the vibration restraint(s) shall be located outside of the partition, wall or floor assembly for which the equipment or systems pass through. [101:8.5.6.67] Where designs take transmission of vibrations into consideration, any vibration isolation shall meet one of the following conditions:

1. It shall be provided on either side of the smoke barrier.

2. It shall be designed for the specific purpose.
12.9.7.4
Smoke barriers that are also constructed as fire barriers shall be protected with a joint system that is designed and tested to resist the spread of fire for a time period equal to the required fire resistance rating of the assembly and restrict the transfer of smoke. [101:8.5.7.43]

12.9.7.5
Testing of the joint system in a smoke barrier that also serves as fire barrier shall be representative of the actual installation. [101:8.5.7.54]

Where required by Chapters 11 through 43, and where two or more fire protection or life safety systems are integrated, the integrated system shall be tested to verify the proper operation and function of such systems in accordance with NFPA 4. [101:9.11.4]

13.3.2.7.3
The requirements of 13.3.2.7.2 shall not apply to the following:

1. *Assembly occupancies consisting of a single multipurpose room of less than 12,000 ft² (1115 m²) that are not used for exhibition or display and are not part of a mixed occupancy
2. Gymnasiums, skating rinks, and swimming pools used exclusively for participant sports with no audience facilities for more than 300 persons
3. *Locations in stadia and arenas as follows:
   1. Over the floor areas used for contest, performance, or entertainment, provided that the roof construction is more than 50 ft (15 m) above the floor level, and use is restricted to low fire hazard uses
   2. Over the seating areas, provided that use is restricted to low fire hazard uses
   3. Over open-air concourses where an approved engineering analysis substantiates the ineffectiveness of the sprinkler protection due to building height and combustible loading
4. Locations in unenclosed stadia and arenas as follows:
   1. Press boxes of less than 1000 ft² (93 m²)
   2. Storage facilities of less than 1000 ft² (93 m²) if enclosed with not less than 1-hour fire resistance–rated construction
   3. Enclosed areas underneath grandstands that comply with 25.3.4 [101:12.3.5.3]

13.3.2.7.5 Fire Protection Stages.
Every stage shall be protected by an approved, supervised automatic sprinkler system in compliance with Section 13.3. [101:12.4.6.10]

13.3.2.8.3
The sprinklers specified by 13.3.2.8.2 shall not be required where otherwise permitted in the following locations:

1. Locations in stadia and arenas as follows:
   1. Over the floor areas used for contest, performance, or entertainment
   2. Over the seating areas
   3. Over open-air concourses where an approved engineering analysis substantiates the ineffectiveness of the sprinkler protection due to building height and combustible loading
2. Locations in unenclosed stadia and arenas as follows:
   1. Press boxes of less than 1000 ft\(^2\) (93 m\(^2\))
   2. Storage facilities of less than 1000 ft\(^2\) (93 m\(^2\)) if enclosed with not less than 1-hour fire resistance-rated construction
   3. Enclosed areas underneath grandstands that comply with 25.3.4

13.3.2.8.5 Fire Protection, Stages.

Every stage shall be protected by an approved automatic sprinkler system in compliance with Section 13.3. [101:13.4.6.10]

13.3.2.9.1* Educational occupancy buildings exceeding 12,000 ft\(^2\) (1120 m\(^2\)) shall be protected throughout by an approved, supervised automatic sprinkler system in accordance with Section 13.3. shall be protected throughout by an approved, supervised automatic sprinkler system in accordance with Section 13.3. [101:14.3.5.1]

13.3.2.9.2 The requirement of 13.3.2.9.1 shall not apply to any of the following:
   1. Non-relocatable buildings having an area not exceeding 1000 ft\(^2\) (93 m\(^2\))
   2. Non-relocatable buildings containing a single classroom
   3. Relocatable buildings complying with all of the following:
      1. Building area does not exceed 1000 ft\(^2\) (93 m\(^2\))
      2. Building contains a single classroom
      3. Building is located not less than 30 ft (9.1 m) from another building

Educational occupancy buildings four or more stories in height shall be protected throughout by an approved, supervised automatic sprinkler system in accordance with Section 13.3. [101:14.3.5.2]
13.3.2.12.3
Where a jurisdiction adopts this edition of the Code and previously adopted the 2012-2015 edition, the sprinklering required by 13.3.2.12.2 shall be installed within 9 years of the adoption of this Code. [101:19.4.2.2]

13.3.2.12.4
Where a jurisdiction adopts this edition of the Code and previously adopted the 2009-2012 edition, the sprinklering required by 13.3.2.12.2 shall be installed within 6 years of the adoption of this Code. [101:19.4.2.3]

13.3.2.12.8*
Where this Code permits exceptions for fully sprinklered buildings or smoke compartments, the sprinkler system shall meet all of the following criteria:

1. It shall be in accordance with Section 13.3.
2. It shall be installed in accordance with NFPA 13, unless it is an approved existing system.
3. It shall be electrically connected to the fire alarm system.
4. It shall be fully supervised.
5. In Type I and Type II construction, where the AHJ has prohibited sprinklers, approved alternative protection measures shall be permitted to be substituted for sprinkler protection in specified areas without causing a building to be classified as nonsprinklered. [101:19.3.5.7]

13.3.2.12.9*
Where this Code permits exceptions for fully sprinklered buildings or smoke compartments and specifically references this paragraph, the sprinkler system shall meet all of the following criteria:

1. It shall be installed throughout the building or smoke compartment in accordance with Section 13.3.
2. It shall be installed in accordance with NFPA 13, unless it is an approved existing system.
3. It shall be electrically connected to the fire alarm system.
4. It shall be fully supervised.
5. It shall be equipped with listed quick-response or listed residential sprinklers throughout all smoke compartments containing patient sleeping rooms.
6. Standard-response sprinklers shall be permitted to be continued to be used in approved existing sprinkler systems where quick-response and residential sprinklers were not listed for use in such locations at the time of installation.
7. Standard-response sprinklers shall be permitted for use in hazardous areas protected in accordance with 19.3.2.1 of NFPA 101. [101:19.3.5.8]
Where an automatic sprinkler system is installed, either for total or partial building coverage, the system shall be in accordance with Section 13.3, as modified by 13.3.2.15.3. In hotel or dormitory occupancies up to and including four stories in height, that are located in buildings and not exceeding 60 ft (18.3 m) in height four or fewer stories above grade plane, systems in accordance with NFPA 13R shall be permitted. [101:28.3.5.3]

Where located in a building of Type III, Type IV, or Type V construction designed in accordance with 4.6.3(5), and where the roof assembly is located more than 55 ft (16.764 m) feet (17 m) above the lowest level of required fire department vehicle access, attics shall comply with 28.3.5.3.1.1, 28.3.5.3.1.2, and one of the following:

1. Attics shall be provided with sprinkler protection.
2. Attics shall be constructed with noncombustible materials.
3. Attics shall be constructed with fire-retardant-treated wood.
4. Attics shall be filled with noncombustible insulation.

[101:28.3.5.3.1]

The height of the roof assembly shall be determined by measuring the distance from the lowest level of required fire department vehicle access adjacent to the building to the eave of the highest pitched roof, the intersection of the highest roof to the exterior wall, or the top of the highest parapet, whichever yields the greatest distance.

[101:28.3.5.3.1.1]

Required fire department vehicle access roads used in 28.3.5.3.1.1 shall include only those roads that are necessary for required fire department vehicle access in compliance with the fire code.

[101:28.3.5.3.1.2]

Where an automatic sprinkler system is installed, either for total or partial building coverage, the system shall be in accordance with Section 13.3, as modified by 13.3.2.16.3 and 13.3.2.16.4.
In buildings up to and including four or fewer stories in height and not exceeding 60 ft (18.3 m) in height above grade plane, systems in accordance with NFPA 13R shall be permitted. [101:29.3.5.3]

13.3.2.17.2
Where an automatic sprinkler system is installed, either for total or partial building coverage, the system shall be installed in accordance with Section 13.3, as modified by 13.3.2.17.3 and 13.3.2.17.5. In buildings, hotel or dormitory, apartment buildings, and occupancies up to and including four or fewer stories in height, that are located in buildings not exceeding 60 ft (18.3 m) in height above grade plane, systems in accordance with NFPA 13R shall be permitted. [101:30.3.5.2]

13.3.2.17.2.1
Where located in a building of Type III, Type IV, or Type V construction designed in accordance with Section 4.6.3(5), and where the roof assembly is located more than 55 feet (17 m) above the lowest level of required fire department vehicle access, attics shall comply with 30.3.5.3.1.1, 30.3.5.3.1.2, and one of the following:

1. Provide Attics shall be provided with sprinkler protection.
2. Construct the attic using Attics shall be constructed with noncombustible materials.
3. Construct the attic using Attics shall be constructed with fire-retardant-treated wood.
4. Fill the attic Attics shall be filled with noncombustible insulation.

[101:30.3.5.2.1]

13.3.2.17.2.1.1
The height of the roof assembly shall be determined by measuring the distance from the lowest level of required fire department vehicle access adjacent to the building to the eave of the highest pitched roof, the intersection of the highest roof to the exterior wall, or the top of the highest parapet, whichever yields the greatest distance. [101:30.3.5.2.1.1]

13.3.2.17.2.1.2
Required fire department vehicle access roads used in 30.3.5.3.1.1 shall include only those roads that are necessary for required fire department vehicle access in compliance with the fire code. [101:30.3.5.2.1.2]
In buildings sprinklered in accordance with NFPA 13, closets less than 12 ft² (1.1 m²) in area in individual dwelling units shall not be required to be sprinklered. Closets that contain equipment such as washers, dryers, furnaces, or water heaters shall be sprinklered, regardless of size. [101:30.3.5.3]

13.3.2.18.1*
Where an automatic sprinkler system is installed, either for total or partial building coverage, the system shall be installed in accordance with Section 13.3, as modified by 13.3.2.18.2 and 13.3.2.18.4. In buildings four or fewer stories in height above grade plane, systems in accordance with NFPA 13R shall be permitted. [101:31.3.5.2]

13.3.2.18.2
In individual dwelling units, sprinkler installation shall not be required in closets not exceeding 24 ft² (2.2 m²) and in bathrooms not exceeding 55 ft² (5.1 m²). Closets that contain equipment such as washers, dryers, furnaces, or water heaters shall be sprinklered, regardless of size. [101:31.3.5.3]

13.3.2.19.2.2
In buildings four or fewer stories in height above grade plane, systems in accordance with NFPA 13R shall be permitted. [101:26.3.6.2.2]

13.3.2.20.2
Where an automatic sprinkler system is installed, either for total or partial building coverage, the system shall be in accordance with Section 13.3. In buildings of four or fewer stories in height above grade plane, systems in accordance with NFPA 13R and with NFPA 13D shall also be permitted. [101:24.3.5.2]

13.3.2.21.2.3.1
In buildings four or fewer stories in height above grade plane, systems in accordance with NFPA 13R shall be permitted. All habitable areas, closets, roofed porches, roofed decks, and roofed balconies shall be sprinklered. [101:32.2.3.5.3.1]

13.3.2.21.2.3.2*
An automatic sprinkler system with a 30-minute water supply, and complying with all of the following requirements and with NFPA 13D, shall be permitted:

1. All habitable areas, closets, roofed porches, roofed decks, and roofed balconies shall be sprinklered.
2. Facilities with more than eight residents shall be treated as two-family dwellings with regard to water supply. [101:32.2.3.5.3.2]
13.3.2.21.2.7.2
Where an automatic sprinkler system is required by 13.3.2.21.2, attics not used for living purposes, storage, or fuel-fired equipment shall meet one of the following criteria:

1. Attics shall be protected throughout by a heat detection system arranged to activate the building fire alarm system in accordance with Section 13.7.
2. Attics shall be protected with automatic sprinklers that are part of the required, approved automatic sprinkler system in accordance with 13.3.1.2.
3. Attics shall be of noncombustible or limited-combustible construction.
4. Attics shall be constructed of fire-retardant-treated wood in accordance with NFPA703.

13.3.2.22.2.1
Where an automatic sprinkler system is installed, for either total or partial building coverage, all of the following requirements shall be met:

1. The system shall be in accordance with Section 13.3 and shall initiate the fire alarm system in accordance with 13.7.2.21, as modified by 13.3.2.22.2.1.1 through 13.3.2.22.2.1.6.
2. The adequacy of the water supply shall be documented to the AHJ. [101:32.2.3.5.3.7.2]

13.3.2.22.3
Sprinkler piping serving not more than six sprinklers for any isolated hazardous area shall be permitted to be installed in accordance with 13.3.1.4 and shall meet all of the following requirements:

1. In new installations, where more than two sprinklers are installed in a single area, waterflow detection shall be provided to initiate the fire alarm system required by 13.7.2.21.
2. The duration of water supplies shall be as required for the sprinkler systems addressed in 13.3.2.22.2.1. [101:32.2.3.5.6]

13.3.2.23.4.1.1
The mall structurebuilding and all anchor buildings shall be protected throughout by an approved, supervised automatic sprinkler system in accordance with NFPA 13 and 13.3.2.23.4.1.2. [101:36.4.4.13.1]

13.3.2.23.4.1.2
The system shall be installed in such a manner that any portion of the system serving tenant spaces can be taken out of service without affecting the operation of the portion of the system serving the mall concourse. [101:36.4.4.13.2]

13.7.1.8.6
System smoke detectors in accordance with NFPA 72 and arranged to function in the same manner as single-station or multiple-station smoke alarms shall be permitted in lieu of smoke alarms. [101:9.6.2.10.67]

13.7.1.8.7
Smoke alarms, other than battery-operated smoke alarms as permitted by other sections of this Code, shall be powered in accordance with the requirements of NFPA 72. [101:9.6.2.10.28]

13.7.1.8.8*
In new construction, where two or more smoke alarms are required within a dwelling unit, suite of rooms, or similar area, they shall be arranged so that operation of any smoke alarm shall cause the alarm in all smoke alarms within the dwelling unit, suite of rooms, or similar area to sound, unless otherwise permitted by one of the following:

1. The requirement of 13.7.1.8.8 shall not apply where permitted by another section of this Code.
2. The requirement of 13.7.1.8.8 shall not apply to configurations that provide equivalent distribution of the alarm signal. [101:9.6.2.10.8]

13.7.1.8.9
The alarms described in 13.7.1.8.8 shall sound only within an individual dwelling unit, suite of rooms, or similar area and shall not actuate the building fire alarm system, unless otherwise permitted by the AHJ. [101:9.6.2.10.9]

13.7.1.8.10
Smoke alarms shall be permitted to be connected to the building fire alarm system for the purpose of annunciation in accordance with NFPA 72. [101:9.6.2.10.10]

13.7.1.9.5
Unless otherwise provided in 13.7.1.9.5.1 through 13.7.1.9.5.8, notification signals for occupants to evacuate shall be audible and visible signals in accordance with NFPA 72 and ICC/ANSI A117.1, *American National Standard for Accessible and Usable Buildings and Facilities*, or other means of notification acceptable to the AHJ. [101:9.6.3.5]

13.7.1.9.5.4
Visible signals shall not be required in lodging or rooming houses in accordance with the provisions of Chapter 26 of NFPA 101. [101:9.6.3.5.4]
13.7.1.9.6.4 The general evacuation signal shall not be required to operate in exit stair enclosures. [101:9.6.3.6.4]

13.7.1.9.6.5 The general evacuation signal shall not be required to operate in elevator cars. [101:9.6.3.6.5]

13.7.1.9.9.2 Where permitted by Chapters 11 through 43 of NFPA 101, automatically transmitted or live voice announcements shall be permitted to be made via a voice communication or public address system that complies with all of the following:

1. Occupant notification, either live or recorded, shall be initiated at a constantly attended receiving station by personnel trained to respond to an emergency.
2. An approved secondary power supply shall be provided for other than existing, previously approved systems.
3. The system shall be audible above the expected ambient noise level.
4. Emergency announcements shall take precedence over any other use. [101:9.6.3.9.2]

13.7.1.11.1 Fire safety emergency control functions shall be installed in accordance with the requirements of NFPA 72. [101:9.6.5.1]

13.7.1.13.9.4 Unless otherwise prohibited by another section of elsewhere in this Code, where a building not exceeding four stories in height is protected by an automatic water mist system in accordance with 9.7.3 of NFPA 101, the water mist system shall be permitted to be annunciated on the fire alarm system as a single zone. [101:9.6.7.4.4]

13.7.1.15* Risk Analysis for Mass Notification Systems.

13.7.1.15.1 Where Required.

13.7.1.15.1.1 Where required by another section of this Code, a risk analysis for mass notification systems shall be provided in accordance with the requirements of Chapter 24 of NFPA 72 and the provisions of 13.7.1.15.2 through 13.7.1.15.4. [101:9.14.1.1]
13.7.1.15.1.2 Where a mass notification system is required by the risk analysis in 13.7.1.15.1.1, the system shall be in accordance with the requirements of Chapter 24 of NFPA 72. [101:9.14.1.2]

13.7.1.15.2 Purpose.

13.7.1.15.2.1 The purpose of the mass notification system shall be to communicate information about emergencies including, but not limited to, fire, human-caused events (accidental and intentional), other dangerous situations, accidents, and natural disasters. [101:9.14.2.1]

13.7.1.15.2.2 The purpose of the emergency action plan for the mass notification system shall be to identify the mass notification system design and performance requirements in accordance with the results of the risk analysis. [101:9.14.2.2]

13.7.1.15.3 Documentation.

13.7.1.15.3.1 The emergency action plan, risk assessment report, and accompanying documentation shall be submitted to the authority having jurisdiction by the registered design professional (RDP). The format and content of the documentation shall be acceptable to the authority having jurisdiction. [101:9.14.3.1]

13.7.1.15.3.2* Where required by the authority having jurisdiction, an independent review of the emergency action plan, risk assessment, and the accompanying documentation by one or more individuals possessing expertise in risk characterization for accidental and intentional hazards shall be performed. [101:9.14.3.2]

13.7.1.15.4 Emergency Action Plan.

The completed emergency action plan in accordance with Section 4.8 of NFPA 101 shall be used for the design of the mass notification/emergency communications system. [101:9.14.4]

13.7.2.1.1.1 New assembly occupancies with occupant loads of more than 300 and all theaters with more than one audience-viewing room shall be provided with an approved fire alarm system in accordance with Section 13.7 and 13.7.2.1, unless otherwise permitted by 13.7.2.1.1.2. [101:12.3.4.1.1]
New assembly occupancies that are a part of a multiple occupancy protected as a mixed occupancy (see 6.1.14) shall be permitted to be served by a common fire alarm system, provided that the individual requirements of each occupancy are met. [101:12.3.4.1.2]

13.7.2.1.4 Carbon Monoxide Detection.

13.7.2.1.4.1 New assembly occupancies shall be provided with carbon monoxide detection and warning equipment in accordance with Section 13.7.1.14 in the locations specified as follows:

1. On the ceilings of rooms containing permanently installed fuel-burning appliances or fuel-burning fireplaces
2. Centrally located within occupiable spaces served by the first supply air register from permanently installed fuel-burning HVAC systems
3. *Centrally located within occupiable spaces adjacent to an attached garage

[101:12.3.4.4.1]

13.7.2.1.4.2 Carbon monoxide detectors as specified in 12.3.4.4.1 shall not be required in the following locations:

1. Garages
2. Occupiable spaces with attached garages that are open parking structures as defined in 6.3.282.3
3. Occupiable spaces with attached garages that are mechanically ventilated in accordance with the mechanical code

[101:12.3.4.4.2]

13.7.2.1.5 Risk Analysis for Mass Notification Systems.

A risk analysis in accordance with Section 13.7.1.15 shall be performed for new assembly occupancies with an occupant load of 500 or more to determine if a mass notification system is required. [101:12.3.4.5]

13.7.2.2.1.1 Existing assembly occupancies with occupant loads of more than 300 and all theaters with more than one audience-viewing room shall be provided with an approved fire alarm system in accordance with Section 13.7 and 13.7.2.2, unless otherwise permitted by 13.7.2.2.1.2, 13.7.2.2.1.3, or 13.7.2.2.1.4. [101:13.3.4.1.1]

13.7.2.2.1.2
Existing assembly occupancies that are a part of a multiple occupancy protected as a mixed occupancy (see 6.1.14) shall be permitted to be served by a common fire alarm system, provided that the individual requirements of each occupancy are met. [101:13.3.4.1.2]

13.7.2.2.1.4
The requirement of 13.7.2.2.1.1 shall not apply to existing assembly occupancies where, in the judgment of the AHJ, adequate alternative provisions exist or are provided for the discovery of a fire and for alerting the occupants promptly. [101:13.3.4.1.4]

13.7.2.3.1.1
New educational occupancies shall be provided with a fire alarm system in accordance with Section 13.7 and 13.7.2.3. [101:14.3.4.1.1]

13.7.2.3.4.1
Carbon monoxide alarms or carbon monoxide detectors in accordance with 13.7.1.14 shall be provided in new educational occupancies in the locations specified as follows:

1. Carbon monoxide detectors shall be installed on the ceilings of rooms containing permanently installed fuel-burning appliances.
2. Carbon monoxide detectors shall be installed centrally located within occupiable spaces served by the first supply air register from a permanently installed, fuel-burning HVAC system.
3. Carbon monoxide detectors shall be installed centrally located within occupiable spaces adjacent to a communicating attached garage.
4. Carbon monoxide detectors shall be installed centrally located within occupiable spaces adjacent to an attached garage with a separation wall constructed of gypsum wallboard. [101:14.3.4.1.1]

13.7.2.3.4.2
Carbon monoxide alarms and carbon monoxide detectors as specified in 13.7.2.3.4.1 shall not be required in the following locations:

1. Garages
2. Occupiable spaces with communicating attached garages that are open parking structures as defined in 3.3.185.26.3
3. Occupiable spaces with communicating attached garages that are mechanically ventilated in accordance with the applicable mechanical code
4. Occupiable spaces that are separated from attached garages by walls constructed of gypsum wallboard where the garage is an open parking structure as defined in 3.3.282.8.4
5. Occupiable spaces that are separated from attached garages by walls constructed of gypsum wallboard where the garage is mechanically ventilated in accordance with the mechanical code.
13.7.2.3.5 Risk Analysis for Mass Notification Systems.
A risk analysis in accordance with Section 13.7.1.15 shall be performed to determine if a mass notification system is required. [101:14.3.4.5]

13.7.2.4.1.1 Existing educational occupancies shall be provided with a fire alarm system in accordance with Section 13.7 and 13.7.2.4. [101:15.3.4.1.1]

13.7.2.5.1 General.
New day-care occupancies, other than day-care occupancies housed in one room having at least one door opening directly to the outside at grade plane or to an exterior exit access balcony in accordance with 14.10.3, shall be provided with a fire alarm system in accordance with Section 13.7 and 13.7.2.5. [101:16.3.4.1]

13.7.2.5.6.3 Single-station or multiple-station smoke alarms or smoke detectors shall be provided in all rooms used for sleeping in accordance with 13.7.1.8. [101:16.6.3.4.24]

13.7.2.5.6.4 Single-station or multiple-station carbon monoxide alarms or detectors shall be provided in accordance with 13.7.1.14 in day-care homes where client sleeping occurs and one or both of the following conditions exist:

1. Fuel-fired equipment is present.
2. An enclosed parking structure is attached to the day-care home. [101:16.6.3.4.56]

13.7.2.6.1 General.
Existing day-care occupancies, other than day-care occupancies housed in one room, shall be provided with a fire alarm system in accordance with Section 13.7 and 13.7.2.6. [101:17.3.4.1]

13.7.2.6.5 Detection.
A smoke detection system in accordance with 13.7.1 shall be installed in existing day-care occupancies, other than those housed in one room or those housing clients capable of self-preservation where no sleeping facilities are provided, and such system shall comply with both of the following:

1. Detectors shall be installed on each story in front of the doors to the stairways and in the corridors of all floors occupied by the day-care occupancy.
2. Detectors shall be installed in lounges, recreation areas, and sleeping rooms in the day-care occupancy.

[101:17.3.4.5]

13.7.2.6.6.3 Single-station or multiple-station smoke alarms or smoke detectors shall be provided in all rooms used for sleeping in accordance with 13.7.1.8, other than as permitted by 13.7.2.6.6.4.

[101:17.6.3.4.44]

13.7.2.6.6.4 Approved existing battery-powered smoke alarms, rather than house electrical service–powered smoke alarms required by 13.7.2.6.6.3, shall be permitted where the facility has testing, maintenance, and battery replacement programs that ensure reliability of power to the smoke alarms. [101:17.6.3.4.45]

13.7.2.7.1 General. New health care occupancies shall be provided with a fire alarm system in accordance with Section 13.7 and 13.7.2.7. [101:18.3.4.1]

13.7.2.7.4 Emergency Control Fire Safety Functions. Operation of any activating device in the required fire alarm system shall be arranged to accomplish automatically any control functions to be performed by that device. (See 13.7.1.11.) [101:18.3.4.4]

13.7.2.8.1 General. Existing health care occupancies shall be provided with a fire alarm system in accordance with Section 13.7 and 13.7.2.8. [101:19.3.4.1]

13.7.2.8.4 Emergency Control Fire Safety Functions. Operation of any activating device in the required fire alarm system shall be arranged to accomplish automatically any control functions to be performed by that device. (See 13.7.1.11.) [101:19.3.4.4]
13.7.2.9.1 General.
New ambulatory health care facilities shall be provided with fire alarm systems in accordance with Section 13.7 and 13.7.2.9, except as modified by 13.7.2.9.2 through 13.7.2.9.4. [101:20.3.4.1]

13.7.2.9.4 Emergency Control Fire Safety Functions.
Operation of any activating device in the required fire alarm system shall be arranged to accomplish automatically, without delay, any control functions required to be performed by that device. (See 13.7.1.11.) [101:20.3.4.4]

13.7.2.10.1 General.
Existing ambulatory health care facilities shall be provided with fire alarm systems in accordance with Section 13.7 and 13.7.2.10, except as modified by 13.7.2.10.2 through 13.7.2.10.4. [101:21.3.4.1]

13.7.2.10.4 Emergency Control Fire Safety Functions.
Operation of any activating device in the required fire alarm system shall be arranged to accomplish automatically, without delay, any control functions required to be performed by that device. (See 13.7.1.11.) [101:21.3.4.4]

13.7.2.11.1 General.
New detention and correctional occupancies shall be provided with a fire alarm system in accordance with Section 13.7 and 13.7.2.11, except as modified by 13.7.2.11.2 through 13.7.2.11.4.3. [101:22.3.4.1]

13.7.2.11.3.1 Occupant Notification.
Occupant notification shall be accomplished automatically in accordance with 13.7.1.9, and the following also shall apply:

1. A positive alarm sequence shall be permitted in accordance with 13.7.1.9.4.
2. *Any smoke detectors required by this chapter shall be permitted to be arranged to alarm at a constantly attended location only and shall not be required to accomplish general occupant notification. [101:22.3.4.3.2-1]

13.7.2.12.1 General.
Existing detention and correctional occupancies shall be provided with a fire alarm system in accordance with Section 13.7 and 13.7.2.12, except as modified by 13.7.2.12.2 through 13.7.2.12.4.4. [101:23.3.4.1]

13.7.2.14.1.1
New and existing lodging or rooming houses, other than those meeting 13.7.2.14.1.2, shall be provided with a fire alarm system in accordance with Section 13.7. [101:26.3.4.1.1]

13.7.2.14.1.2
A fire alarm system in accordance with Section 13.7 shall not be required in existing lodging or rooming houses that have an existing smoke detection system meeting or exceeding the requirements of 13.7.2.14.5.1 where that detection system includes not less than one manual fire alarm box per floor arranged to initiate the smoke detection alarm. [101:26.3.4.1.2]

13.7.2.15.4 Detection.
A corridor smoke detection system in accordance with Section 13.7 shall be provided in buildings other than those protected throughout by an approved, supervised automatic sprinkler system in accordance with 13.7.2.15. [101:28.3.4.45]

13.7.2.15.5* Smoke Alarms.
Smoke alarms shall be installed in accordance with 13.7.1.8 in every guest room and every living area and sleeping room within a guest suite. [101:28.3.4.56]

13.7.2.15.6.1 Carbon monoxide alarms or carbon monoxide detectors in accordance with 13.7.1.14 and 13.7.2.15.6 shall be provided in new hotels and dormitories where either of the following conditions exists:

1. Guest rooms or guest suites with communicating attached garages, unless otherwise exempted by 13.7.2.15.6.3
2. Guest rooms or guest suites containing a permanently installed fuel-burning appliance or fuel-burning fireplace

[101:28.3.4.62.1]

13.7.2.15.6.2 Where required by 13.7.2.15.6.1, carbon monoxide alarms or carbon monoxide detectors shall be installed in the following locations:

1. Outside of each separate guest room or guest suite sleeping area in the immediate vicinity of the sleeping rooms
2. On every occupiable level of a guest room and guest suite

[101:28.3.4.62.2]

13.7.2.15.6.3 Carbon monoxide alarms and carbon monoxide detectors as specified in 13.7.2.15.6.1(1) shall not be required in the following locations:
1. In garages
2. Within guest rooms or guest suites with communicating attached garages that are open parking structures as defined by the building code
3. Within guest rooms or guest suites with communicating attached garages that are mechanically ventilated in accordance with the mechanical code

[101:28.3.4.67.3]

13.7.2.15.6.4
Where fuel-burning appliances or fuel-burning fireplaces are installed outside guest rooms or guest suites, carbon monoxide alarms or carbon monoxide detectors shall be installed in accordance with the manufacturer’s published instructions in the locations specified as follows:

1. On the ceilings of rooms containing permanently installed fuel-burning appliances or fuel-burning fireplaces
2. Centrally located within occupiable spaces served by the first supply air register from a permanently installed, fuel-burning HVAC system
3. Centrally located within occupiable spaces adjacent to a communicating attached garage

[101:28.3.4.67.4]

13.7.2.15.6.5
Where carbon monoxide detectors are installed in accordance with 28.3.4.7.4(1), the alarm signal shall be automatically transmitted to an approved on-site location or to an off-premises location in accordance with NFPA 720. [101:28.3.4.7.5]

13.7.2.15.7 Risk Analysis for Mass Notification.

13.7.2.15.7.1
A risk analysis in accordance with Section 13.7.1.15 shall be performed for grade K through 12, college, or university dormitories with an occupant load greater than 100 to determine if a mass notification system is required. [101:28.3.4.4.1]

13.7.2.15.7.1
Applicable portions of an existing risk analysis shall be permitted to be used when a new building is added to the campus. [101:28.3.4.4.2]

13.7.2.17.1.1
New apartment buildings four or more stories in height or with more than 11 dwelling units, other than those meeting the requirements of 13.7.2.17.1.2, shall be provided with a fire alarm system in accordance with Section 13.7, except as modified by 13.7.2.17.2 through 13.7.2.17.5. [101:30.3.4.1.1]
13.7.2.17.6.4
Where fuel-burning appliances or fuel-burning fireplaces are installed outside dwelling units, carbon monoxide alarms or carbon monoxide detectors shall be installed in accordance with the manufacturer’s published instructions in the locations specified as follows:

1. On the ceilings of rooms containing permanently installed fuel-burning appliances or fuel-burning fireplaces
2. Centrally located position within occupiable spaces served by the first supply air register from a permanently installed, fuel-burning HVAC system
3. Centrally located position within occupiable spaces adjacent to a communicating attached garage

[101:30.3.4.6.4]

13.7.2.17.6.5
Where carbon monoxide detectors are installed in accordance with 30.3.4.6.4(1), the alarm signal shall be automatically transmitted to an approved on-site location or to an off-premises location in accordance with NFPA 720. [101:30.3.4.6.5]

13.7.2.18.1.1
Existing apartment buildings four or more stories in height or with more than 11 dwelling units, other than those meeting the requirements of 13.7.2.18.1.2, shall be provided with a fire alarm system in accordance with Section 13.7, except as modified by 13.7.2.18.5. [101:31.3.4.1.1]

13.7.2.19.1 General. A fire alarm system shall be provided in accordance with Section 13.7. [101:32.2.3.4.1]

13.7.2.19.2 Initiation. Initiation of the required fire alarm system shall be by manual means in accordance with 13.7.1.7.1(1). [101:32.2.3.4.2]

13.7.2.19.3.1
Approved smoke alarms shall be provided in accordance with 13.7.1.8. [101:32.2.3.4.34.1]

13.7.2.19.3.2
Smoke alarms shall be installed on all levels, including basements but excluding crawl spaces and unfinished attics. [101:32.2.3.4.34.2]

13.7.2.19.3.3
Additional smoke alarms shall be installed in all living areas, as defined in 3.3.21.5 of NFPA 101. [101:32.2.3.4.34.3]

13.7.2.19.3.4 Each sleeping room shall be provided with an approved smoke alarm in accordance with 13.7.1.8. [101:32.2.3.4.4]

13.7.2.20.9 Carbon Monoxide Alarms and Carbon Monoxide Detection Systems.

13.7.2.20.9.1 Carbon monoxide alarms or carbon monoxide detectors in accordance with Section 13.7.1.14 and 32.3.3.4.9 shall be provided in new large board and care facilities where either of the following conditions exists:
Where large board and care facilities have communicating attached garages, unless otherwise exempted by 13.7.2.20.9.3

1. Where sleeping rooms or sleeping room suites contain fuel-burning appliances or fuel-burning fireplaces

13.7.2.20.9.2 Where required by 32.3.3.4.9.1, carbon monoxide alarms or carbon monoxide detectors shall be installed in the following locations:

1. Outside each separate sleeping room area in the immediate vicinity of the sleeping rooms
2. Within sleeping rooms containing fuel-burning appliances or fuel-burning fireplaces
3. On every occupiable level of a sleeping room and sleeping room suite
4. Centrally located within occupiable spaces adjacent to a communicating attached garage, unless otherwise exempted by 32.3.3.4.9.3

13.7.2.20.9.3 Carbon monoxide alarms and carbon monoxide detectors as specified in 32.3.3.4.9.1(1) shall not be required in the following locations:

1. In garages
2. Within facilities with communicating attached garages that are open parking structures as defined by the building code
3. Within facilities with communicating attached garages that are mechanically ventilated in accordance with the mechanical code
13.7.2.20.9.4
Where fuel-burning appliances or fuel-burning fireplaces are installed outside sleeping rooms, carbon monoxide alarms or carbon monoxide detectors shall be installed in the locations specified as follows:

1. Within rooms containing fuel-burning appliances or fuel-burning fireplaces
2. Centrally located within occupiable spaces served by the first supply air register from a fuel-burning HVAC system

13.7.2.21.1 Fire Alarm Systems. A fire alarm system shall be provided in accordance with Section 13.7, unless the provisions of 13.7.2.21.1.1 or 13.7.2.21.1.2 are met. [101:33.2.3.4.1]

13.7.2.21.2 Initiation. Initiation of the required fire alarm system shall be by manual means in accordance with 13.7.1.7.1(1). [101:33.2.3.4.2]

13.7.2.24.1 General. Existing Class A mercantile occupancies shall be provided with a fire alarm system in accordance with Section 13.7. [101:37.3.4.1]

13.7.2.25.1 General. A fire alarm system in accordance with Section 13.7 shall be provided in all new business occupancies where any one of the following conditions exists:

1. The building is three or more stories in height.
2. The occupancy is subject to 50 or more occupants above or below the level of exit discharge.
3. The occupancy is subject to 300 or more total occupants.

[101:38.3.4.1]

13.7.2.25.2 Initiation. Initiation of the required fire alarm system shall be by any one of the following means:

1. Manual means in accordance with 13.7.1.7.1(1)
2. Approved automatic fire detection system in accordance with 13.7.1.7.1(2) that provides protection throughout the building and the provision of 13.7.1.7.6 shall apply.

3. Approved automatic sprinkler system in accordance with 13.7.1.7.1(3) that provides protection throughout the building and the provision of 13.7.1.7.6 shall apply.

13.7.2.25.5  Risk Analysis for Mass Notification.

13.7.2.25.5.1  Business occupancies requiring a fire alarm system in accordance with 13.7.2.25.1 shall conduct a risk analysis to determine the need for a mass notification system in accordance with Section 13.7.1.15. [101:38.3.4.5.1]

13.7.2.25.5.2*  A risk analysis to determine the need for a mass notification system in accordance with Section 13.7.1.15 shall be conducted for buildings containing a classroom where the building is owned, rented, leased, or operated by a college or university. [101:38.3.4.5.2]

13.7.2.26.1  General.
A fire alarm system in accordance with Section 13.7 shall be provided in all existing business occupancies where any one of the following conditions exists:

1. The building is three or more stories in height.
2. The occupancy is subject to 100 or more occupants above or below the level of exit discharge.
3. The occupancy is subject to 1000 or more total occupants.

[101:39.3.4.1]

13.7.2.27.1  General.
A fire alarm system shall be required in accordance with Section 13.7 for new and existing industrial occupancies, unless the total occupant load of the building is under 100 persons and unless, of these, fewer than 25 persons are above or below the level of exit discharge.

[101:40.3.4.1]

14.2  Exit Access Corridors.
Corridors used as exit access and serving an area having an occupant load exceeding 30 shall be separated from other parts of the building by walls having not less than a 1-hour fire resistance rating in accordance with Section 12.7, unless otherwise permitted by one of the following:
1. This requirement shall not apply to existing buildings, provided that the occupancy classification does not change.
2. This requirement shall not apply where otherwise provided in Chapters 11 through 43 of NFPA 101. [101:7.1.3.1]

14.3 Exits.
14.3.1 Where this Code requires an exit to be separated from other parts of the building, the separating construction shall meet the requirements of Section 8.2 of NFPA 101 and the following:

1. *The separation shall have a minimum 1-hour fire resistance rating where the exit connects three or fewer stories.
2. The separation specified in 14.3.1(1), other than an existing separation, shall be supported by construction having not less than a 1-hour fire resistance rating.
3. *The separation shall have a minimum 2-hour fire resistance rating where the exit connects four or more stories, unless one of the following conditions exists:
   1. In existing non-high-rise buildings, existing exit stair enclosures shall have a minimum 1-hour fire resistance rating.
   2. In existing buildings protected throughout by an approved, supervised automatic sprinkler system in accordance with Section 13.3, existing exit stair enclosures shall have a minimum 1-hour fire resistance rating.
   3. The minimum 1-hour enclosures in accordance with 28.2.2.1.2, 29.2.2.1.2, 30.2.2.1.2, and 31.2.2.1.2 of NFPA 101 shall be permitted as an alternative to the requirement of 14.3.1(3).
4. Reserved.
5. The minimum 2-hour fire resistance–rated separation required by 14.3.1(3) shall be constructed of an assembly of noncombustible or limited-combustible materials and shall be supported by construction having a minimum 2-hour fire resistance rating, unless otherwise permitted by 14.3.1(7).
6. *Structural elements, or portions thereof, that support exit components and either penetrate into a fire resistance–rated assembly or are installed within a fire resistance–rated wall assembly shall be protected, as a minimum to the fire resistance rating required by 14.3.1(1) or 14.3.1(3).
7. In Type III, Type IV, and Type V construction, as defined in NFPA 220 (see 8.2.1.2 of NFPA 101), fire retardant–treated wood enclosed in noncombustible or limited-combustible materials shall be permitted in accordance with NFPA 220.
8. Openings in the separation shall be protected by fire door assemblies equipped with door closers complying with 14.5.4.
9. *Openings in exit enclosures shall be limited to door assemblies from normally occupied spaces and corridors and door assemblies for egress from the enclosure, unless one of the following conditions exists:
   1. Vestibules that separate normally unoccupied spaces from an exit enclosure shall be permitted provided the vestibule is separated from adjacent spaces by corridor
walls and related opening protective components as required for the occupancy involved but not less than a smoke partition in accordance with Section 8.4 of NFPA 101.

2. In buildings of Type I or Type II construction as defined in NFPA 220 (see 8.2.1.2 of NFPA 101), fire protection-rated door assemblies to normally unoccupied building service equipment support areas as addressed in Section 7.13 of NFPA 101 shall be permitted, provided the space is separated from the exit enclosure by fire barriers as required by 14.3.1(3).

3. Openings in exit passageways in mall buildings as provided in Chapters 36 and 37 of NFPA 101 shall be permitted.

4. In buildings of Type I or Type II construction, as defined in NFPA 220 (see 8.2.1.2 of NFPA 101), existing fire protection-rated door assemblies to interstitial spaces shall be permitted, provided that such spaces meet all of the following criteria:
   1. The space is used solely for distribution of pipes, ducts, and conduits.
   2. The space contains no storage.
   3. The space is separated from the exit enclosure in accordance with Section 12.7.

5. Existing openings to mechanical equipment spaces protected by approved existing fire protection-rated door assemblies shall be permitted, provided that the following criteria are met:
   1. The space is used solely for non-fuel-fired mechanical equipment.
   2. The space contains no storage of combustible materials.
   3. The building is protected throughout by an approved, supervised automatic sprinkler system in accordance with Section 13.3 or the mechanical equipment space is provided with sprinkler protection in accordance with Section X.X and provided with complete smoke detection in accordance with Section X.X.

10. Penetrations into, and openings through, an exit enclosure assembly shall be limited to the following:
   1. Door assemblies permitted by 14.3.1(9)
   2. Electrical conduit serving the exit enclosure stairway
   3. Pathways for devices for security and communication systems serving the exit enclosure, where pathways are installed in metal conduit

11. Penetrations or communicating openings shall be prohibited between adjacent exit enclosures.

12. All penetrations in fire barriers separating the exit from other parts of the building shall be protected in accordance with X.X.X.

12.13. Membrane penetrations shall be permitted on the exit access side of the exit enclosure and shall be protected in accordance with 12.7.5.6.
14.4.3 Impediments to Egress.
Any device or alarm installed to restrict the improper use of a means of egress, and any device or system installed to monitor or record use of a means of egress, shall be designed and installed so that it cannot, even in case of failure, impede or prevent emergency use of such means of egress unless otherwise provided in 14.5.3 and Chapters 18, 19, 22, and 23 of NFPA 101.

14.5.1.2# Door Leaf Swing Direction.
Door leaves required to be of the side-hinged or pivoted-swinging type shall swing in the direction of egress travel under any of the following conditions:

1. Where serving a room or area with an occupant load of 50 or more, except under any of the following conditions:
   1. Door leaves in horizontal exits shall not be required to swing in the direction of egress travel where permitted by 7.2.4.3.8.1 or 7.2.4.3.8.2 of NFPA 101.
   2. Door leaves in smoke barriers shall not be required to swing in the direction of egress travel in existing health care occupancies, as provided in Chapter 19 of NFPA 101.
   3. Where the door assembly is used in an exit enclosure, unless the door opening serves an individual living unit that opens directly into an exit enclosure
   4. Where the door opening serves a high hazard contents area

14.5.1.3.2 When fully open, any door leaf in a means of egress shall not project more than 7 in. (180 mm) into the required width of an aisle, a corridor, a passageway, or a landing, unless the door leaf is equipped with an approved self-closing device and is not required by the provisions of 14.5.1.2 to swing in the direction of egress travel.

14.5.1.3.3 Surface-mounted latch release hardware on the door leaf shall be exempt from being included in the maximum 7 in. (180 mm) projection requirement of 14.5.1.3.2, provided that both of the following criteria are met:

1. The hardware is mounted to the side of the door leaf that faces the aisle, corridor, passageway, or landing when the door leaf is in the open position.
2. The hardware is mounted not less than 34 in. (865 mm), and not more than 48 in. (1220 mm), above the floor.
Exterior door assemblies shall be permitted to have key-operated locks from the egress side, provided that all of the following criteria are met:

1. This alternative is permitted in Chapters 11 through 43 of NFPA 101 for the specific occupancy.
2. A readily visible, durable sign in letters not less than 1 in. (25 mm) high on a contrasting background that reads as follows is located on or adjacent to the door leaf: THIS DOOR TO REMAIN UNLOCKED WHEN THE BUILDING IS OCCUPIED
3. The locking device is of a type that is readily distinguishable as locked.
4. A key is immediately available to any occupant inside the building when it is locked.

Where permitted by Chapters 11 through 43 of NFPA 101, two releasing operations shall be permitted for doors secured against unwanted entry.

Door assemblies in the means of egress shall be permitted to be electrically locked if equipped with approved listed electrical locking systems released by the operation of door hardware that incorporates a built-in switch, provided that all of the following conditions are met:

1. The hardware for egress-side occupant release of the electrical lock is affixed to the door leaf.
2. The hardware has an obvious method of operation that is readily operated in the direction of egress under all lighting conditions.
3. The hardware is capable of being operated with one hand in the direction of egress.
4. Operation of the hardware directly interrupts the power supply directly to the electric lock and unlocks the door assembly in the direction of egress.
5. *Loss of power to the listed releasing hardware automatically electrically unlocks the door assembly in the direction of egress.
6. Hardware for new installations is listed in accordance with ANSI/UL 294.

If a stair enclosure allows access to the roof of the building, the door assembly to the roof either shall be kept locked or shall allow re-entry from the roof.
14.5.2.11

Where pairs of door leaves are required in a means of egress, one of the following criteria shall be met:

1. Each leaf of the pair shall be provided with a releasing device that does not depend on the release of one leaf before the other.

2. Approved automatic flush bolts shall be used and arranged such that both of the following criteria are met:
   
   a. The door leaf equipped with the automatic flush bolts shall have no doorknob or surface-mounted hardware on the egress side of the door.
   
   b. Unlatching of any leaf shall not require more than one operation.

[101:7.2.1.5.11]

14.5.3.1 Delayed-Egress Electrical Locking Systems.

14.5.3.1.1 Approved, listed, delayed-egress electrical locking systems shall be permitted to be installed on door assemblies serving low and ordinary hazard contents in buildings protected throughout by an approved, supervised automatic fire detection system in accordance with Section 13.7 or an approved, supervised automatic sprinkler system in accordance with Section 13.3, and where permitted in Chapters 11 through 43 of NFPA 101, provided that the following criteria are met:

1. The delay of the delayed-egress electrical locking system door leaves shall deactivate allowing unobstructed egress unlock upon actuation of one of the following:
   
   1. Approved, supervised automatic sprinkler system in accordance with Section 13.3
   2. Not more than one heat detector of an approved, supervised automatic fire detection system in accordance with Section 13.7
   3. Not more than two smoke detectors of an approved, supervised automatic fire detection system in accordance with Section 13.7

2. The delay of the delayed-egress electrical locking system door leaves shall deactivate allowing unobstructed egress unlock upon loss of power controlling the lock or locking mechanism.

3. *An irreversible process shall release the electrical lock in the direction of egress unlock within 15 seconds, or 30 seconds where approved by the AHJ, upon application of a force to the release device required in 14.5.2.10 under all of the following conditions:
   
   1. The force shall not be required to exceed 15 lbf (67 N).
   2. The force shall not be required to be continuously applied for more than 3 seconds.
   3. The initiation of the release process shall activate an audible signal in the vicinity of the door opening.
   4. Once the electrical lock has been released by the application of force to the releasing device, rearming the delay electronics shall be by manual means only.
4. *A readily visible, durable sign that conforms to the visual characters requirements of ICC/ANSI A117.1 in letters not less than 1 in. (25 mm) high and not less than 1/8 in. (3.2 mm) in stroke width on a contrasting background shall be located on the door leaf adjacent to the release device in the direction of egress, and shall read as follows:*

1. PUSH UNTIL ALARM SOUNDS, DOOR CAN BE OPENED IN 15 SECONDS, for doors that swing in the direction of egress travel

2. PULL UNTIL ALARM SOUNDS, DOOR CAN BE OPENED IN 15 SECONDS, for doors that swing against the direction of egress travel

5. The egress side of doors equipped with delayed-egress electrical locking systemshall be provided with emergency lighting in accordance with Section 7.9 of NFPA 101.

5.6. Hardware for new installations shall be listed in accordance with ANSI/UL 294, Standard for Access Control System Units.

\[101:7.2.1.6.1.1\]

14.5.3.1.2

The provisions of 14.5.3.2 for sensor-release of electrical locking systems for access-controlled egress door assemblies shall not apply to door assemblies with delayed-egress electrical locking systems. \[101:7.2.1.6.1.2\]


Where permitted in Chapters 11 through 43 of NFPA 101, door assemblies in the means of egress shall be permitted to be equipped with sensor-release electrical locking system hardware approved entrance and egress access control system, provided that all of the following criteria are met:

1. A sensor shall be provided on the egress side, arranged to electrically unlock the door leaf in the direction of egress upon detection of an approaching occupant.

2. Door leaves shall automatically electrically unlock in the direction of egress upon loss of power to the sensor or to the part of the access controllocking system that electrically locks the door leaves.

3. Door locks shall be arranged to electrically unlock in the direction of egress from a manual release device complying with all of the following criteria:

   1. The manual release device shall be located on the egress side, 40 in. to 48 in. (1015 mm to 1220 mm) vertically above the floor, and within 60 in. (1525 mm) of the secured door openings.

   2. The requirement of XXXXX to locate the manual release device within 60 in. (1525 mm) of the secured door opening shall not apply to previously approved existing installations.

   3. The manual release device shall be readily accessible and clearly identified by a sign that reads as follows: PUSH TO EXIT.

   4. When operated, the manual release device shall result in direct interruption of power to the electrical lock — independent of the locking system electronics — and the lock shall remain unlocked for not less than 30 seconds.
4. Activation of the building fire-protective signaling system, if provided, shall automatically electrically unlock the door leaves in the direction of egress, and the door leaves shall remain electrically unlocked until the fire-protective signaling system has been manually reset.

5. The activation of manual fire alarm boxes that activate the building fire-protective signaling system specified in 14.5.3.2(4) shall not be required to unlock the door leaves.

6. Activation of the building automatic sprinkler or fire detection system, if provided, shall automatically electrically unlock the door leaves in the direction of egress, and the door leaves shall remain electrically unlocked until the fire-protective signaling system has been manually reset.

7. The egress side of sensor-release electrically locked access-controlled egress doors, other than existing sensor-release electrically locked access-controlled egress doors, shall be provided with emergency lighting in accordance with Section 14.13.

Hardware for new installations shall be listed in accordance with ANSI/UL 294.

101:7.2.1.6.2

14.5.3.3 Elevator Lobby Exit Access Door Assemblies Locking.
Where permitted in Chapters 11 through 43 of NFPA 101, door assemblies separating the elevator lobby from the exit access required by 14.9.1.6.1 shall be permitted to be electrically electronically locked, provided that all the following criteria are met:

1. The electrical locking hardware is listed in accordance with ANSI/UL 294, Standard for Access Control System Units.

2. The building is protected throughout by a fire alarm system in accordance with Section 13.7.

3. The building is protected throughout by an approved, supervised automatic sprinkler system in accordance with Section 13.3.

4. Waterflow in the sprinkler system required by 14.5.3.3(3) is arranged to initiate the building fire alarm system.

5. The elevator lobby is protected by an approved, supervised smoke detection system in accordance with Section 13.7.

6. Detection of smoke by the detection system required by 14.5.3.3(5) is arranged to initiate the building fire alarm system and notify building occupants.

7. Initiation of the building fire alarm system by other than manual fire alarm boxes unlocks the electrical locks on the elevator lobby door assembly.

8. Loss of power to the elevator lobby electrical electronic lock system unlocks the electrical locks on the elevator lobby door assemblies.

9. Once unlocked, the elevator lobby door assemblies remain electrically unlocked until the building fire alarm system has been manually reset.

10. Where the elevator lobby door assemblies remain mechanically latched after being electrically unlocked, latch-releasing hardware in accordance with 14.5.2.10 is affixed to the door leaves.

11. A two-way communication system is provided for communication between the elevator lobby and a central control point that is constantly staffed.
12. The central control point staff required by 14.5.3.3(11) is capable, trained, and authorized to provide emergency assistance.

13. The provisions of 14.5.3.1 for delayed-egress electrical locking systems are not applied to the elevator lobby door assemblies.

14. *The provisions of 14.5.3.2 for sensor-release of electrical locking systems access-controlled egress door assemblies are not applied to the elevator lobby door assemblies. [101:7.2.1.6.3]

14.5.3.4*

14.5.3.4.1 Where a side-hinged or pivoted-swinging door assembly is required to be equipped with panic or fire exit hardware, such hardware shall meet all of the following criteria:

1. It shall consist of a cross bar or a push pad, with the length of the actuating portion of which extends across the cross bar or push pad not less than one-half of the width of the door leaf.

2. It shall be mounted as follows:

   a. New installations shall be not less than 34 in. (865 mm), nor and not more than 48 in. (1220 mm), above the floor.

   b. Existing installations shall be not less than 30 in. (760 mm), nor and not more than 48 in. (1220 mm), above the floor.

3. It shall be constructed so that a horizontal force not to exceed 15 lbf (66 N) actuates the cross bar or push pad and latches. [101:7.2.1.7.1]

14.5.3.4.2* Only approved fire exit hardware shall be used on fire protection-rated door assemblies. New panic hardware and new fire exit hardware shall comply with ANSI/UL 305 and ANSI/BHMA A156.3. [101:7.2.1.7.2]

14.5.3.4.3 Delayed Action Closers. Doors required to be self-closing and not required to be automatic closing shall be permitted to be equipped with delayed action closers. [101:7.2.1.8.4]

14.5.5* Powered Door Leaf Operation.

14.5.5.1* General.

Where means of egress door leaves are operated by power upon the approach of a person or are provided with power-assisted manual operation, the design shall be such that, in the event of power failure, the leaves open manually to allow egress travel or close when necessary to safeguard the means of egress. [101:7.2.1.9.1]

14.5.5.1.1
New power-operated swinging doors, power-operated sliding doors, and power-operated folding doors shall comply with ANSI/BHMA A156.10, *Power Operated Pedestrian Doors*. [101:7.2.1.9.1.1]

14.5.5.1.2
New power-assisted swinging doors and low-energy power-operated swinging doors shall comply with ANSI/BHMA A156.19, *Power Assist and Low Energy Power Operated Doors*. [101:7.2.1.9.1.2]

14.5.5.1.3
New low-energy power-operated sliding doors and low-energy power-operated folding doors shall comply with ANSI/BHMA A156.38, *Low Energy Power Operated Sliding and Folding Doors*. [101:7.2.1.9.1.3]

14.5.5.1.4
The forces required to manually open the door leaves specified in 7.2.1.9.1 shall not exceed those required in 7.2.1.4.5, except that the force required to set the leaf in motion shall not exceed 50 lbf (222 N). [101:7.2.1.9.1.4]

14.5.5.1.5
The door assembly shall be designed and installed so that, when a force is applied to the door leaf on the side from which egress is made, it shall be capable of swinging from any position to provide full use of the required width of the opening in which it is installed. (See 7.2.1.4.) [101:7.2.1.9.1.5]

14.5.5.1.6
A readily visible, durable sign in letters not less than 1 in. (25 mm) high on a contrasting background that reads as follows shall be located on the egress side of each door opening: IN EMERGENCY, PUSH TO OPEN [101:7.2.1.9.1.6]

14.5.5.1.7
Sliding, power-operated door assemblies in an exit access serving an occupant load of fewer than 50 that manually open in the direction of door leaf travel, with forces not exceeding those required in 7.2.1.4.5, shall not be required to have the swing-out feature required by 7.2.1.9.1.5. The required sign shall be in letters not less than 1 in. (25 mm) high on a contrasting background and shall read as follows: IN EMERGENCY, SLIDE TO OPEN [101:7.2.1.9.1.7]

14.5.5.1.8*
In the emergency breakout mode, a door leaf located within a two-leaf opening shall be exempt from the minimum 32 in. (810 mm) single-leaf requirement of 7.2.1.2.3.2(1), provided that the clear width of the single leaf is not less than 30 in. (760 mm). [101:7.2.1.9.1.8]
For a biparting sliding door assembly in the emergency breakout mode, a door leaf located within a multiple-leaf opening shall be exempt from the minimum 32 in. (810 mm) single-leaf requirement of 7.2.1.3.2(1) if a clear opening of not less than 32 in. (810 mm) is provided by all leafs broken out. [101: 7.2.1.9.1.9]

Door assemblies complying with 7.2.1.14 shall be permitted to be used. [101: 7.2.1.9.1.10]

The requirements of 7.2.1.9.1 through 7.2.1.9.1.10 shall not apply in detention and correctional occupancies where otherwise provided in Chapters 22 and 23. [101: 7.2.1.9.1.11]

14.5.5.2 Self-Closing or Self-Latching Door Leaf Operation.
Where door leaves are required to be self-closing or self-latching and are operated by power upon the approach of a person, or are provided with power-assisted manual operation, they shall be permitted in the means of egress where they meet the following criteria:

1. The door leaves can be opened manually in accordance with 7.2.1.9.1 to allow egress travel in the event of power failure.
2. New door leaves remain in the closed position, unless actuated or opened manually.
3. When actuated, new door leaves remain open for not more than 30 seconds.
4. Door leaves held open for any period of time close — and the power-assist mechanism ceases to function — upon operation of approved smoke detectors installed in such a way as to detect smoke on either side of the door opening in accordance with the provisions of NFPA 72.
5. Door leaves required to be self-latching are either self-latching or become self-latching upon operation of approved smoke detectors per 7.2.1.9.2(4).

14.5.6 Revolving Door Assemblies.

Revolving door assemblies, whether used or not used in the means of egress, shall comply with all of the following:

1. New revolving doors shall comply with ANSI/BHMA A156.27, Power and Manual Operated Revolving Doors, and shall be installed in accordance with the manufacturer’s installation instructions.
2. Revolving door wings shall be capable of book-fold or breakout for egress in accordance with BHMA A156.27, unless they are existing revolving doors approved by the authority having jurisdiction.

3. When revolving door wings are collapsed into the book-fold position, the parallel egress paths formed shall provide an aggregate width of 36 in. (915 mm), unless they are approved existing revolving door assemblies.

4. Revolving door assemblies shall not be used within 10 ft (3050 mm) of the foot or the top of stairs or escalators.

5. A dispersal area acceptable to the authority having jurisdiction shall be located between stairs or escalators and the revolving door assembly.

6. The revolutions per minute (rpm) of door wings shall not exceed the following:
   1. The values in Table 7.2.1.10.1 for existing revolving doors.
   2. The values in BHMA A156.27 for new revolving doors.

7. Each revolving door assembly shall have a conforming side-hinged swinging door assembly in the same wall as the revolving door within 10 ft (3050 mm) of the revolving door, unless one of the following conditions applies:
   1. Revolving door assemblies shall be permitted without adjacent swinging door assemblies, as required by 7.2.1.10.1(6), in street floor elevator lobbies, provided that no stairways or door openings from other parts of the building discharge through the lobby and the lobby has no occupancy other than as a means of travel between the elevators and street.
   2. The requirement of 7.2.1.10.1(6) shall not apply to existing revolving door assemblies where the number of revolving door assemblies does not exceed the number of swinging door assemblies within 20 ft (6100 mm) of the revolving door assembly.

Table 14.5.6.1 Existing Revolving Door Assembly Maximum Speed

<table>
<thead>
<tr>
<th>Inside Diameter</th>
<th>Power-Driven Speed Control (rpm)</th>
<th>Manual Speed Control (rpm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>ft/in.</td>
<td>mm</td>
<td></td>
</tr>
<tr>
<td>6 ft 6 in.</td>
<td>1980</td>
<td>11</td>
</tr>
<tr>
<td>7 ft</td>
<td>2135</td>
<td>10</td>
</tr>
<tr>
<td>7 ft 6 in.</td>
<td>2285</td>
<td>9</td>
</tr>
<tr>
<td>8 ft</td>
<td>2440</td>
<td>9</td>
</tr>
<tr>
<td>8 ft 6 in.</td>
<td>2590</td>
<td>8</td>
</tr>
<tr>
<td>9 ft</td>
<td>2745</td>
<td>8</td>
</tr>
<tr>
<td>9 ft 6 in.</td>
<td>2895</td>
<td>7</td>
</tr>
<tr>
<td>10 ft</td>
<td>3050</td>
<td>7</td>
</tr>
</tbody>
</table>

Where permitted in Chapters 11 through 43, revolving door assemblies shall be permitted as a component in a means of egress, provided that all of the following criteria are met:
1. Revolving door openings shall not be given credit for more than 50 percent of the required egress capacity.

2. Each revolving door opening shall not be credited with more than a 50-person capacity or, if of not less than a 9 ft (2745 mm) diameter, a revolving door assembly shall be permitted egress capacity based on the clear opening width provided when collapsed into a book-fold position.

3. Revolving door wings shall be capable of being collapsed into a book-fold position when a force not exceeding 130 lbf (580 N) is applied to the wings within 3 in. (75 mm) of the outer edge. [101:7.2.1.10.2]

14.5.6.3 Revolving door assemblies not used as a component of a means of egress shall have a collapsing force not exceeding 180 lbf (800 N) applied at a point 3 in. (75 mm) from the outer edge of the outer wing stile and 40 in. (1015 mm) above the floor. [101:7.2.1.10.3]

14.5.6.4 The requirement of 7.2.1.10.3 shall not apply to revolving door assemblies, provided that the collapsing force is reduced to a force not to exceed 130 lbf (580 N) under all of the following conditions:

1. Power failure, or removal of power to the device holding the wings in position
2. Actuation of the automatic sprinkler system, where such a system is provided
3. Actuation of a smoke detection system that is installed to provide coverage in all areas within the building that are within 75 ft (23 m) of the revolving door assemblies
4. Actuation of a clearly identified manual control switch in an approved location that reduces the holding force to a force not to exceed 130 lbf (580 N) [101:7.2.1.10.4]

14.5.7 Turnstiles and Similar Devices

14.5.7.1

Turnstiles or similar devices that restrict travel to one direction or are used to collect fares or admission charges shall not be placed so as to obstruct any required means of egress, unless otherwise specified in 7.2.1.11.1.1, 7.2.1.11.1.2, and 7.2.1.11.1.3. [101:7.2.1.11.1]

14.5.7.1.1
Approved turnstiles not exceeding 39 in. (990 mm) in height that turn freely in the direction of egress travel shall be permitted where revolving door assemblies are permitted in Chapters 11 through 43. [101:7.2.1.11.1.1]

14.5.7.1.2
Where turnstiles are approved by the authority having jurisdiction and permitted in Chapters 11 through 43, each turnstile shall be credited for a capacity of 50 persons, provided that such turnstiles meet all of the following criteria:

1. They freewheel in the egress direction when primary power is lost, and freewheel in the direction of egress travel upon manual release by an employee assigned in the area.
2. They are not given credit for more than 50 percent of the required egress width.
3. They are not in excess of 39 in. (990 mm) in height and have a clear width of not less than 161⁄2 in. (420 mm).

[101:7.2.1.11.1.2]

14.5.7.1.3*
Security access turnstiles that impede travel in the direction of egress utilizing a physical barrier shall be permitted to be considered as a component of the means of egress, where permitted in Chapters 11 through 43, provided that all the following criteria are met:

1. The building is protected throughout by an approved, supervised automatic sprinkler system in accordance with Section 9.7.
2. Each security access turnstile lane configuration has a minimum clear passage width of 22 in. (560 mm).
3. Any security access turnstile lane configuration providing a clear passage width of less than 32 in. (810 mm) shall be given an egress capacity of 50 persons.
4. Any security access turnstile lane configuration providing a clear passage width of 32 in. (810 mm) or more shall be given an egress capacity as calculated in accordance with Section 7.3.
5. Each secured physical barrier shall automatically retract or swing to an unobstructed open position in the direction of egress, under each of the following conditions:
   1. Upon loss of power to the turnstile or any part of the access control system that secures the physical barrier
   2. Upon actuation of a readily accessible and clearly identified manual release device that results in direct interruption of power to each secured physical barrier, remains in the open position for not less than 30 seconds, and is positioned at one of the following locations:
      1. The manual release device is located on the egress side of each security access turnstile lane.
      2. The manual release device is located at an approved location where it can be actuated by an employee assigned to the area.
   3. Upon actuation of the building fire-protective signaling system, if provided, and for which the following apply:
1. The physical barrier remains in the open position until the fire-protective signaling system is manually reset.

2. The actuation of manual fire alarm boxes that actuate the building fire-protective signaling system is not required to meet the requirements specified in 7.2.11.1.3(5)(c).

4. Upon actuation of the building automatic sprinkler or fire detection system, and for which the physical barrier remains in the open position until the fire-protective signaling system is manually reset

[101:7.2.1.11.3]

14.5.7.2
Turnstiles exceeding 39 in. (990 mm) in height shall meet the requirements for revolving door assemblies in 7.2.1.10 or the requirements of 7.2.11.1.3 for security access turnstiles.

[101:7.2.1.11.2]

14.5.7.3
Turnstiles located in, or furnishing access to, required exits shall provide not less than 16\(\frac{1}{2}\) in. (420 mm) clear width at and below a height of 39 in. (990 mm) and at least 22 in. (560 mm) clear width at heights above 39 in. (990 mm).

[101:7.2.1.11.3]

14.5.8 Door Openings in Folding Partitions.

Where permanently mounted folding or movable partitions divide a room into smaller spaces, a swinging door leaf or open doorway shall be provided as an exit access from each such space, unless otherwise specified in 7.2.1.12.1 and 7.2.1.12.2.

[101:7.2.1.12]

14.5.8.2
A door leaf or opening in the folding partition shall not be required, provided that all of the following criteria are met:

1. The subdivided space is not used by more than 20 persons at any time.
2. The use of the space is under adult supervision.
3. The partitions are arranged so that they do not extend across any aisle or corridor used as an exit access to the required exits from the story.
4. The partitions conform to the interior finish and other requirements of this Code.
5. The partitions are of an approved type, have a simple method of release, and are capable of being opened quickly and easily by experienced persons in case of emergency.

[101:7.2.1.12.1]
Where a subdivided space is provided with not less than two means of egress, the swinging door leaf in the folding partition specified in 7.2.1.12 shall not be required, and one such means of egress shall be permitted to be equipped with a horizontal-sliding door assembly complying with 7.2.1.14. [101:7.2.1.12.2]

14.5.9 Balanced Door Assemblies. If panic hardware is installed on balanced door leaves, the panic hardware shall be of the push-pad type, and the pad shall not extend more than approximately one-half the width of the door leaf, measured from the latch stile. [See 7.2.1.7.1(1)] [101:7.2.1.13]

14.5.10 Special-Purpose Horizontally Sliding Accordion or Folding Door Assemblies. Special-purpose horizontally sliding accordion or folding door assemblies shall be permitted in means of egress, provided that all of the following criteria are met:

1. The door leaf is readily operable from either side without special knowledge or effort.
2. The force that, when applied to the operating device in the direction of egress, is required to operate the door leaf is not more than 15 lbf (67 N).
3. The force required to operate the door leaf in the direction of travel is not more than 30 lbf (133 N) to set the leaf in motion and is not more than 15 lbf (67 N) to close the leaf or open it to the minimum required width.
4. The door leaf is operable using a force of not more than 50 lbf (222 N) when a force of 250 lbf (1100 N) is applied perpendicularly to the leaf adjacent to the operating device, unless the door opening is an existing special-purpose horizontally sliding accordion or folding exit access door assembly serving an area with an occupant load of fewer than 50.
5. The door assembly complies with the fire protection rating, if required, and, where rated, is self-closing or automatic-closing by means of smoke detection in accordance with 7.2.1.8 and is installed in accordance with NFPA 80.

[101:7.2.1.14]

14.5.11 Inspection of Door Openings.

14.5.11.1 Where required by Chapters 11 through 43, the following door assemblies shall be inspected and tested not less than annually in accordance with 7.2.1.15.2 through 7.2.1.15.7:

1. Door leaves equipped with panic hardware or fire exit hardware in accordance with 7.2.1.7
2. Door assemblies in exit enclosures
3. Door hardware-release of electrically locked egress door assemblies
4. Door assemblies with special locking arrangements subject to 7.2.1.6

[101:7.2.1.15.1]
14.5.11.2*

The inspection and testing interval for fire-rated and nonrated door assemblies shall be permitted to exceed 12 months under a written performance-based program. [101:7.2.1.15.2]

14.5.11.2.1
Goals established under a performance-based program shall provide assurance that the door assembly will perform its intended function. [101:7.2.1.15.2.1]

14.5.11.2.2
Technical justification for inspection, testing, and maintenance intervals shall be documented. [101:7.2.1.15.2.2]

14.5.11.2.3
The performance-based option shall include historical data. [101:7.2.1.15.2.3]

14.5.11.3
A written record of the inspections and testing shall be signed and kept for inspection by the authority having jurisdiction. [101:7.2.1.15.3]

14.5.11.4
Functional testing of door assemblies shall be performed by individuals who can demonstrate knowledge and understanding of the operating components of the type of door being subjected to testing. [101:7.2.1.15.4]

14.5.11.5
Door assemblies shall be visually inspected from both sides of the opening to assess the overall condition of the assembly. [101:7.2.1.15.5]

14.5.11.6
As a minimum, the following items shall be verified:

1. Floor space on both sides of the openings is clear of obstructions, and door leaves open fully and close freely.
2. Forces required to set door leaves in motion and move to the fully open position do not exceed the requirements in 7.2.1.4.5.
3. Latching and locking devices comply with 7.2.1.5.
4. Releasing hardware devices are installed in accordance with 7.2.1.5.10.1.
5. Door leaves of paired openings are installed in accordance with 7.2.1.5.11.
6. Door closers are adjusted properly to control the closing speed of door leaves in accordance with accessibility requirements.
7. Projection of door leaves into the path of egress does not exceed the encroachment permitted by 7.2.1.4.3.
8. Powered door openings operate in accordance with 7.2.1.9.
9. Signage required by 7.2.1.4.1(3), 7.2.1.5.5, 7.2.1.6, and 7.2.1.9 is intact and legible.
10. Door openings with special locking arrangements function in accordance with 7.2.1.6.
11. Security devices that impede egress are not installed on openings, as required by 7.2.1.5.12.
12. Where required by 7.2.2.5.5.7, door hardware marking is present and intact.
13. Emergency lighting on sensor-release of electrical locking systems and doors equipped with delayed-egress electrical locking systems is present in accordance with Section 7.9.

[101:7.2.1.15.6]

14.5.11.7*
Door openings not in proper operating condition shall be repaired or replaced without delay.

[101:7.2.1.15.7]

14.5.4.2
In any building of low or ordinary hazard contents, as defined in 3.3.144.2 and 3.3.144.3, or where approved by the AHJ, doors and doors leaves shall be permitted to be automatic-closing, provided that all of the following criteria are met:

1. Upon release of the hold-open mechanism, the leaf becomes self-closing.
2. The release device is designed so that the leaf instantly releases manually and, upon release, becomes self-closing, or the leaf can be readily closed.
3. The automatic releasing mechanism or medium is activated by the operation of approved smoke detectors installed in accordance with the requirements for smoke detectors for door leaf release service in NFPA 72.
4. Upon loss of power to the hold-open device, the hold-open mechanism is released and the door leaf becomes self-closing.
5. The release by means of smoke detection of one door leaf in a stair enclosure results in the closing of all door leaves serving that stair. [101:7.2.1.8.2]

14.6.2.2
Construction shall extend vertically from the finished ground level to a point 10 ft (3050 mm) above the topmost landing of the stairs or to the roofline, whichever is lower. [101:7.2.2.5.2.2]

14.6.2.3
The fire resistance rating of the separation extending 10 ft (3050 mm) from the stairs shall not be required to exceed 1 hour where openings have not less than a 3/4-hour fire protection rating. [101:7.2.2.5.2.3]
14.7.4.1
The width of an exit passageway shall be sized to accommodate the aggregate required capacity of all exits that discharge through it, unless one of the following conditions applies:

1. *Where an exit passageway serves occupants of the level of exit discharge as well as other stories, the capacity shall not be required to be aggregated."

2. As provided in Chapters 36 and 37 of NFPA 101, an exit passageway in a mall structure shall be permitted to accommodate occupant loads independently from the mall concourse and the tenant spaces. *(See 36.2.2.7.2 and 37.2.2.7.2 of NFPA 101.)*

14.8.1.1.1
The total capacity of the means of egress for any story, balcony, tier, or other occupied space shall be sufficient for the occupant load thereof unless one of the following conditions exists:

*(14.8.1.1.1)* The authority having jurisdiction shall be permitted to establish the occupant load as the number of persons for which existing means of egress is adequate, provided that measures are established to prevent occupancy by a greater number of persons.

*(2)* The egress capacity shall have been previously approved as being adequate.

*101:7.3.1.1.1*

<table>
<thead>
<tr>
<th>Use</th>
<th>(ft²/ person)a</th>
<th>(m²/ person)b</th>
</tr>
</thead>
<tbody>
<tr>
<td>Concentrated use, without fixed seating</td>
<td>7 net</td>
<td>0.65 net</td>
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<tr>
<td>Less concentrated use, without fixed seating</td>
<td>15 net</td>
<td>1.4 net</td>
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<tr>
<td>Bench-type seating</td>
<td>1 person/18 linear in.</td>
<td>1 person/455 linear mm</td>
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<tr>
<td>Fixed seating</td>
<td>Use number of fixed seats</td>
<td>Use number of fixed seats</td>
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<tr>
<td>Waiting spaces</td>
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<td>Casinos and similar gaming areas</td>
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<td><strong>Air traffic</strong> levels</td>
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<td>3.7</td>
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<tr>
<td><strong>Day-Care Use</strong></td>
<td>35 net</td>
<td>3.3 net</td>
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<td><strong>Detention and Correctional Use</strong></td>
<td>120</td>
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<td>Classrooms</td>
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<td>Shops, laboratories, vocational rooms</td>
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<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Inpatient treatment departments</td>
<td>240</td>
<td>22.3</td>
</tr>
<tr>
<td>Sleeping departments</td>
<td>120</td>
<td>11.1</td>
</tr>
<tr>
<td>Ambulatory health care</td>
<td>150</td>
<td>13</td>
</tr>
<tr>
<td><strong>Industrial Use</strong></td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>General and high hazard industrial</td>
<td>100</td>
<td>9.3</td>
</tr>
</tbody>
</table>

**Special-purpose industrial**          | NA                              | NA                              |

**Mercantile Use**                        | -                               | -                               |
<p>| Sales area on street floor                 | 30                              | 2.8                             |
| Sales area on two or more street floors   | 40                              | 3.7                             |
| Sales area on floor below street floor    | 30                              | 2.8                             |
| Sales area on floors above street         | 60                              | 5.6                             |</p>
<table>
<thead>
<tr>
<th>Use</th>
<th>( (\text{ft}^2/\text{person})^a )</th>
<th>( (\text{m}^2/\text{person})^b )</th>
</tr>
</thead>
<tbody>
<tr>
<td>Floors or portions of floors used only for offices</td>
<td>See business use.</td>
<td>See business use.</td>
</tr>
<tr>
<td>Floors or portions of floors used only for storage, receiving, and shipping, and not open to general public</td>
<td>300</td>
<td>27.9</td>
</tr>
<tr>
<td>Mall buildings(^c)structures(^d)</td>
<td>Per factors applicable to use of space(^e)</td>
<td></td>
</tr>
<tr>
<td><strong>Residential Use</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hotels and dormitories</td>
<td>200</td>
<td>18.6</td>
</tr>
<tr>
<td>Apartment buildings</td>
<td>200</td>
<td>18.6</td>
</tr>
<tr>
<td>Board and care, large</td>
<td>200</td>
<td>18.6</td>
</tr>
<tr>
<td><strong>Storage Use</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>In storage occupancies</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>In mercantile occupancies</td>
<td>300</td>
<td>27.9</td>
</tr>
<tr>
<td>In other than storage and mercantile occupancies</td>
<td>500</td>
<td>46.5</td>
</tr>
</tbody>
</table>

NA: Not applicable. The occupant load is the maximum probable number of occupants present at any time.

\(^a\)All factors are expressed in gross area unless marked “net.”

\(^b\)For the purpose of determining occupant load in mercantile occupancies where, due to differences in the finished ground level of streets on different sides, two or more floors directly accessible from streets (not including alleys or similar back streets) exist, each such floor is permitted to be considered a street floor. The occupant load factor is one person for each 40 \(\text{ft}^2\) (3.7 \(\text{m}^2\)) of gross floor area of sales space.

\(^c\)For the purpose of determining occupant load in mercantile occupancies with no street floor, as defined in 3.3.234, but with access directly from the street by stairs or escalators, the floor at the point of entrance to the mercantile occupancy is considered the street floor.

\(^d\)For any food court or other assembly use areas located in the mall concourse that are not included as a portion of the gross leasable area of the mall structurebuilding, the occupant load is calculated based on the occupant load factor for that use as specified in Table 14.8.1.2. The remaining mall concourse -area is not required to be assigned an occupant load.

\(^e\)The portions of the mall concourse that are considered a pedestrian way and not used as gross leasable area are not required to be assessed an occupant load based on Table 14.8.1.2. However, means of egress from a mall pedestrian way are required to be provided for an occupant load determined by dividing the gross leasable area of the mall structurebuilding (not including anchor stores) by the appropriate lowest whole number occupant load factor from Figure 14.8.1.2(a) or Figure 14.8.1.2(b).

Each individual tenant space is required to have means of egress to the outside or to the mall concourse based on occupant loads calculated by using the appropriate occupant load factor from Table 14.8.1.2.
Each individual anchor store is required to have means of egress independent of the mall concourse. See A.14.8.1.2.

[101:Table 7.3.1.2]

Figure 14.8.1.2(a) Mall Building Structure Occupant Load Factors (U.S. Customary Units).

[101:Figure 7.3.1.2(a)]

Figure 14.8.1.2(b) Mall Building Structure Occupant Load Factors (SI Units). [101:Figure 7.3.1.2(b)]
14.8.3.1
Egress capacity for approved components of means of egress shall be based on the capacity factors shown in Table 14.8.3.1, unless otherwise provided in 14.8.3.2. [101:7.3.3.1]
Table 14.8.3.1 Capacity Factors

<table>
<thead>
<tr>
<th>Area</th>
<th>Stairways (width per person)</th>
<th>Level Components and Ramps (width per person)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>in.</td>
<td>mm</td>
</tr>
<tr>
<td>Board and care</td>
<td>0.4</td>
<td>10.2</td>
</tr>
<tr>
<td>Health care, sprinklered</td>
<td>0.3</td>
<td>7.6</td>
</tr>
<tr>
<td>Health care, nonsprinklered</td>
<td>0.6</td>
<td>15</td>
</tr>
<tr>
<td>High hazard contents</td>
<td>0.7</td>
<td>18</td>
</tr>
<tr>
<td>All others</td>
<td>0.3</td>
<td>7.6</td>
</tr>
</tbody>
</table>

For stairways wider than 44 in. (1120 mm) and subject to the 0.3 in. (7.6 mm) width per person capacity factor, the capacity shall be permitted to be increased using the following equation:

\[ C = 146.7 + \left( \frac{W_R - 44}{0.218} \right) \]

where:

\[ C = \text{capacity, in persons, rounded to the nearest integer} \]
$W_n = \text{nominal width of the stair as permitted by 14.8.3.2 (in.)}$ [101:7.3.3.2]

14.9.2.1 600 Volts, Nominal, or Less.
The minimum number of means of egress for working space about electrical equipment, other than existing electrical equipment, shall be in accordance with NFPA 70, Section 110.26(C). [101:7.4.2.1]

14.9.2.2.1 Number of Means of Egress, Over 600 Volts, Nominal.
The minimum number of means of egress for working space about electrical equipment, other than existing electrical equipment, shall be in accordance with NFPA 70, Section 110.33(A). [101:7.4.2.2.1]

14.9.2.2.2 Door Unlatching and Direction of Door Swing.
The method of door unlatching and direction of door swing for working space about electrical equipment, other than existing electrical equipment, shall be in accordance with Section 110.26(C)(3) of NFPA 70. [101:7.4.2.2.2]

14.9.2.2 Over 600 Volts, Nominal.

14.9.2.2.1 Number of Means of Egress.
The minimum number of means of egress for working space about electrical equipment, other than existing electrical equipment, shall be in accordance with NFPA 70, Section 110.33(A). [101:7.4.2.2.1]

7.4.2.2.2 Door Unlatching and Direction of Door Swing.
The method of door unlatching and direction of door swing for working space about electrical equipment, other than existing electrical equipment, shall be in accordance with Section 110.33(A)(3) of NFPA 70. [101:7.4.2.2.2]

14.10.1.2.1 Approved existing corridors that require passage through a room to access an exit shall be permitted to continue to be used, provided that all of the following criteria are met:

1. The path of travel is marked in accordance with Section 14.14.
2. Doors to such rooms comply with 7.2.1 of NFPA 101.
3. Such arrangement is not prohibited by the applicable occupancy chapter in NFPA 101. [101:7.5.1.2.1]

14.11.1.1
Yards, courts, open spaces, or other portions of the exit discharge shall be of the required width and size to provide all occupants with a safe access to a public way. \[101:7.7.1.1\]

14.11.2 Exit Discharge Through Interior Building Areas.

Exits shall be permitted to discharge through interior building areas, provided that all of the following are met:

1. Not more than 50 percent of the required number of exit stairs serving normally occupied areas of each floor, and not more than 50 percent of the exit stair capacity required for normally occupied areas of each floor, shall discharge through areas on any level of discharge, except as otherwise permitted by one of the following:
   1. One hundred percent of the exits shall be permitted to discharge through areas on any level of discharge in detention and correctional occupancies as otherwise provided in Chapters 22 and 23.
   2. In existing buildings, the 50 percent limit on egress capacity shall not apply if the 50 percent limit on the required number of exits is met.
2. Each level of discharge shall discharge directly outside at the finished ground level or discharge directly outside and provide access to the finished ground level by outside stairs or outside ramps.
3. The interior exit discharge shall lead to a free and unobstructed way to the exterior of the building, and such way shall be readily apparent or shall be visible and identifiable by exit signage from the point of discharge from the exit.
4. The interior exit discharge shall be protected by one of the following methods:
   1. The level of discharge shall be protected throughout by an approved automatic sprinkler system in accordance with Section 13.3, or the portion of the level of discharge used for interior exit discharge shall be protected by an approved automatic sprinkler system in accordance with Section 13.3 and shall be separated from the nonsprinklered portion of the floor by fire barriers with a fire resistance rating meeting the requirements for the enclosure of exits. (See 14.3.1.)
   2. The interior exit discharge area shall be in a vestibule or foyer that meets all of the following criteria:
      1. The depth from the exterior of the building shall be not more than 10 ft (3050 mm), and the length shall be not more than 30 ft (9.1 m).
      2. The foyer shall be separated from the remainder of the level of discharge by fire barriers with a minimum 1-hour fire resistance rating, and existing installations of wired glass in steel frames shall be permitted to be continued in use.
      3. The foyer shall serve only as means of egress and shall include an exit directly to the outside.
5. The entire area on the level of discharge shall be separated from areas below by construction having a fire resistance rating not less than that required for the exit enclosure, unless otherwise provided in 14.11.2(6).
6. Levels below the level of discharge in an atrium shall be permitted to be open to the level of discharge where such level of discharge is protected in accordance with 8.6.7 of NFPA 101.
14.11.3.3*

Stairs and ramps that continue more than one-half story below the level of discharge shall be provided with an approved means to prevent or dissuade occupants from traveling past the level of discharge during emergency building evacuation. [101:7.7.3.3]

14.13.1.1*

Emergency lighting facilities for means of egress shall be provided in accordance with Section 14.13 for the following:

1. Buildings or structures where required in Chapters 11 through 43 of NFPA 101
2. Underground and limited access structures as addressed in Section 11.7 of NFPA 101
3. High-rise buildings as required by NFPA 101
4. Doors equipped with delayed-egress locks
5. Stair shafts and vestibules of smokeproof enclosures, for which the following also apply:
   1. The stair shaft and vestibule shall be permitted to include a standby generator that is installed for the smokeproof enclosure mechanical ventilation equipment.
   2. The standby generator shall be permitted to be used for the stair shaft and vestibule emergency lighting power supply.
6. New sensor-release of electrical locking systems access-controlled egress doors in accordance with 14.5.3.2 [101:7.9.1.1]


Tactile signage shall be provided to meet all of the following criteria, unless otherwise provided in 14.14.1.4:

1. Tactile signage shall be located at each exit door requiring an exit sign.
2. Tactile signage shall read as follows: EXIT

[101:7.10.1.3]
1. The directional indicator shall be located outside of the EXIT legend, not less than 3/8 in. (9.5 mm) from any letter.
2. The directional indicator shall be of a chevron type, as shown in Figure 14.14.6.2.1.
3. The directional indicator shall be identifiable as a directional indicator at a distance of 40 ft (12 m).
4. A directional indicator larger than the minimum established for compliance with 14.14.6.2.1(3) shall be proportionately increased in height, width, and stroke.
5. The directional indicator shall be located at the end of the sign for the direction indicated.

16.1.3*
In buildings under construction, adequate escape facilities shall be maintained at all times for the use of construction workers. Escape facilities shall consist of doors, walkways, stairs, ramps, fire escapes, ladders, or other approved means or devices arranged in accordance with the general principles of Chapter 14 and NFPA 101 insofar as they can reasonably be applied to buildings under construction.

Chapter 20 Occupancy Fire Safety
20.1 Assembly Occupancies.
20.1.1 Application.
New and existing assembly occupancies shall comply with Section 20.1 and NFPA 101.
20.1.1.1 Permits.
Permits, where required, shall comply with Section 1.12.
20.1.1.2 Indoor children’s playground structures shall also comply with Section 10.19.
20.1.2 Flame-Retardant Requirements.
20.1.2.1 Combustible scenery of cloth, film, vegetation (dry), and similar materials shall comply with one of the following:
(1) They shall meet the flame propagation performance criteria contained in Test Method 1 or Test Method 2, as appropriate, of NFPA 701.
(2) They shall exhibit a heat release rate not exceeding 100 kW when tested in accordance with NFPA 289 using the 20 kW ignition source.

20.1.2.2 Foamed plastics (see definition of cellular or foamed plastic in 3.3.41 of NFPA 101) shall be permitted to be used if they exhibit a heat release rate not exceeding 100 kW when tested in accordance with NFPA 289 using the 20 kW ignition source or by specific approval of the AHJ.

20.1.2.3 Scenery and stage properties not separated from the audience by proscenium opening protection shall be of noncombustible materials, limited-combustible materials, or fire-retardant-treated wood.
In theaters, motion picture theaters, and television stage settings, with or without horizontal projections, and in simulated caves and caverns of foamed plastic, any single fuel package shall have a heat release rate not to exceed 100 kW where tested in accordance with one of the following:

1. ANSI/UL 1975, Standard for Fire Tests for Foamed Plastics Used for Decorative Purposes

2. NFPA 289 using the 20 kW ignition source

20.1.3 Interior Finish.

20.1.3.1 General.

Interior finish shall be in accordance with Section 12.5.

20.1.3.2 Corridors, Lobbies, and Enclosed Stairways.

New and existing interior wall and ceiling finish materials complying with Section 12.5 shall be Class A or Class B in all corridors and lobbies and shall be Class A in enclosed stairways.

20.1.3.3 Assembly Areas.

New and existing interior wall and ceiling finish materials complying with Section 12.5 shall be Class A or Class B in general assembly areas having occupant loads of more than 300 and shall be Class A, Class B, or Class C in assembly areas having occupant loads of 300 or fewer.

20.1.3.4 Screens.

New and existing screens on which pictures are projected shall comply with requirements of Class A or Class B interior finish in accordance with Section 12.5.

20.1.3.5 Interior Floor Finish.

20.1.3.5.1 New interior floor finish shall comply with Section 12.5.

20.1.3.5.2 New interior floor finish in exit enclosures and exit access corridors and in spaces not separated from them by walls complying with 12.3.6 of NFPA 101 shall be not less than Class II.

20.1.3.5.3 New interior floor finish shall comply with 12.5.8.1 or 12.5.8.2, as applicable.

20.1.4 Special Amusement Buildings.

20.1.4.1 General.

Special amusement buildings, regardless of occupant load, shall meet the requirements for assembly occupancies in addition to the requirements of 20.1.4, unless the special amusement building is a multilevel play structure that is not more than 10 ft (3050 mm) in height and has aggregate horizontal projections not exceeding 160 ft² (15 m²). [101:12.4.8.1; 101:13.4.8.1]

20.1.4.2 Automatic Sprinklers.

Every special amusement building, other than buildings or structures not exceeding 10 ft (3050 mm) in height and not exceeding 160 ft² (15 m²) in aggregate horizontal projection, shall be protected throughout by an approved, supervised automatic sprinkler system installed and maintained in accordance with Section 13.3. [101:12.4.8.2; 101:13.4.8.2]

20.1.4.3 Temporary Water Supply.

Where the special amusement building required to be sprinklered by 20.1.4.2 is movable or portable, the sprinkler water supply shall be permitted to be provided by an approved temporary means. [101:12.4.8.3; 101:13.4.8.3]
20.1.4.4 Smoke Detection.
Where the nature of the special amusement building is such that it operates in reduced lighting levels, the building shall be protected throughout by an approved automatic smoke detection system in accordance with Section 13.7. [101:12.4.8.4; 101:13.4.8.4]

20.1.4.5 Alarm Initiation.
Actuation of any smoke detection system device shall sound an alarm at a constantly attended location on the premises. [101:12.4.8.5; 101:13.4.8.5]

20.1.4.6 Illumination.
Actuation of the automatic sprinkler system, or any other suppression system, or actuation of a smoke detection system having an approved verification or cross-zoning operation capability shall provide for the following:
(1) Increase in illumination in the means of egress to that required by Section 14.12
(2) Termination of any conflicting or confusing sounds and visuals [101:12.4.8.6; 101:13.4.8.6]

20.1.4.7 Exit Marking.
20.1.4.7.1
Exit marking shall be in accordance with Section 14.14. [101:12.4.8.7.1; 101:13.4.8.7.1]

20.1.4.7.2
Floor proximity exit signs shall be provided in accordance with 14.14.1.6. [101:12.4.8.7.2; 101:13.4.8.7.2]

20.1.4.7.3*
In special amusement buildings where mazes, mirrors, or other designs are used to confound the egress path, approved directional exit marking that becomes apparent in an emergency shall be provided. [101:12.4.8.7.3; 101:13.4.8.7.3]

20.1.4.8 Interior Finish.
Interior wall and ceiling finish materials complying with Section 12.5 shall be Class A throughout. [101:12.4.8.8; 101:13.4.8.8]

20.1.5 Operating Features.
20.1.5.1 Means of Egress Inspection.
20.1.5.1.1
The building owner or agent shall inspect the means of egress to ensure it is maintained free of obstructions, and correct any deficiencies found, prior to each opening of the building to the public. [101:12.7.1.1; 101:13.7.1.1]

20.1.5.1.2
The building owner or agent shall prepare and maintain records of the date and time of each inspection on approved forms, listing any deficiencies found and actions taken to correct them. [101:12.7.1.2; 101:13.7.1.2]

20.1.5.1.3 Inspection of Door Openings.
Door openings shall be inspected in accordance with 7.2.1.15 of NFPA 101. [101:12.7.1.3]

20.1.5.2 Special Provisions for Food Service Operations.
20.1.5.2.1
All devices in connection with the preparation of food shall be installed and operated to avoid hazard to the safety of occupants. [101:12.7.2.1; 101:13.7.2.1]

20.1.5.2.2
All devices in connection with the preparation of food shall be of an approved type and shall be installed in an approved manner. [101:12.7.2.2; 101:13.7.2.2]
Food preparation facilities shall be protected in accordance with Chapter 50 (NFPA 96) and shall not be required to have openings protected between food preparation areas and dining areas.\[101:12.7.2.3; 101:13.7.2.3\]

20.1.5.2.4

Portable cooking equipment that is not flue-connected shall be permitted only as follows:

(1) Equipment fueled by small heat sources that can be readily extinguished by water, such as candles or alcohol-burning equipment, including solid alcohol, shall be permitted to be used, provided that precautions satisfactory to the AHJ are taken to prevent ignition of any combustible materials.

(2) Candles shall be permitted to be used on tables used for food service where securely supported on substantial noncombustible bases located to avoid danger of ignition of combustible materials and only where approved by the AHJ.

(3) Candle flames shall be protected.

(4) "Flaming sword" or other equipment involving open flames and flamed dishes, such as cherries jubilee or crêpes suzette, shall be permitted to be used, provided that precautions subject to the approval of the AHJ are taken.

(5) Listed and approved LP-Gas commercial food service appliances shall be permitted to be used where in accordance with Chapter 69.\[101:12.7.2.4; 101:13.7.2.4\]

20.1.5.2.4.1 Permits.

Permits, where required, shall comply with Section 1.12.

20.1.5.3 Open Flame Devices and Pyrotechnics.

No open flame devices or pyrotechnic devices shall be used in any assembly occupancy, unless otherwise permitted by one of the following:

(1) Pyrotechnic special effect devices shall be permitted to be used on stages before proximate audiences for ceremonial or religious purposes, as part of a demonstration in exhibits, or as part of a performance, provided that both of the following criteria are met:

(a) Precautions satisfactory to the AHJ are taken to prevent ignition of any combustible material.

(b) Use of the pyrotechnic device complies with Section 65.3.

(2) Flame effects before an audience shall be permitted in accordance with Section 65.4.

(3) Open flame devices shall be permitted to be used in the following situations, provided that precautions satisfactory to the AHJ are taken to prevent ignition of any combustible material or injury to occupants:

(a) “For ceremonial or religious purposes

(b) On stages and platforms where part of a performance

(c) Where candles on tables are securely supported on substantial noncombustible bases and candle flame is protected

(d) The requirement of 20.1.5.3 shall not apply to heat-producing equipment complying with 11.2.2.

(e) The requirement of 20.1.5.3 shall not apply to food service operations in accordance with 20.1.5.2.

(f) Gas lights shall be permitted to be used, provided that precautions are taken, subject to the approval of the AHJ, to prevent ignition of any combustible materials.\[101:12.7.3; 101:13.7.3\]

20.1.5.3.1 Permits.

Permits, where required, shall comply with Section 1.12.

20.1.5.4 Furnishings, Decorations, and Scenery.

20.1.5.4.1* Fabrics and films used for decorative purposes, all draperies and curtains, and similar furnishings shall be in accordance with the provisions of 12.6.2.\[101:12.7.4.1; 101:13.7.4.1\]
20.1.5.4.2
The AHJ shall impose controls on the quantity and arrangement of combustible contents in assembly occupancies to provide an adequate level of safety to life from fire. [101:12.7.4.2; 101:13.7.4.2]

20.1.5.4.3*
Exposed foamed plastic materials and unprotected materials containing foamed plastic used for decorative purposes or stage scenery shall have a heat release rate not exceeding 100 kW where tested in accordance with one of the following:
(1) UL 1975, Standard for Fire Tests for Foamed Plastics Used for Decorative Purposes
(2) NFPA 289 using the 20 kW ignition source
[101:12.7.4.3; 101:13.7.4.3]

20.1.5.4.4
The requirement of 20.1.5.4.3 shall not apply to individual foamed plastic items and items containing foamed plastic where the foamed plastic does not exceed 1 lb (0.45 kg) in weight. [101:12.7.4.4; 101:13.7.4.4]

20.1.5.5 Special Provisions for Exposition Facilities.

20.1.5.5.1 Permits.
Permits, where required, shall comply with Section 1.12.

20.1.5.5.2 General.
No display or exhibit shall be installed or operated to interfere in any way with access to any required exit or with the visibility of any required exit or required exit sign; nor shall any display block access to fire-fighting equipment. [101:12.7.5.1; 101:13.7.5.1]

20.1.5.5.3 Materials Not on Display.
A storage room having an enclosure consisting of a smoke barrier having a minimum 1-hour fire resistance rating and protected by an automatic extinguishing system shall be provided for combustible materials not on display, including combustible packing crates used to ship exhibitors’ supplies and products. [101:12.7.5.2; 101:13.7.5.2]

20.1.5.5.4 Exhibits.

20.1.5.5.4.1
Exhibits shall comply with 20.1.5.5.4.2 through 20.1.5.5.4.11. [101:12.7.5.3.1; 101:13.7.5.3.1]

20.1.5.5.4.2
The travel distance within the exhibit booth or exhibit enclosure to an exit access aisle shall not exceed 50 ft (15 m). [101:12.7.5.3.2; 101:13.7.5.3.2]

20.1.5.5.4.3
The upper deck of multilevel exhibits exceeding 300 ft² (28 m²) shall have not less than two remote means of egress. [101:12.7.5.3.3; 101:13.7.5.3.3]

20.1.5.5.4.4
Exhibit booth construction materials shall be limited to the following:
(1) Noncombustible or limited-combustible materials
(2) Wood exceeding ⅛ in. (6.3 mm) nominal thickness
(3) Wood that is pressure-treated, fire-retardant wood meeting the requirements of NFPA 703
(4) Flame-retardant materials complying with one of the following:
   (a) They shall meet the flame propagation performance criteria contained in Test Method 1 or Test Method 2, as appropriate, of NFPA 701.
   (b) They shall exhibit a heat release rate not exceeding 100 kW when tested in accordance with NFPA 289 using the 20 kW ignition source.
(5) Textile wall coverings, such as carpeting and similar products used as wall or ceiling finishes, complying with the provisions of 10.2.2 and 10.2.4 of NFPA 101
(6) Plastics limited to those that comply with Sections 12.3.3 and 10.2 of NFPA 101
(7) Foamed plastics and materials containing foamed plastics having a heat release rate for any single fuel package that does not exceed 100 kW where tested in accordance with one of the following:
   (a) UL 1975, Standard for Fire Tests for Foamed Plastics Used for Decorative Purposes
   (b) NFPA 289 using the 20 kW ignition source
(8) Cardboard, honeycombed paper, and other combustible materials having a heat release rate for any single fuel package that does not exceed 150 kW where tested in accordance with one of the following:
   (a) UL 1975
   (b) NFPA 289, using the 20 kW ignition source

20.1.5.5.4.5 Curtains, drapes, and decorations shall comply with 12.6.2. [101:12.7.5.3.4; 101:13.7.5.3.4]
20.1.5.5.4.6 Acoustical and decorative material including, but not limited to, cotton, hay, paper, straw, moss, split bamboo, and wood chips shall be flame-retardant treated to the satisfaction of the AHJ. [101:12.7.5.3.6; 101:13.7.5.3.6]
20.1.5.5.4.6.1 Materials that cannot be treated for flame retardancy shall not be used. [101:12.7.5.3.6.1; 101:13.7.5.3.6.1]
20.1.5.5.4.6.2 Foamed plastics, and materials containing foamed plastics and used as decorative objects such as, but not limited to, mannequins, murals, and signs, shall have a heat release rate for any single fuel package that does not exceed 150 kW where tested in accordance with one of the following:
   (1) UL 1975, Standard for Fire Tests for Foamed Plastics Used for Decorative Purposes
   (2) NFPA 289 using the 20 kW ignition source
[101:12.7.5.3.6.2; 101:13.7.5.3.6.2]
20.1.5.5.4.6.3 Where the aggregate area of acoustical and decorative materials is less than 10 percent of the individual floor or wall area, such materials shall be permitted to be used subject to the approval of the AHJ. [101:12.7.5.3.6.3; 101:13.7.5.3.6.3]
20.1.5.5.4.7 The following shall be protected by automatic extinguishing systems:
   (1) Single-level exhibit booths exceeding 300 ft² (28 m²) and covered with a ceiling
   (2) Each level of multilevel exhibit booths, including the uppermost level where the uppermost level is covered with a ceiling [101:12.7.5.3.7; 101:13.7.5.3.7]
20.1.5.5.4.7.1 The requirements of 20.1.5.5.4.7 shall not apply where otherwise permitted by the following:
   (1) Ceilings that are constructed of open grate design or listed dropout ceilings in accordance with NFPA 13 shall not be considered ceilings within the context of 20.1.5.5.4.7.
   (2) Vehicles, boats, and similar exhibited products having over 100 ft² (9.3 m²) of roofed area shall be provided with smoke detectors acceptable to the AHJ.
(3) *The requirement of 20.1.5.5.4.7(2) shall not apply where fire protection of multilevel exhibit booths is consistent with the criteria developed through a life safety evaluation of the exhibition hall in accordance with 12.4.1 or 13.4.1 of NFPA 101, subject to approval of the AHJ. [101:12.7.5.3.7.1; 101:13.7.5.3.7.1]

20.1.5.5.4.7.2

A single exhibit or group of exhibits with ceilings that do not require sprinklers shall be separated by a distance of not less than 10 ft (3050 mm) where the aggregate ceiling exceeds 300 ft² (28 m²). [101:12.7.5.3.7.2; 101:13.7.5.3.7.2]

20.1.5.5.4.7.3

The water supply and piping for the sprinkler system shall be permitted to be of an approved temporary means that is provided by a domestic water supply, a standpipe system, or a sprinkler system. [101:12.7.5.3.7.3; 101:13.7.5.3.7.3]

20.1.5.5.4.8

Open flame devices within exhibit booths shall comply with 20.1.5.3. [101:12.7.5.3.8; 101:13.7.5.3.8]

20.1.5.5.4.9

Cooking and food-warming devices in exhibit booths shall comply with 20.1.5.2 and all of the following:

(1) Gas-fired devices shall comply with the following:

(a) Natural gas-fired devices shall comply with Section 11.4.

(b) The requirement of 20.1.5.5.4.9(1)(a) shall not apply to compressed natural gas where permitted by the AHJ.

(c) The use of LP-Gas cylinders shall be prohibited.

(d) Nonrefillable LP-Gas cylinders shall be approved for use where permitted by the AHJ.

(2) The devices shall be isolated from the public by not less than 48 in. (1220 mm) or by a barrier between the devices and the public.

(3) Multi-well cooking equipment using combustible oils or solids shall comply with Chapter 50.

(4) Single-well cooking equipment using combustible oils or solids shall meet all of the following criteria:

(a) The equipment shall have lids available for immediate use.

(b) The equipment shall be limited to 2 ft² (0.2 m²) of cooking surface.

(c) The equipment shall be placed on noncombustible surface materials.

(d) The equipment shall be separated from each other by a horizontal distance of not less than 24 in. (610 mm).

(e) The requirement of 20.1.5.5.4.9(4)(d) shall not apply to multiple single-well cooking equipment where the aggregate cooking surface area does not exceed 2 ft² (0.2 m²).

(f) The equipment shall be kept at a horizontal distance of not less than 24 in. (610 mm) from any combustible material.

(5) A portable fire extinguisher in accordance with Section 13.6 shall be provided within the booth for each device, or an approved automatic extinguishing system shall be provided. [101:12.7.5.3.9; 101:13.7.5.3.9]

20.1.5.5.4.10

Combustible materials within exhibit booths shall be limited to a one-day supply. Storage of combustible materials behind the booth shall be prohibited. (See 20.1.5.4.2 and 20.1.5.5.3.) [101:12.7.5.3.10; 101:13.7.5.3.10]

20.1.5.5.4.11

Plans for the exposition, in an acceptable form, shall be submitted to the AHJ for approval prior to setting up any exhibit. [101:12.7.5.3.11; 101:13.7.5.3.11]
The plan shall show all details of the proposed exposition. [101:12.7.5.3.11.1; 101:13.7.5.3.11.1]

20.1.5.5.4.11.2
No exposition shall occupy any exposition facility without approved plans. [101:12.7.5.3.11.2; 101:13.7.5.3.11.2]

20.1.5.5.4.12 Vehicles.
Vehicles on display within an exposition facility shall comply with 20.1.5.5.4.12.1 through 20.1.5.5.4.12.5. [101:12.7.5.4; 101:13.7.5.4]

20.1.5.5.4.12.1
All fuel tank openings shall be locked and sealed in an approved manner to prevent the escape of vapors; fuel tanks shall not contain in excess of one-half their capacity or contain in excess of 10 gal (38 L) of fuel, whichever is less. [101:12.7.5.4.1; 101:13.7.5.4.1]

20.1.5.5.4.12.2
At least one battery cable shall be removed from the batteries used to start the vehicle engine, and the disconnected battery cable shall then be taped. [101:12.7.5.4.2; 101:13.7.5.4.2]

20.1.5.5.4.12.3
Batteries used to power auxiliary equipment shall be permitted to be kept in service. [101:12.7.5.4.3; 101:13.7.5.4.3]

20.1.5.5.4.12.4
Fueling or defueling of vehicles shall be prohibited. [101:12.7.5.4.4; 101:13.7.5.4.4]

20.1.5.5.4.12.5
Vehicles shall not be moved during exhibit hours. [101:12.7.5.4.5; 101:13.7.5.4.5]

20.1.5.5.4.13 Prohibited Materials.

20.1.5.5.4.13.1
The following items shall be prohibited within exhibit halls:
(1) Compressed flammable gases
(2) Flammable or combustible liquids
(3) Hazardous chemicals or materials
(4) Class II or greater lasers, blasting agents, and explosives [101:12.7.5.5.1; 101:13.7.5.5.1]

20.1.5.5.4.13.2
The AHJ shall be permitted to allow the limited use of any items specified in 20.1.5.5.4.13.1 under special circumstances. [101:12.7.5.5.2; 101:13.7.5.5.2]

20.1.5.6 Crowd Managers.

20.1.5.6.1
Assembly occupancies shall be provided with a minimum of one trained crowd manager or crowd manager supervisor. Where the occupant load exceeds 250, additional trained crowd managers or crowd manager supervisors shall be provided at a ratio of 1 crowd manager or crowd manager supervisor for every 250 occupants, unless otherwise permitted by one of the following:
(1) This requirement shall not apply to assembly occupancies used exclusively for religious worship with an occupant load not exceeding 500.
(2) The ratio of trained crowd managers to occupants shall be permitted to be reduced where, in the opinion of the AHJ, the existence of an approved, supervised automatic sprinkler system and the nature of the event warrant. [101:12.7.6.1; 101:13.7.6.1]

20.1.5.6.2*
The crowd manager shall receive approved training in crowd management techniques. [101:12.7.6.2; 101:13.7.6.2]
20.1.5.6.3
Duties and responsibilities for the crowd manager and crowd manager supervisor shall be documented within a written emergency plan as required by 12.7.13 of NFPA 101. [101:12.7.6.3; 101:13.7.6.3]

20.1.5.6.4* The training for the duties and responsibilities of crowd managers shall include the following:
(1) Understanding crowd manager roles and responsibilities
(2) Understanding safety and security hazards that can endanger public assembly
(3) Understanding crowd management techniques
(4) Introduction to fire safety and fire safety equipment
(5) Understanding methods of evacuation and movement
(6) Understanding procedures for reporting emergencies
(7) Understanding crowd management emergency response procedures
(8) Understanding the paths of travel and exits, facility evacuation and emergency response procedures and, where provided, facility shelter-in-place procedures
(9) Familiarization with the venue and guest services training
(10) Other specific event-warranted training
[101:12.7.6.4; 101:13.7.6.4]

20.1.5.6.5 The training for the duties and responsibilities of crowd manager supervisors shall include the following:
(1) The duties described in 20.1.5.6.4
(2) Understanding crowd manager supervisor roles and responsibilities
(3) Understanding of incident management procedures
(4) Understanding the facility evacuation plan
(5) Understanding the facility command structure
[101:12.7.6.5; 101:13.7.6.5]

20.1.5.7* Fire Detail.
Fire details, if deemed necessary in any assembly occupancy, shall be determined by the AHJ.

20.1.5.8* Drills.
20.1.5.8.1 The employees or attendants of assembly occupancies shall be trained and drilled in the duties they are to perform in case of fire, panic, or other emergency to effect orderly exiting. [101:12.7.7.1; 101:13.7.7.1]

20.1.5.8.2 Employees or attendants of assembly occupancies shall be instructed in the proper use of portable fire extinguishers and other manual fire suppression equipment where provided. [101:12.7.7.2; 101:13.7.7.2]

20.1.5.8.3* In the following assembly occupancies, an audible announcement shall be made, or a projected image shall be shown, prior to the start of each program that notifies occupants of the location of the exits to be used in case of a fire or other emergency:
(1) Theaters
(2) Motion picture theaters
(3) Auditoriums
(4) Other similar assembly occupancies with occupant loads exceeding 300 where there are noncontinuous programs [101:12.7.7.3; 101:13.7.7.3]
The requirement of 20.1.5.8.3 shall not apply to assembly occupancies in schools where used for nonpublic events. [101:12.7.7.4; 101:13.7.7.4]

20.1.5.9  Smoking.

20.1.5.9.1  Smoking in assembly occupancies shall be regulated by the AHJ. [101:12.7.8.1; 101:13.7.8.1]

20.1.5.9.2  In rooms or areas where smoking is prohibited, plainly visible signs shall be posted that read as follows:

   NO SMOKING

[101:12.7.8.2; 101:13.7.8.2]

20.1.5.9.3  No person shall smoke in prohibited areas that are so posted, unless permitted by the AHJ under both of the following conditions:

   (1)  Smoking shall be permitted on a stage only where it is a necessary and rehearsed part of a performance.

   (2)  Smoking shall be permitted only where the smoker is a regular performing member of the cast.

[101:12.7.8.3; 101:13.7.8.3]

20.1.5.9.4  Where smoking is permitted, suitable ashtrays or receptacles shall be provided in convenient locations.

[101:12.7.8.4; 101:13.7.8.4]

20.1.5.10  Seating.

20.1.5.10.1  Secured Seating.

20.1.5.10.1.1  Seats in assembly occupancies accommodating more than 200 persons shall be securely fastened to the floor, except where fastened together in groups of not less than three and as permitted by 20.1.5.10.1.2 and 20.1.5.10.2. [101:12.7.9.1.1; 101:13.7.9.1.1]

20.1.5.10.1.2  Balcony and box seating areas that are separated from other areas by rails, guards, partial-height walls, or other physical barriers and have a maximum of 14 seats shall be exempt from the requirement of 20.1.5.10.1.1. [101:12.7.9.1.2; 101:13.7.9.1.2]

20.1.5.10.2  Unsecured Seating.

20.1.5.10.2.1  Seats not secured to the floor shall be permitted in restaurants, night clubs, and other occupancies where fastening seats to the floor might be impracticable. [101:12.7.9.2.1; 101:13.7.9.2.1]

20.1.5.10.2.2  Unsecured seats shall be permitted, provided that, in the area used for seating, excluding such areas as dance floors and stages, there is not more than one seat for each 15 ft² (1.4 m²) of net floor area, and adequate aisles to reach exits are maintained at all times. [101:12.7.9.2.2; 101:13.7.9.2.2]

20.1.5.10.2.3  Seating diagrams shall be submitted for approval by the AHJ to permit an increase in occupant load per 14.8.1.3. [101:12.7.9.2.3; 101:13.7.9.2.3]

20.1.5.10.3  Festival Seating.

Festival seating, as defined in 3.3.111, shall be prohibited within a building, unless otherwise permitted by one of the following:

(1)  Festival seating shall be permitted in assembly occupancies having occupant loads of 250 or less.
Festival seating shall be permitted in assembly occupancies where occupant loads exceed 250, provided that an approved life safety evaluation has been performed. (See 10.15.3.) [101:12.2.5.4.1; 101:13.2.5.4.1]

20.1.5.10.4 Occupant Load Posting.

20.1.5.10.4.1
Every room constituting an assembly occupancy and not having fixed seats shall have the occupant load of the room posted in a conspicuous place near the main exit from the room. [101:12.7.9.3.1; 101:13.7.9.3.1]

20.1.5.10.4.2
Approved signs shall be maintained in a legible manner by the owner or authorized agent. [101:12.7.9.3.2; 101:13.7.9.3.2]

20.1.5.10.4.3
Signs shall be durable and shall indicate the number of occupants permitted for each room use. [101:12.7.9.3.3; 101:13.7.9.3.3]

20.1.5.11 Clothing.
Clothing and personal effects shall not be stored in corridors, and spaces not separated from corridors, unless otherwise permitted by one of the following:
(1) In new assembly occupancies, this requirement shall not apply to corridors, and spaces not separated from corridors, that are protected by an approved, supervised automatic sprinkler system in accordance with Section 13.3. [101:12.7.12(1)]
(2) In existing assembly occupancies, this requirement shall not apply to corridors, and spaces not separated from corridors, that are protected by an approved automatic sprinkler system in accordance with Section 13.3. [101:13.7.12(1)]
(3) This requirement shall not apply to corridors, and spaces not separated from corridors, that are protected by a smoke detection system in accordance with Section 13.3. [101:12.7.12(2); 101:13.7.12(2)]
(4) This requirement shall not apply to storage in metal lockers, provided that the required egress width is maintained. [101:12.7.12(3); 101:13.7.12(3)]

20.1.5.12 Projection Rooms.

20.1.5.12.1
Film or video projectors or spotlights utilizing light sources that produce particulate matter or toxic gases, or light sources that produce hazardous radiation, without protective shielding shall be located within a projection room complying with 12.3.2.1.2 of NFPA 101. [101:12.4.7.3; 101:13.4.7.3]

20.1.5.12.2
Every projection room shall be of permanent construction consistent with the building construction type in which the projection room is located and shall comply with the following:
(1) Openings shall not be required to be protected.
(2) The room shall have a floor area of not less than 80 ft² (7.4 m²) for a single machine and not less than 40 ft² (3.7 m²) for each additional machine.
(3) Each motion picture projector, floodlight, spotlight, or similar piece of equipment shall have a clear working space of not less than 30 in. (760 mm) on each side and at its rear, but only one such space shall be required between adjacent projectors. [101:12.4.7.4; 101:13.4.7.4]

20.1.5.13 Integrated Fire Protection Systems
Integrated fire protection systems shall be tested in accordance with 13.1.3 [101:12.7.14; 101:13.7.14]
20.2 Educational Occupancies.

20.2.1 Application.
New and existing educational occupancies shall comply with Section 20.2 and NFPA 101.

20.2.2 Flexible Plan and Open Plan Buildings.

20.2.2.1
Flexible plan and open plan buildings shall comply with the requirements of 20.2.2 as modified by 20.2.2.5. \[101:14.4.3.1; 101:15.4.3.1\]

20.2.2.2
Each room occupied by more than 300 persons shall have two or more means of egress entering into separate atmospheres. \[101:14.4.3.2; 101:15.4.3.2\]

20.2.2.3
Where three or more means of egress are required, the number of means of egress permitted to enter into the same atmosphere shall not exceed two. \[101:14.4.3.3; 101:15.4.3.3\]

20.2.2.4
Flexible plan buildings shall be permitted to have walls and partitions rearranged periodically only if revised plans or diagrams have been approved by the AHJ. \[101:15.4.3.4\]

20.2.2.5
Flexible plan buildings shall be evaluated while all folding walls are extended and in use as well as when they are in the retracted position. \[101:14.4.3.5; 101:15.4.3.5\]

20.2.3 Interior Finish.

20.2.3.1 General.
Interior finish shall be in accordance with Section 12.5. \[101:14.3.3.1; 101:15.3.3.1\]

20.2.3.2 Interior Wall and Ceiling Finish.

New and existing interior wall and ceiling finish materials complying with Section 12.5 shall be permitted as follows:

1. Exits — Class A \[101:14.3.3.2(1); 101:15.3.3.2(1)\]
2. In new educational occupancies other than exits — Class A or Class B \[101:14.3.3.2(2)\]
3. In existing educational occupancies, corridors and lobbies — Class A or Class B \[101:15.3.3.2(2)\]
4. Low-height partitions not exceeding 60 in. (1525 mm) and used in locations other than exits — Class A, Class B, or Class C \[101:14.3.3.2(3); 101:15.3.3.2(3)\]

20.2.3.3 Interior Floor Finish.

20.2.3.3.1 New interior floor finish shall comply with Section 12.5. \[101:14.3.3.3.1\]

20.2.3.3.2 New interior floor finish in exit enclosures and exit access corridors and spaces not separated from them by walls complying with 14.3.6 of NFPA 101 shall be not less than Class II. \[101:14.3.3.3.2\]

20.2.3.3.3 New interior floor finish shall comply with 12.5.8.1 or 12.5.8.2, as applicable. \[101:14.3.3.3.3\]

20.2.3.4 Existing Interior Floor Finish.

(Reserved) \[101:15.3.3.3\]

20.2.4 Operating Features.

20.2.4.1 Emergency Action Plan.
Emergency action plans shall be provided in accordance with Section 10.8. \[101:14.7.1; 101:15.7.1\]

20.2.4.2 Emergency Egress Drills.

20.2.4.2.*
Emergency egress drills shall be conducted in accordance with Section 10.5 and the applicable provisions of 20.2.4.2.3 as otherwise provided in 20.2.4.2.2. [101:14.7.2.1; 101:15.7.2.1]

20.2.4.2.2
Approved training programs designed for education and training and for the practice of emergency egress to familiarize occupants with the drill procedure, and to establish conduct of the emergency egress as a matter of routine, shall be permitted to receive credit on a one-for-one basis for not more than four of the emergency egress drills required by 20.2.4.2.3, provided that a minimum of four emergency egress drills are completed prior to the conduct of the first such training and practice program. [101:14.7.2.2; 101:15.7.2.2]

20.2.4.2.3
Emergency egress drills shall be conducted as follows:
(1) Not less than one emergency egress drill shall be conducted every month the facility is in session, unless both of the following criteria are met:
   (a) In climates where the weather is severe, the monthly emergency egress drills shall be permitted to be deferred.
   (b) The required number of emergency egress drills shall be conducted, and not less than four shall be conducted before the drills are deferred.
(2) All occupants of the building shall participate in the drill.
(3) One additional emergency egress drill, other than for educational occupancies that are open on a year-round basis, shall be required within the first 30 days of operation. [101:14.7.2.3; 101:15.7.2.3]

20.2.4.2.4
All emergency drill alarms shall be sounded on the fire alarm system. [101:14.7.2.4; 101:15.7.2.4]

20.2.4.3 Inspection.

20.2.4.3.1*
It shall be the duty of principals, teachers, or staff to inspect all exit facilities daily to ensure that all stairways, doors, and other exits are in proper condition. [101:14.7.3.1; 101:15.7.3.1]

20.2.4.3.2
Open plan buildings shall require extra surveillance to ensure that exit paths are maintained clear of obstruction and are obvious. [101:14.7.3.2; 101:15.7.3.2]

20.2.4.3.3 Inspection of Door Openings.
Door openings shall be inspected in accordance with 7.2.1.15 of NFPA 101. [101:14.7.3.3; 101:15.7.3.3]

20.2.4.4 Furnishings and Decorations.
20.2.4.4.1
Draperies, curtains, and other similar furnishings and decorations in educational occupancies shall be in accordance with the provisions of 12.6.2. [101:14.7.4.1; 101:15.7.4.1]

20.2.4.4.2
Clothing and personal effects shall not be stored in corridors, unless otherwise permitted by one of the following:
(1) This requirement shall not apply to corridors protected by an automatic sprinkler system in accordance with Section 13.3.
(2) This requirement shall not apply to corridor areas protected by a smoke detection system in accordance with 13.7.1.4.
(3) This requirement shall not apply to storage in metal lockers, provided that the required egress width is maintained. [101:14.7.4.2; 101:15.7.4.2]
Artwork and teaching materials shall be permitted to be attached directly to the walls in accordance with the following:

(1) In new educational occupancies, the artwork and teaching materials shall not exceed 20 percent of the wall area in a building that is not protected throughout by an approved, supervised automatic sprinkler system in accordance with Section 13.3. \[101:14.7.4.3(1)\]

(2) In existing educational occupancies, the artwork and teaching materials shall not exceed 20 percent of the wall area in a building that is not protected throughout by an approved automatic sprinkler system in accordance with Section 13.3. \[101:15.7.4.3(1)\]

(3) In new educational occupancies, the artwork and teaching materials shall not exceed 50 percent of the wall area in a building that is protected throughout by an approved, supervised automatic sprinkler system in accordance with Section 13.3. \[101:14.7.4.3(2)\]

(4) In existing educational occupancies, the artwork and teaching materials shall not exceed 50 percent of the wall area in a building that is protected throughout by an approved automatic sprinkler system in accordance with Section 13.3. \[101:15.7.4.3(2)\]

20.2.4.5 Unvented Fuel-Fired Heating Equipment.

Unvented fuel-fired heating equipment, other than gas space heaters in compliance with NFPA 54/ANSI Z223.1, National Fuel Gas Code, shall be prohibited. \[101:14.5.2.2; 101:15.5.2.2\]

20.2.4.6 Integrated Fire Protection Systems

In new educational occupancies, integrated fire protection systems shall be tested in accordance with 13.1.3. \[101:14.7.6\]

20.3 Day-Care Occupancies.

20.3.1 Application.

New and existing day-care occupancies shall comply with Section 20.3 and NFPA 101.

20.3.1.1 In new day-care occupancies, where a facility houses more than one age group or self-preservation capability, the strictest requirements applicable to any group present shall apply throughout the day-care occupancy or building, as appropriate to a given area, unless the area housing such a group is maintained as a separate fire area. \[101:16.1.1.6\]

20.3.1.2 In existing day-care occupancies, where a facility houses clients of more than one self-preservation capability, the strictest requirements applicable to any group present shall apply throughout the day-care occupancy or building, as appropriate to a given area, unless the area housing such a group is maintained as a separate fire area. \[101:17.1.1.6\]

20.3.1.3 Rooms or spaces used for temporary child care, during short-term activities of the child’s relative or guardian within the same building, shall not be required to meet the provisions of this chapter unless the provisions of Section 20.3 where providing day care while services are being held in the building. \[101:16.1.1.7; 101:17.1.1.7\]

20.3.1.4 General.

Occupancies that include preschools, kindergartens, and other schools whose purpose is primarily educational for children 24 months of age or older, even though the children who attend such schools are of preschool age, shall comply with the provisions of Chapter 14 or Chapter 15 of NFPA 101, as applicable. \[101:16.1.2.1; 101:17.1.2.1\]

20.3.1.5 Adult Day-Care Occupancies.

20.3.1.5.1
Adult day-care occupancies shall include any building or portion thereof used for less than 24 hours per day to house more than three adults requiring care, maintenance, and supervision by other than their relative(s). [101:16.1.2.2.1; 101:17.1.2.2.1]

20.3.1.5.2
Clients in adult day-care occupancies shall be ambulatory or semiambulatory and shall not be bedridden. [101:16.1.2.2.2; 101:17.1.2.2.2]

20.3.1.5.3
Clients in adult day-care occupancies shall not exhibit behavior that is harmful to themselves or to others. [101:16.1.2.2.3; 101:17.1.2.2.3]

20.3.2 General Requirements.

20.3.2.1
Unvented fuel-fired heating equipment, other than gas space heaters in compliance with NFPA 54/ANSI Z223.1, National Fuel Gas Code, shall be prohibited. [101:16.5.2.2; 101:17.5.2.2]

20.3.2.2* Door Latches.
Every door latch to closets, storage areas, kitchens, and other similar spaces or areas shall be such that clients can open the door from inside the space or area. [101:16.2.2.2.4; 101:17.2.2.2.4]

20.3.2.3 Bathroom Doors.
Every bathroom door lock shall be designed to allow opening of the locked door from the outside by an opening device that shall be readily accessible to the staff. [101:16.2.2.2.5; 101:17.2.2.2.5]

20.3.2.4 Flexible Plan and Open Plan Buildings.

20.3.2.4.1
In new day-care occupancies, flexible plan and open plan buildings shall comply with the requirements of 20.3.2.4 as modified by 20.3.2.4.3 through 20.3.2.4.6. [101:16.4.3.1]

20.3.2.4.2
In existing day-care occupancies, flexible plan and open plan buildings shall comply with the requirements of 20.3.2.4 as modified by 20.3.2.4.3 and 20.3.2.4.4. [101:17.4.3.1]

20.3.2.4.3
Flexible plan buildings shall be permitted to have walls and partitions rearranged periodically only if revised plans or diagrams have been approved by the AHJ. [101:16.4.3.2; 101:17.4.3.2]

20.3.2.4.4
Flexible plan buildings shall be evaluated while all folding walls are extended and in use as well as when they are in the retracted position. [101:16.4.3.3; 101:17.4.3.3]

20.3.2.4.5
Each room occupied by more than 300 persons shall have two or more means of egress entering into separate atmospheres. [101:16.4.3.4]

20.3.2.4.6
Where three or more means of egress are required from a single room, the number of means of egress permitted to enter into a common atmosphere shall not exceed two. [101:16.4.3.5]

20.3.3 Interior Finish.

20.3.3.1 General.
Interior finish shall be in accordance with Section 12.5. [101:16.3.3.1; 101:17.3.3.1]

20.3.3.2 New Interior Wall and Ceiling Finish.
New interior wall and ceiling finish materials complying with Section 12.5 shall be Class A in stairways, corridors, and lobbies; in all other occupied areas, new interior wall and ceiling finish shall be Class A or Class B. [101:16.3.3.2]
20.3.3.3 Existing Interior Wall and Ceiling Finish.
Existing interior wall and ceiling finish materials complying with Section 12.5 shall be Class A or Class B throughout. [101:17.3.3.2]

20.3.3.4 Interior Floor Finish.
20.3.3.4.1
New interior floor finish shall comply with Section 12.5. [101:16.3.3.3.1]

20.3.3.4.2
New interior floor finish in exit enclosures and exit access corridors and spaces not separated from them by walls complying with 14.3.6 of NFPA 101 shall be not less than Class II. [101:16.3.3.3.2]

20.3.3.4.3
New interior floor finish shall comply with 12.5.8.1 or 12.5.8.2, as applicable. [101:16.3.3.3.3]

20.3.3.4.4 Existing Interior Floor Finish.
(Reserved) [101:17.3.3.3]

20.3.4 Day-Care Homes.
20.3.4.1 Classification.
20.3.4.1.1
In new day-care homes, the requirements of 20.3.4 shall apply to day-care homes in which more than 3, but not more than 12, clients receive care, maintenance, and supervision by other than their relative(s) or legal guardian(s) for less than 24 hours per day, generally within a dwelling unit. (See also 16.6.1.4 of NFPA 101.) [101:16.6.1.2]

20.3.4.1.2*
In existing day-care homes, the requirements of Section 17.6 of NFPA 101 shall apply to existing day-care homes in which more than 3, but not more than 12, clients receive care, maintenance, and supervision by other than their relative(s) or legal guardian(s) for less than 24 hours per day, generally within a dwelling unit. An existing day-care home shall be permitted the option of meeting the requirements of Section 16.6 of NFPA 101 in lieu of Section 17.6 of NFPA 101. Any existing day-care home that meets the requirements of Chapter 16 of NFPA 101 shall be judged as meeting the requirements of this chapter. (See also 17.6.1.4 of NFPA 101.) [101:17.6.1.2]

20.3.4.1.3
In new day-care homes, where a facility houses more than one age group or one self-preservation capability, the strictest requirements applicable to any group present shall apply throughout the day-care home or building, as appropriate to a given area, unless the area housing such a group is maintained as a separate fire area. [101:16.6.1.3]

20.3.4.1.4
In existing day-care homes, where a facility houses clients of more than one self-preservation capability, the strictest requirements applicable to any group present shall apply throughout the day-care home or building, as appropriate to a given area, unless the area housing such a group is maintained as a separate fire area. [101:17.6.1.3]

20.3.4.1.5
Facilities that supervise clients on a temporary basis with a parent or guardian in close proximity shall not be required to meet the provisions of 20.3.4. [101:16.6.1.4; 101:17.6.1.4]

20.3.4.1.6
Places of religious worship shall not be required to meet the provisions of 20.3.4 where operating a day-care home while services are being held in the building. [101:16.6.1.5; 101:17.6.1.5]

20.3.4.2 Operating Features.
Emergency Action Plans.

Emergency action plans shall be provided in accordance with Section 10.8. [101:16.7.1; 101:17.7.1]

Emergency Egress and Relocation Drills.

Emergency egress and relocation drills shall be conducted in accordance with Section 10.5 and the applicable provisions of 20.3.4.2.2. [101:16.7.2.1; 101:17.7.2.1]

Emergency egress and relocation drills shall be conducted as follows:

1. Not less than one emergency egress and relocation drill shall be conducted every month the facility is in session, unless both of the following criteria are met:
   a. In climates where the weather is severe, the monthly emergency egress and relocation drills shall be permitted to be deferred.
   b. The required number of emergency egress and relocation drills shall be conducted, and not less than four shall be conducted before the drills are deferred.

2. The monthly frequency specified by 20.3.4.2.2(1) shall be permitted to be bimonthly in adult day-care centers.

3. All occupants of the building shall participate in the drill.

4. One additional emergency egress and relocation drill, other than for day-care occupancies that are open on a year-round basis, shall be required within the first 30 days of operation. [101:16.7.2.2; 101:17.7.2.2]

Inspections.

Fire prevention inspections shall be conducted monthly by a trained senior member of the staff, after which a copy of the latest inspection report shall be posted in a conspicuous place in the day-care facility. [101:16.7.3.1; 101:17.7.3.1]

It shall be the duty of site administrators and staff members to inspect all exit facilities daily to ensure that all stairways, doors, and other exits are in proper condition. [101:16.7.3.2; 101:17.7.3.2]

Open plan buildings shall require extra surveillance to ensure that exit paths are maintained clear of obstruction and are obvious. [101:16.7.3.3; 101:17.7.3.3]

Inspection of Door Openings.

Door openings shall be inspected in accordance with 7.2.1.15 of NFPA 101. [101:16.7.3.4; 101:17.7.3.4]

Furnishings and Decorations.

Draperies, curtains, and other similar furnishings and decorations in day-care occupancies, other than in day-care homes, shall be in accordance with the provisions of 12.6.2. [101:16.7.4.1; 101:17.7.4.1]

Clothing and personal effects shall not be stored in corridors, unless otherwise permitted by one of the following:

1. This requirement shall not apply to corridors protected by an automatic sprinkler system in accordance with Section 13.3.

2. This requirement shall not apply to corridor areas protected by a smoke detection system in accordance with Section 13.7.
This requirement shall not apply to storage in metal lockers, provided that the required egress width is maintained. [101:16.7.4.2; 101:17.7.4.2]

20.3.4.2.3.5.3
Artwork and teaching materials shall be permitted to be attached directly to the walls in accordance with the following:

1. In new day-care homes, the artwork and teaching materials shall not exceed 20 percent of the wall area in a building that is not protected throughout by an approved, supervised automatic sprinkler system in accordance with Section 13.3. [101:16.7.4.3(1)]

2. In existing day-care homes, the artwork and teaching materials shall not exceed 20 percent of the wall area in a building that is not protected throughout by an approved automatic sprinkler system in accordance with Section 13.3. [101:17.7.4.3(1)]

3. In new day-care homes, the artwork and teaching materials shall not exceed 50 percent of the wall area in a building that is protected throughout by an approved automatic sprinkler system in accordance with Section 13.3. [101:16.7.4.3(2)]

4. In existing day-care homes, the artwork and teaching materials shall not exceed 50 percent of the wall area in a building that is protected throughout by an approved automatic sprinkler system in accordance with Section 13.3. [101:17.7.4.3(2)]

20.3.4.2.3.5.4
The provision of 12.6.3 for cigarette ignition resistance of newly introduced upholstered furniture and mattresses shall not apply to day-care homes. [101:16.7.4.4; 101:17.7.4.4]

20.3.4.2.3.6
Day-Care Staff.
Adequate adult staff shall be on duty and alert at all times where clients are present. [101:16.7.5; 101:17.7.5]

20.3.4.2.3.7
Integrated Fire Protection Systems
In new day-care occupancies, integrated fire protection systems shall be tested in accordance with 13.1.3. [101:16.7.6]

20.4
Health Care Occupancies.
20.4.1
Application.
New and existing health care occupancies shall comply with Section 20.4, NFPA 101, and NFPA 99.

20.4.2
Operating Features.
20.4.2.1
Evacuation and Relocation Plan and Fire Drills.
20.4.2.1.1
The administration of every health care occupancy shall have, in effect and available to all supervisory personnel, written copies of a plan for the protection of all persons in the event of fire, for their evacuation to areas of refuge, and for their evacuation from the building when necessary. [101:18.7.1.1; 101:19.7.1.1]

20.4.2.1.2
All employees shall be periodically instructed and kept informed with respect to their duties under the plan required by 20.4.2.1.1. [101:18.7.1.2; 101:19.7.1.2]

20.4.2.1.3
A copy of the plan required by 20.4.2.1.1 shall be readily available at all times in the telephone operator's location or at the security center. [101:18.7.1.3; 101:19.7.1.3]

20.4.2.1.4
The provisions of Section 10.5 and 20.4.2.1.2 through 20.4.2.2.3 shall apply.
20.4.2.1.5* Fire drills in health care occupancies shall include the transmission of a fire alarm signal and simulation of emergency fire conditions. [101:18.7.1.4; 101:19.7.1.4]

20.4.2.1.6 Infirm or bedridden patients shall not be required to be moved during drills to safe areas or to the exterior of the building. [101:18.7.1.5; 101:19.7.1.5]

20.4.2.1.7 Drills shall be conducted quarterly on each shift to familiarize facility personnel (nurses, interns, maintenance engineers, and administrative staff) with the signals and emergency action required under varied conditions. [101:18.7.1.6; 101:19.7.1.6]

20.4.2.1.8 When drills are conducted between 9:00 p.m. (2100 hours) and 6:00 a.m. (0600 hours), a coded announcement shall be permitted to be used instead of audible alarms. [101:18.7.1.7; 101:19.7.1.7]

20.4.2.1.9 Employees of health care occupancies shall be instructed in life safety procedures and devices. [101:18.7.1.8; 101:19.7.1.8]

20.4.2.2 Procedure in Case of Fire.
20.4.2.2.1* Protection of Patients.
20.4.2.2.1.1 For health care occupancies, the proper protection of patients shall require the prompt and effective response of health care personnel. [101:18.7.2.1.1; 101:19.7.2.1.1]

20.4.2.2.2 Fire Safety Plan.
A written health care occupancy fire safety plan shall provide for the following:
(1) Use of alarms
(2) Transmission of alarms to fire department
(3) Emergency phone call to fire department
(4) Response to alarms
(5) Isolation of fire
(6) Evacuation of immediate area
(7) Evacuation of smoke compartment
(8) Preparation of floors and building for evacuation
(9) Extinguishment of fire
(10) Location and operation of doors disguised with murals as permitted by 18.2.2.2.7 and 19.2.2.2.7 of NFPA 101. [101:18.7.2.2; 101:19.7.2.2]

20.4.2.2.3 Staff Response.
All health care occupancy personnel shall be instructed in the use of and response to fire alarms.

20.4.2.2.3.2 All health care occupancy personnel shall be instructed in the use of the code phrase to ensure transmission of an alarm under the following conditions:

1. When the individual who discovers a fire must immediately go to the aid of an endangered person
2. During a malfunction of the building fire alarm system

20.4.2.2.3.3 Personnel hearing the code announced shall first activate the building fire alarm using the nearest manual fire alarm box and then shall execute immediately their duties as outlined in the fire safety plan.

20.4.2.3 Maintenance of Means of Egress.

20.4.2.3.1 Proper maintenance shall be provided to ensure the dependability of the method of evacuation selected.

20.4.2.3.2 Health care occupancies that find it necessary to lock means of egress doors shall, at all times, maintain an adequate staff qualified to release locks and direct occupants from the immediate danger area to a place of safety in case of fire or other emergency.

20.4.2.3.3 Where required by the AHJ, a floor plan shall be provided to indicate the location of all required means of egress corridors in smoke compartments having spaces not separated from the corridor by partitions.

20.4.2.4 Smoking.

Smoking regulations shall be adopted and shall include not less than the following provisions:

1. Smoking shall be prohibited in any room, ward, or individual enclosed space where flammable liquids, combustible gases, or oxygen is used or stored and in any other hazardous location, and such areas shall be posted with signs that read NO SMOKING or shall be posted with the international symbol for no smoking.
2. In health care occupancies where smoking is prohibited and signs are prominently placed at all major entrances, secondary signs with language that prohibits smoking shall not be required.
3. Smoking by patients classified as not responsible shall be prohibited.
4. The requirement of 20.4.2.4(3) shall not apply where the patient is under direct supervision.
5. Ashtrays of noncombustible material and safe design shall be provided in all areas where smoking is permitted.
6. Metal containers with self-closing cover devices into which ashtrays can be emptied shall be readily available to all areas where smoking is permitted.

20.4.2.5 Furnishings, Mattresses, and Decorations.

20.4.2.5.1 Draperies, curtains, and other loosely hanging fabrics and films serving as furnishings or decorations in health care occupancies shall be in accordance with the provisions of 12.6.2(see 18.3.5.10 or 19.3.5.10 of NFPA 101), and the following also shall apply:

1. Such curtains shall include cubicle curtains.
2. Such curtains shall not include curtains at showers and baths.
(3) Such draperies and curtains shall not include draperies and curtains at windows in patient sleeping rooms in sprinklered smoke compartments.

(4) Such draperies and curtains shall not include draperies and curtains in other rooms or areas where the draperies and curtains comply with all of the following:
   (a) Individual drapery or curtain panel area does not exceed 48 ft² (4.5 m²).
   (b) Total area of drapery and curtain panels per room or area does not exceed 20 percent of the aggregate area of the wall on which they are located.
   (c) Smoke compartment in which draperies or curtains are located is sprinklered in accordance with 13.3.2.12.

20.4.2.5.2
Newly introduced upholstered furniture within health care occupancies shall comply with one of the following provisions, unless otherwise provided in 20.4.2.5.3:
   (1) The furniture shall meet the criteria specified in 12.6.3.1 and 12.6.3.2.1.
   (2) The furniture shall be in a building protected throughout by an approved, supervised automatic sprinkler system in accordance with NFPA 13.

20.4.2.5.3
The requirements of 20.4.2.5.2, 12.6.3.1, and 12.6.3.2.1 shall not apply to upholstered furniture belonging to the patient in sleeping rooms of existing nursing homes where the following criteria are met:
   (1) A smoke detector shall be installed where the patient sleeping room is not protected by automatic sprinklers.
   (2) Battery-powered single-station smoke detectors shall be permitted.

20.4.2.5.4
Newly introduced mattresses within health care occupancies shall comply with one of the following provisions, unless otherwise provided in 20.4.2.5.5:
   (1) The mattresses shall meet the criteria specified in 12.6.3.2 and 12.6.3.2.2.
   (2) The mattresses shall be in a building protected throughout by an approved, supervised automatic sprinkler system in accordance with NFPA 13.

20.4.2.5.5
The requirements of 12.6.3.2, 12.6.3.2.2, and 20.4.2.5.4 shall not apply to mattresses belonging to the patient in sleeping rooms of existing nursing homes where the following criteria are met:
   (1) A smoke detector shall be installed where the patient sleeping room is not protected by automatic sprinklers.
   (2) Battery-powered single-station smoke detectors shall be permitted.

20.4.2.5.6
Combustible decorations shall be prohibited in any health care occupancy, unless one of the following criteria is met:
   (1) They are flame-retardant or are treated with approved fire-retardant coating that is listed and labeled for application to the material to which it is applied.
   (2) The decorations meet the flame propagation performance criteria contained in Test Method 1 or Test Method 2, as appropriate, of NFPA 701.
The decorations exhibit a heat release rate not exceeding 100 kW when tested in accordance with NFPA 289 using the 20 kW ignition source.

The decorations, such as photographs, paintings, and other art, are attached directly to the walls, ceiling, and non-fire-rated doors in accordance with the following:

(a) Decorations on non-fire-rated doors do not interfere with the operation or any required latching of the door and do not exceed the area limitations of 20.4.2.5.6(b), (c), or (d).

(b) Decorations do not exceed 20 percent of the wall, ceiling, and door areas inside any room or space of a smoke compartment that is not protected throughout by an approved automatic sprinkler system in accordance with Section 13.3.

c) Decorations do not exceed 30 percent of the wall, ceiling, and door areas inside any room or space of a smoke compartment that is protected throughout by an approved supervised automatic sprinkler system in accordance with Section 13.3.

(d) Decorations do not exceed 50 percent of the wall, ceiling, and door areas inside patient sleeping rooms having a capacity not exceeding four persons, in a smoke compartment that is protected throughout by an approved, supervised automatic sprinkler system in accordance with Section 13.3.

In existing health care occupancies, they are decorations, such as photographs or paintings, in such limited quantities that a hazard of fire development or spread is not present.

20.4.2.5.7
Soiled linen or trash collection receptacles shall not exceed 32 gal (121 L) in capacity and shall meet the following requirements:

(1) The average density of container capacity in a room or space shall not exceed 0.5 gal/ft² (20.4 L/m²).

(2) A capacity of 32 gal (121 L) shall not be exceeded within any 64 ft² (6 m²) area.

(3) Mobile soiled linen or trash collection receptacles with capacities greater than 32 gal (121 L) shall be located in a room protected as a hazardous area when not attended.

(4) Container size and density shall not be limited in hazardous areas.

Containers used solely for recycling clean waste or for patient records awaiting destruction shall be permitted to be excluded from the limitations of 20.4.2.5.7 where all the following conditions are met:

(1) Each container is limited to a capacity of 96 gal (363 L) except as permitted by 20.4.2.5.8(2) or (3).

(2) *Containers with capacities greater than 96 gal (363 L) shall be located in a room protected as a hazardous area when not attended.

(3) Container size shall not be limited in hazardous areas.

(4) Containers for combustibles shall be labeled and listed as meeting the requirements of FM Approval Standard 6921, Approval Standard for Containers for Combustible Waste; however, such testing, listing, and labeling shall not be limited to FM Approvals.

20.4.2.5.8*
The provisions of 19.2.1.1 through 19.2.1.2 applicable to soiled linen and trash receptacles shall not apply.

20.4.2.6 Portable Space-Heating Devices.
Portable space-heating devices shall be prohibited in all health care occupancies, unless both of the following criteria are met:

(1) Such devices are permitted to be used only in nonsleeping staff and employee areas.

(2) The heating elements of such devices do not exceed 212°F (100°C).
20.4.2.7 Integrated Fire Protection Systems
Integrated fire protection systems shall be tested in accordance with 13.3.13.

20.4.3 Interior Finish.
20.4.3.1 General.
Interior finish shall be in accordance with Section 12.5

20.4.3.2 New Interior Wall and Ceiling Finish.
Interior wall and ceiling finish materials complying with Section 12.5 shall be permitted throughout if Class A, except as indicated in 20.4.3.2.1 or 20.4.3.2.2.

20.4.3.2.1 New walls and ceilings shall be permitted to have Class A or Class B interior finish in individual rooms having a capacity not exceeding four persons.

20.4.3.2.2 New corridor wall finish not exceeding 48 in. (1220 mm) in height that is restricted to the lower half of the wall shall be permitted to be Class A or Class B.

20.4.3.3 Existing Interior Wall and Ceiling Finish.
Existing interior wall and ceiling finish materials complying with Section 12.5 shall be permitted to be Class A or Class B.

20.4.4 Interior Finish (Nonsprinklered Smoke Compartment Rehabilitation).
20.4.4.1 General.
Interior finish within the modification area shall be in accordance with Section 12.5.

20.4.4.2 Interior Wall and Ceiling Finish.
Newly installed interior wall and ceiling finish materials complying with Section 12.5 shall be permitted throughout nonsprinklered smoke compartments if the materials are Class A, except as otherwise permitted in 20.4.4.2.1 or 20.4.4.2.2.

20.4.4.2.1 Walls and ceilings shall be permitted to have Class A or Class B interior finish in individual rooms having a capacity not exceeding four persons.

20.4.4.2.2 Corridor wall finish not exceeding 48 in. (1220 mm) in height and restricted to the lower half of the wall shall be permitted to be Class A or Class B.

20.4.5 Interior Floor Finish.
20.4.5.1 Newly installed interior floor finish shall comply with Section 12.5.

The requirements for newly installed interior floor finish in exit enclosures and corridors not separated from them by walls complying with 19.3.5.7 of NFPA 101 shall be as follows:
1. Unrestricted in smoke compartments protected throughout by an approved, supervised automatic sprinkler system in accordance with 19.3.5.7 of NFPA 101
2. Not less than Class I in smoke compartments not protected throughout by an approved, supervised automatic sprinkler system in accordance with 19.3.5.7 of NFPA 101

20.4.3.5.3 Existing Interior Floor Finish.
No restrictions shall apply to existing interior floor finish. [101:19.3.3.3]

20.5 Residential Board and Care Occupancies.

20.5.1 Application.
New and existing residential board and care occupancies shall comply with Section 20.5 and NFPA 101.

20.5.2 Operating Features.

20.5.2.1 Emergency Action Plan.

20.5.2.1.1 The administration of every residential board and care facility shall have, in effect and available to all supervisory personnel, written copies of a plan for protecting all persons in the event of fire, for keeping persons in place, for evacuating persons to areas of refuge, and for evacuating persons from the building when necessary. [101:32.7.1.1; 101:33.7.1.1]

20.5.2.1.2 The emergency action plan shall include special staff response, including the fire protection procedures needed to ensure the safety of any resident, and shall be amended or revised whenever any resident with unusual needs is admitted to the home. [101:32.7.1.2; 101:33.7.1.2]

20.5.2.1.3 All employees shall be periodically instructed and kept informed with respect to their duties and responsibilities under the plan, and such instruction shall be reviewed by the staff not less than every 2 months. [101:32.7.1.3; 101:33.7.1.3]

20.5.2.2 Resident Training.

20.5.2.2.1 All residents participating in the emergency action plan shall be trained in the proper actions to be taken in the event of fire. [101:32.7.2.1; 101:33.7.2.1]

20.5.2.2.2 The training required by 20.5.2.2.1 shall include actions to be taken if the primary escape route is blocked. [101:32.7.2.2; 101:33.7.2.2]

20.5.2.2.3 If a resident is given rehabilitation or habilitation training, training in fire prevention and the actions to be taken in the event of a fire shall be a part of the training program. [101:32.7.2.3; 101:33.7.2.3]

20.5.2.2.4 Residents shall be trained to assist each other in case of fire to the extent that their physical and mental abilities permit them to do so without additional personal risk. [101:32.7.2.4; 101:33.7.2.4]

20.5.2.3 Emergency Egress and Relocation Drills.
Emergency egress and relocation drills shall be conducted in accordance with 20.5.2.3.1 through 20.5.2.3.6. [101:32.7.3; 101:33.7.3]

20.5.2.3.1 Emergency egress and relocation drills shall be conducted not less than six times per year on a bimonthly basis, with not less than two drills conducted during the night when residents are sleeping, as modified by 20.5.2.3.5 and 20.5.2.3.6. [101:32.7.3.1; 101:33.7.3.1]
20.5.2.3.2
The emergency drills shall be permitted to be announced to the residents in advance. [101:32.7.3.2; 101:33.7.3.2]

20.5.2.3.3
The drills shall involve the actual evacuation of all residents to an assembly point, as specified in the emergency action plan, and shall provide residents with experience in egressing through all exits and means of escape required by this Code. [101:32.7.3.3; 101:33.7.3.3]

20.5.2.3.4
Exits and means of escape not used in any drill shall not be credited in meeting the requirements of this Code for board and care facilities. [101:32.7.3.4; 101:33.7.3.4]

20.5.2.3.5
Actual exiting from windows shall not be required to comply with 20.5.2.3; opening the window and signaling for help shall be an acceptable alternative. [101:32.7.3.5; 101:33.7.3.5]

20.5.2.3.6
Residents who cannot meaningfully assist in their own evacuation or who have special health problems shall not be required to actively participate in the drill. Subsection 20.4.2 shall apply in such instances. [101:32.7.3.6; 101:33.7.3.6]

20.5.2.4 Smoking.

20.5.2.4.1*
Smoking regulations shall be adopted by the administration of board and care occupancies. [101:32.7.4.1; 101:33.7.4.1]

20.5.2.4.2
Where smoking is permitted, noncombustible safety-type ashtrays or receptacles shall be provided in convenient locations. [101:32.7.4.2; 101:33.7.4.2]

20.5.2.5* Furnishings, Bedding, and Decorations.

20.5.2.5.1
New draperies, curtains, and other similar loosely hanging furnishings and decorations in board and care facilities shall comply with 20.5.2.5.1.1 and 20.5.2.5.1.2. [101:32.7.5.1; 101:33.7.5.1]

20.5.2.5.1.1
New draperies, curtains, and other similar loosely hanging furnishings and decorations in board and care facilities shall be in accordance with the provisions of 12.6.2, unless otherwise permitted by 20.5.2.5.1.2. [101:32.7.5.1.1; 101:33.7.5.1.1]

20.5.2.5.1.2
In other than common areas, new draperies, curtains, and other similar loosely hanging furnishings and decorations shall not be required to comply with 20.5.2.5.1.1 where the building is protected throughout by an approved automatic sprinkler system installed in accordance with 13.3.2.21.2 for new small facilities, 13.3.2.21.1 for new large facilities, 13.3.2.22.2 for existing small facilities, or 13.3.2.22.1 for existing large facilities. [101:32.7.5.1.2; 101:33.7.5.1.2]

20.5.2.5.2*
New upholstered furniture within board and care facilities shall comply with 20.5.2.5.2.1 or 20.5.2.5.2.2. [101:32.7.5.2; 101:33.7.5.2]

20.5.2.5.2.1
New upholstered furniture shall be tested in accordance with the provisions of 12.6.3.1(1) and 12.6.3.2.1. [101:32.7.5.2.1; 101:33.7.5.2.1]

20.5.2.5.2.2
Upholstered furniture belonging to residents in sleeping rooms shall not be required to be tested, provided that a smoke alarm is installed in such rooms; battery-powered single-station smoke alarms shall be permitted in such rooms. [101:32.7.5.2.2; 101:33.7.5.2.2]

20.5.2.5.2.3*

Newly introduced mattresses within board and care facilities shall comply with 20.5.2.5.2.3.1 or 20.5.2.5.2.3.2. [101:32.7.5.3; 101:33.7.5.3]

20.5.2.5.2.3.1

Newly introduced mattresses shall be tested in accordance with the provisions of 12.6.3.2 and 12.6.3.2.2. [101:32.7.5.3.1; 101:33.7.5.3.1]

20.5.2.5.2.3.2

Mattresses belonging to residents in sleeping rooms shall not be required to be tested, provided that a smoke alarm is installed in such rooms; battery-powered single-station smoke alarms shall be permitted in such rooms. [101:32.7.5.3.2; 101:33.7.5.3.2]

20.5.2.5.3

No stove or combustion heater shall be located to block escape in case of fire caused by the malfunction of the stove or heater. [101:32.2.5.2.2; 101:33.2.5.2.2]

20.5.2.5.4

Unvented fuel-fired heaters shall not be used in any residential board and care facility. [101:32.2.5.2.3; 101:33.2.5.2.3]

20.5.3 Interior Finish.

20.5.3.1 Small Facilities.

20.5.3.1.1 General.

Interior finish shall be in accordance with Section 12.5. [101:32.2.3.3.1; 101:33.2.3.3.1]

20.5.3.1.2 New Interior Wall and Ceiling Finish.

New interior wall and ceiling finish materials complying with Section 12.5 shall be Class A, Class B, or Class C. [101:32.2.3.3.2]

20.5.3.1.3 Existing Interior Wall and Ceiling Finish.

Existing interior wall and ceiling finish materials complying with Section 12.5 shall be as follows:

(1) Class A or Class B in facilities other than those having prompt evacuation capability
(2) Class A, Class B, or Class C in facilities having prompt evacuation capability [101:32.2.3.3.2]

20.5.3.1.4 Interior Floor Finish.

20.5.3.1.4.1 New interior floor finish shall comply with Section 12.5. [101:32.2.3.3.3.1]

20.5.3.1.4.2 New interior floor finish shall comply with 12.5.8.1 or 12.5.8.2, as applicable. [101:32.2.3.3.3.2]

20.5.3.1.4.3 Existing Interior Floor Finish. (Reserved) [101:32.2.3.3.3.3]

20.5.3.2 Large Facilities.

20.5.3.2.1 General.

Interior finish shall be in accordance with Section 12.5. [101:32.3.3.3.1; 101:33.3.3.3.1]

20.5.3.2.2 New Interior Wall and Ceiling Finish.

New interior wall and ceiling finish materials complying with Section 12.5 shall be in accordance with the following:

(1) Exit enclosures — Class A
Lobbies and corridors — Class B
Rooms and enclosed spaces — Class B

20.5.3.2.3 Existing Interior Wall and Ceiling Finish.
Existing interior wall and ceiling finish materials complying with Section 12.5 shall be Class A or Class B.

20.5.3.2.4 Interior Floor Finish.

20.5.3.2.4.1 New interior floor finish shall comply with Section 12.5. [101:32.3.3.3.1]

20.5.3.2.4.2 New interior floor finish in exit enclosures and exit access corridors and spaces not separated from them by walls complying with 32.3.3.6 of NFPA 101 shall be not less than Class II. [101:32.3.3.3.2]

20.5.3.2.4.3 New interior floor finish shall comply with 12.5.8.1 or 12.5.8.2, as applicable. [101:32.3.3.3.3]

20.5.3.3 Apartment Buildings Housing Board and Care Occupancies.

20.5.3.3.1 New Interior Finish.

20.5.3.3.1.1 The requirements of 20.9.3 shall apply only to the parts of means of egress serving the apartment(s) used as a residential board and care occupancy, as modified by 20.5.3.3.1.2. [101:32.4.3.1.1]

20.5.3.3.1.2 If a new board and care occupancy is created in an existing apartment building, the requirements of 31.3.3 of NFPA 101 shall apply to the parts of the means of egress serving the apartment(s) used as a residential board and care occupancy. [101:32.4.3.1.2]

20.5.3.3.2 Existing Interior Finish.
The requirements of 20.9.3 shall apply only to the parts of means of egress serving the apartment(s) used as a residential board and care occupancy. [101:33.4.3.1]

20.6 Ambulatory Health Care Centers.

20.6.1 Application.
New and existing ambulatory health care centers shall comply with Section 20.6 and NFPA 101.

20.6.2 Operating Features.
20.6.2.1 Evacuation and Relocation Plan and Fire Drills.

20.6.2.1.1 The administration of every ambulatory health care facility shall have, in effect and available to all supervisory personnel, written copies of a plan for the protection of all persons in the event of fire, for their evacuation to areas of refuge, and for their evacuation from the building when necessary. [101:20.7.1.1; 101:21.7.1.2]

20.6.2.1.2 All employees shall be periodically instructed and kept informed with respect to their duties under the plan required by 20.6.2.1.1. [101:20.7.1.2; 101:21.7.1.2]

20.6.2.1.3 A copy of the plan required by 20.6.2.1.1 shall be readily available at all times when the facility is open. [101:20.7.1.3; 101:21.7.1.3]
20.6.2.1.4
The provisions of Section 10.6 and 20.6.2.1.5 through 20.6.2.2.3 shall apply.

20.6.2.1.5*
Fire drills in ambulatory health care facilities shall include the simulation of emergency fire conditions.  
[101:20.7.1.4; 101:21.7.1.4]

20.6.2.1.6
Patients shall not be required to be moved during drills to safe areas or to the exterior of the building.  
[101:20.7.1.5; 101:21.7.1.5]

20.6.2.1.7
Drills shall be conducted quarterly on each shift to familiarize facility personnel (including but not limited to nurses, interns, maintenance engineers, and administrative staff) with the emergency action required under varied conditions.  [101:20.7.1.6; 101:21.7.1.6]

20.6.2.1.8
Employees of ambulatory health care facilities shall be instructed in life safety procedures and devices.  
[101:20.7.1.7; 101:21.7.1.7]

20.6.2.2  Procedure in Case of Fire.

20.6.2.2.1* Protection of Patients.

20.6.2.2.1.1
For ambulatory health care facilities, the proper protection of patients shall require the prompt and effective response of ambulatory health care personnel.  [101:20.7.2.1.1; 101:21.7.2.1.1]

20.6.2.2.1.2
The basic response required of staff shall include the following:
(1) Removal of all occupants directly involved with the fire emergency
(2) Transmission of an appropriate fire alarm signal to warn other building occupants and summon staff
(3) Confinement of the effects of the fire by closing doors to isolate the fire area
(4) Relocation of patients as detailed in the facility’s fire safety plan [101:20.7.2.1.2; 101:21.7.2.1.2]

20.6.2.2.2  Fire Safety Plan.
A written fire safety plan shall provide for the following:
(1) Use of alarms
(2) Transmission of alarms to fire department
(3) Response to alarms
(4) Isolation of fire
(5) Evacuation of immediate area
(6) Evacuation of smoke compartment
(7) Preparation of floors and building for evacuation
(8) Extinguishment of fire [101:20.7.2.2; 101:21.7.2.2]

20.6.2.3  Staff Response.

20.6.2.3.1
All personnel shall be instructed in the use of and response to fire alarms.  [101:20.7.2.3.1; 101:21.7.2.3.1]

20.6.2.3.2
All personnel shall be instructed in the use of the code phrase to ensure transmission of an alarm under either of the following conditions:
(1) When the individual who discovers a fire must immediately go to the aid of an endangered person
(2) During a malfunction of the building fire alarm system
Personnel hearing the code announced shall first activate the building fire alarm using the nearest fire alarm box and then shall execute immediately their duties as outlined in the fire safety plan.

### Maintenance of Exits

Proper maintenance shall be provided to ensure the dependability of the method of evacuation selected.

Ambulatory health care occupancies that find it necessary to lock exits shall, at all times, maintain an adequate staff qualified to release locks and direct occupants from the immediate danger area to a place of safety in case of fire or other emergency.

### Smoking

Smoking regulations shall be adopted and shall include not less than the following provisions:

1. Smoking shall be prohibited in any room, ward, or compartment where flammable liquids, combustible gases, or oxygen is used or stored and in any other hazardous location, and such areas shall be posted with signs that read NO SMOKING or shall be posted with the international symbol for no smoking.
2. In ambulatory health care facilities where smoking is prohibited and signs are placed at all major entrances, secondary signs with language that prohibits smoking shall not be required.
3. Smoking by patients classified as not responsible shall be prohibited.
4. The requirement of 20.6.2.4(3) shall not apply where the patient is under direct supervision.
5. Ashtrays of noncombustible material and safe design shall be provided in all areas where smoking is permitted.
6. Metal containers with self-closing cover devices into which ashtrays can be emptied shall be readily available to all areas where smoking is permitted.

### Furnishings, Mattresses, and Decorations

Draperies, curtains, and other loosely hanging fabrics and films serving as furnishings or decorations in ambulatory health care occupancies shall be in accordance with the provisions of 12.6.2, and the following also shall apply:

1. Such curtains shall include cubicle curtains.
2. Such curtains shall not include curtains at showers.

Newly introduced upholstered furniture shall comply with 12.6.3.1 and one of the following provisions:

1. The furniture shall meet the criteria specified in 12.6.3.2.1.
2. The furniture shall be in a building protected throughout by an approved, supervised automatic sprinkler system in accordance with NFPA 13.

Newly introduced mattresses shall comply with 12.6.3.2 and one of the following provisions:

1. The mattresses shall meet the criteria specified in 12.6.3.2.2.
2. The mattresses shall be in a building protected throughout by an approved, supervised automatic sprinkler system in accordance with NFPA 13.
Combustible decorations shall be prohibited, unless one of the following criteria is met:

1. They are flame-retardant.
2. The decorations meet the flame propagation performance criteria contained in Test Method 1 or Test Method 2, as appropriate, of NFPA 701.
3. The decorations exhibit a heat release rate not exceeding 100 kW when tested in accordance with NFPA 289 using the 20 kW ignition source.
4. *The decorations, such as photographs, paintings, and other art, are attached directly to the walls, ceiling, and non-fire-rated doors in accordance with the following:
   (a) Decorations on non-fire-rated doors do not interfere with the operation or any required latching of the door and do not exceed the area limitations of 20.6.2.5.4(4)(b) or (c).
   (b) Decorations do not exceed 20 percent of the wall, ceiling, and door areas inside any room or space of a smoke compartment that is not protected throughout by an approved automatic sprinkler system in accordance with Section 13.3.
   (c) Decorations do not exceed 30 percent of the wall, ceiling, and door areas inside any room or space of a smoke compartment that is protected throughout by an approved supervised automatic sprinkler system in accordance with Section 13.3. [101:20.7.5.4; 101:21.7.5.4]

20.6.2.5.5 Soiled Linen and Trash Receptacles.

20.6.2.5.5.1 Soiled linen or trash collection receptacles shall not exceed 32 gal (121 L) in capacity, and the following also shall apply:

1. The average density of container capacity in a room or space shall not exceed 0.5 gal/ft² (20.4 L/m²).
2. A capacity of 32 gal (121 L) shall not be exceeded within any 64 ft² (6 m²) area.
3. Mobile soiled linen or trash collection receptacles with capacities greater than 32 gal (121 L) shall be located in a room protected as a hazardous area when not attended.
4. Container size and density shall not be limited in hazardous areas. [101:20.7.5.5.1; 101:21.7.5.5.1]

20.6.2.5.5.2 Containers used solely for recycling clean waste or for patient records awaiting destruction shall be permitted to be excluded from the requirements of 20.6.2.5.5.1 where all the following conditions are met:

1. Each container shall be limited to a maximum capacity of 96 gal (363 L), except as permitted by 20.6.2.5.5.2(2) or (3).
2. Containers with capacities greater than 96 gal (363 L) shall be located in a room protected as a hazardous area when not attended.
3. Container size shall not be limited in hazardous areas.
4. Containers for combustibles shall be labeled and listed as meeting the requirements of FM Approval Standard 6921, Approval Standard for Containers for Combustible Waste; however, such testing, listing, and labeling shall not be limited to FM Approvals. [101:20.7.5.5.2; 101:21.7.5.5.2]

20.6.2.5.3 The provisions of 19.2.1.1 through 19.2.1.2 applicable to soiled linen and trash receptacles shall not apply.

20.6.2.6 Portable Space-Heating Devices.

Portable space-heating devices shall be prohibited in all ambulatory health care occupancies, unless both of the following criteria are met:

1. Such devices are used only in nonsleeping staff and employee areas.
2. The heating elements of such devices do not exceed 212°F (100°C). [101:20.7.8; 101:21.7.8]
20.6.2.7 Integrated Fire Protection Systems
Integrated fire protection systems shall be tested in accordance with 13.1.3. [101:20.7.10, 21.7.10]

20.6.3 Interior Finish.
20.6.3.1 General.
Interior finish shall be in accordance with Section 12.5. [101:20.3.3.1; 101:21.3.3.1]

20.6.3.2 Interior Wall and Ceiling Finish.
20.6.3.2.1 Interior wall and ceiling finish material complying with Section 12.5 shall be Class A or Class B in exits and in exit access corridors. [101:20.3.3.2.1; 101:21.3.3.2.1]

20.6.3.2.2 Interior wall and ceiling finishes shall be Class A, Class B, or Class C in areas other than those specified in 20.6.3.2.1. [101:20.3.3.2.2; 101:21.3.3.2.2]

20.6.3.3 New Interior Floor Finish.
20.6.3.3.1 New interior floor finish shall comply with Section 12.5. [101:20.3.3.3.1]

20.6.3.3.2 New interior floor finish in exit enclosures shall be Class I or Class II. [101:20.3.3.3.2]

20.6.3.3.3 New interior floor finish shall comply with 12.5.8.1 or 12.5.8.2, as applicable. [101:20.3.3.3.3]

20.6.3.4 Existing Interior Floor Finish. (Reserved) [101:21.3.3.3]

20.7 Detention and Correctional Occupancies.
20.7.1 Application.
New and existing detention and correctional occupancies shall comply with Section 20.7 and NFPA 101.

20.7.2 Operating Features.
20.7.2.1 Attendants, Evacuation Plan, Fire Drills.
20.7.2.1.1 Detention and correctional facilities, or those portions of facilities having such occupancy, shall be provided with 24-hour staffing, and the following requirements also shall apply:
(1) Staff shall be within three floors or a 300 ft (91 m) horizontal distance of the access door of each resident housing area.
(2) For Use Condition III, Use Condition IV, and Use Condition V, the arrangement shall be such that the staff involved starts the release of locks necessary for emergency evacuation or rescue and initiates other necessary emergency actions within 2 minutes of alarm.
(3) The following shall apply to areas in which all locks are unlocked remotely in compliance with 22.2.11.8 or 23.2.11.8 of NFPA 101.
(a) Staff shall not be required to be within three floors or 300 ft (91 m) of the access door.
(b) The 10-lock, manual key exemption of 22.2.11.8.2 or 23.2.11.8.2 of NFPA 101 shall not be permitted to be used in conjunction with the alternative requirement of 20.7.2.1.1(3)(a). [101:22.7.1.1; 101:23.7.1.1]

20.7.2.1.2* Provisions shall be made so that residents in Use Condition III, Use Condition IV, and Use Condition V shall be able to notify staff of an emergency. [101:22.7.1.2; 101:23.7.1.2]

20.7.2.1.3* The administration of every detention or correctional facility shall have, in effect and available to all supervisory personnel, written copies of a plan for the protection of all persons in the event of fire, for their
evacuation to areas of refuge, and for evacuation from the building when necessary. [101:22.7.1.3; 101:23.7.1.3]  
20.7.2.1.3.1

All employees shall be instructed and drilled with respect to their duties under the plan. [101:22.7.1.3.1; 101:23.7.1.3.1]  
20.7.2.1.3.2

The plan shall be coordinated with, and reviewed by, the fire department legally committed to serve the facility. [101:22.7.1.3.2; 101:23.7.1.3.2]  
20.7.2.1.4

Employees of detention and correctional occupancies shall be instructed in the proper use of portable fire extinguishers and other manual fire suppression equipment. [101:22.7.1.4; 101:23.7.1.4]  
20.7.2.1.4.1

The training specified in 20.7.2.1.4 shall be provided to new staff promptly upon commencement of duty. [101:22.7.1.4.1; 101:23.7.1.4.1]  
20.7.2.1.4.2

Refresher training shall be provided to existing staff at not less than annual intervals. [101:22.7.1.4.2; 101:23.7.1.4.2]  
20.7.2.2

**Combustible Personal Property.**

Books, clothing, and other combustible personal property allowed in sleeping rooms shall be stored in closable metal lockers or an approved fire-resistant container. [101:22.7.2; 101:23.7.2]  
20.7.2.3

**Heat-Producing Appliances.**

The number of heat-producing appliances, such as toasters and hot plates, and the overall use of electrical power within a sleeping room shall be controlled by facility administration. [101:22.7.3; 101:23.7.3]  
20.7.2.4

**Furnishings, Bedding, and Decorations.**

20.7.2.4.1

Draperies and curtains, including privacy curtains, in detention and correctional occupancies shall be in accordance with the provisions of 12.6.2. [101:22.7.4.1; 101:23.7.4.1]  
20.7.2.4.2

Newly introduced upholstered furniture within detention and correctional occupancies shall meet the criteria specified in 12.6.3.1(2) and 12.6.3.2.1. [101:23.7.4.2]  
20.7.2.4.3*

Newly introduced mattresses within detention and correctional occupancies shall meet the criteria specified in 12.6.3.2 and 12.6.3.2.2. [101:23.7.4.3]  
20.7.2.4.4

Combustible decorations shall be prohibited in any detention or correctional occupancy unless they are flame-retardant and approved. [101:22.7.4.4; 101:23.7.4.4]  
20.7.2.4.5

Wastebaskets and other waste containers shall be of noncombustible or other approved materials. Waste containers with a capacity exceeding 20 gal (76 L) shall be provided with a noncombustible lid or lid of other approved material. [101:22.7.4.5; 101:23.7.4.5]  
20.7.2.5

**Keys.**

All keys necessary for unlocking doors installed in a means of egress shall be individually identified by both touch and sight. [101:22.7.5; 101:23.7.5]  
20.7.2.6

**Portable Space-Heating Devices.**
Portable space-heating devices shall be prohibited in all detention and correctional occupancies. [101:22.7.6; 101:23.7.6]

20.7.2.7 Door Inspection
Doors and door hardware in means of egress shall be inspected *monthly-annually* by an appropriately trained person. The inspection shall be documented. [101:22.7.7; 101:23.7.7]

20.7.2.8 Integrated Fire Protection Systems.
Integrated fire protection systems shall be tested in accordance with 13.1.3. [101:22.7.8; 101:23.7.7]

20.7.3 Interior Finish.

20.7.3.1 General.
Interior finish shall be in accordance with Section 12.5. [101:22.3.3.1; 101:23.3.3.1]

20.7.3.2 New Interior Wall and Ceiling Finish.
New interior wall and ceiling finish materials complying with Section 12.5 shall be Class A or Class B in corridors, in exits, and in any space not separated from corridors and exits by partitions capable of retarding the passage of smoke; and Class A, Class B, or Class C in all other areas. The provisions of 12.5.9.1 shall not apply to new detention and correctional occupancies. [101:22.3.3.2]

20.7.3.3 Existing Interior Wall and Ceiling Finish.
Existing interior wall and ceiling finish materials complying with Section 12.5 shall be Class A or Class B in corridors, in exits, and in any space not separated from corridors and exits by partitions capable of retarding the passage of smoke; and Class A, Class B, or Class C in all other areas. [101:23.3.3.2]

20.7.3.4 New Interior Floor Finish.
20.7.3.4.1 New interior floor finish shall comply with Section 12.5. [101:22.3.3.3.1]

20.7.3.4.2 Interior floor finish in exit enclosures and exit access corridors shall be not less than Class II. The provisions of 12.5.9.2 shall not apply to new detention and correctional occupancies. [101:22.3.3.3.2]

20.7.3.4.3 New interior floor finish shall comply with 12.5.8.1 or 12.5.8.2, as applicable. [101:22.3.3.3.3]

20.7.3.5 Existing Interior Floor Finish.
20.7.3.5.1 Existing interior floor finish complying with Section 12.5 shall be Class I or Class II in corridors and exits. [101:23.3.3.3.1]

20.7.3.5.2 Existing floor finish material of Class A or Class B in nonsprinklered smoke compartments and Class A, Class B, or Class C in sprinklered smoke compartments shall be permitted to be continued to be used, provided that it has been evaluated based on tests performed in accordance with 12.5.4. [101:23.3.3.3.2]

20.7.3.6 Interior Finish (Nonsprinklered Existing Building Renovations).
20.7.3.6.1 Interior Wall and Ceiling Finish.
Interior wall and ceiling finish materials complying with Section 12.5 shall be Class A in corridors, in exits, and in any space not separated from corridors and exits by partitions capable of retarding the passage of smoke; and Class A, Class B, or Class C in all other areas. [101:22.4.4.8.1]

20.7.3.6.2 Interior Floor Finish.

20.7.3.6.2.1 Interior floor finish shall comply with Section 12.5. [101:22.4.4.8.2.1]
New interior floor finish in exit enclosures and exit access corridors shall be not less than Class I. [101:22.4.4.8.2.2]

20.7.3.6.2.3
Interior floor finish shall comply with 12.5.8.1 or 12.5.8.2, as applicable. [101:22.4.4.8.2.3]

20.8 Hotels and Dormitories.

20.8.1 Application.
New and existing hotels and dormitories shall comply with Section 20.8 and NFPA 101.

20.8.2 Operating Features.

20.8.2.1 Hotel Emergency Organization.

20.8.2.1.1* Employees of hotels shall be instructed and drilled in the duties they are to perform in the event of fire, panic, or other emergency. [101:28.7.1.1; 101:29.7.1.1]

20.8.2.1.2* Drills of the emergency organization shall be held at quarterly intervals and shall cover such points as the operation and maintenance of the available first aid fire appliances, the testing of devices to alert guests, and a study of instructions for emergency duties. [101:28.7.1.2; 101:29.7.1.2]

20.8.2.2 Emergency Duties.
Upon discovery of a fire, employees shall carry out all of the following duties:
(1) Activation of the facility fire protection signaling system, if provided
(2) Notification of the public fire department
(3) Other action as previously instructed [101:28.7.2; 101:29.7.2]

20.8.2.3 Drills in Dormitories.
Emergency egress and relocation drills in accordance with Section 10.5 shall be held with sufficient frequency to familiarize occupants with all types of hazards and to establish conduct of the drill as a matter of routine. Drills shall be conducted during peak occupancy periods and shall include suitable procedures to ensure that all persons subject to the drill participate. [101:28.7.3; 101:29.7.3]

20.8.2.4 Emergency Instructions for Residents or Guests.

20.8.2.4.1* A floor diagram reflecting the actual floor arrangement, exit locations, and room identification shall be posted in a location and manner acceptable to the AHJ on, or immediately adjacent to, every guest room door in hotels and in every resident room in dormitories. [101:28.7.4.1; 101:29.7.4.1]

20.8.2.4.2* Fire safety information shall be provided to allow guests to make the decision to evacuate to the outside, to evacuate to an area of refuge, to remain in place, or to employ any combination of the three options. [101:28.7.4.2; 101:29.7.4.2]

20.8.2.4.3 Emergency Action Plans.
Emergency action plans in accordance with Section 10.8 shall be provided. [101:28.7.5]

20.8.2.5 Contents and Furnishings.

20.8.2.5.1 New draperies, curtains, and other similar loosely hanging furnishings and decorations shall meet the flame propagation performance criteria contained in Test Method 1 or Test Method 2, as appropriate, of NFPA 701. [101:28.7.6.1; 101:29.7.6.1]

20.8.2.5.2 Upholstered Furniture and Mattresses.
Newly introduced upholstered furniture shall meet the criteria specified in 12.6.3.1 and 12.6.3.2.2.

Newly introduced mattresses shall meet the criteria specified in 12.6.3.2 and 12.6.3.2.2.

Furnishings or decorations of an explosive or highly flammable character shall not be used.

Fire-retardant coatings shall be maintained to retain the effectiveness of the treatment under service conditions encountered in actual use.

Unvented fuel-fired heaters, other than gas space heaters in compliance with NFPA 54 shall not be used.

In new hotels and dormitories, integrated fire protection systems shall be tested in accordance with 13.1.3.

Interior finish shall be in accordance with Section 12.5.

New interior wall and ceiling finish materials complying with Section 12.5 shall be permitted as follows:

(1) Exit enclosures — Class A
(2) Lobbies and corridors — Class A or Class B
(3) Other spaces — Class A, Class B, or Class C

Existing interior wall and ceiling finish materials complying with Section 12.5 shall be permitted as follows:

(1) Exit enclosures — Class A or Class B
(2) Lobbies and corridors — Class A or Class B
(3) Other spaces — Class A, Class B, or Class C

New interior floor finish shall comply with Section 12.5.

New interior floor finish in exit enclosures and exit access corridors and spaces not separated from them by walls complying with 28.3.6.1 of NFPA 101 shall be not less than Class II.

New interior floor finish shall comply with 12.5.8.1 or 12.5.8.2, as applicable.

In nonsprinklered buildings, newly installed interior floor finish in exits and exit access corridors shall be not less than Class II in accordance with 12.5.8.

New and existing apartment buildings shall comply with Section 20.9 and NFPA 101.
20.9.2 Operating Features.

20.9.2.1 Emergency Instructions for Residents of Apartment Buildings.

Emergency instructions shall be provided annually to each dwelling unit to indicate the location of alarms, egress paths, and actions to be taken, both in response to a fire in the dwelling unit and in response to the sounding of the alarm system. [101:30.7.1; 101:31.7.1]

20.9.2.2 Fuel-Fired Heaters.

Unvented fuel-fired heaters, other than gas space heaters in compliance with NFPA 54, shall not be used. [101:30.5.2.2; 101:31.5.2.2]

20.9.2.3 Inspection of Door Openings

Door openings shall be inspected in accordance with 7.2.1.15 of NFPA 101. [101:30.7.3; 101:31.7.3]


In new apartment buildings, integrated fire protection systems shall be tested in accordance with 13.1.3. [101:30.7.4]

20.9.3 Interior Finish.

20.9.3.1 General.

Interior finish shall be in accordance with Section 12.5. [101:30.3.3.1; 101:31.3.3.1]

20.9.3.2 New Interior Wall and Ceiling Finish.

New interior wall and ceiling finish materials complying with Section 12.5 shall be permitted as follows:

(1) Exit enclosures — Class A
(2) Lobbies and corridors — Class A or Class B
(3) Other spaces — Class A, Class B, or Class C

[101:30.3.3.2]

20.9.3.3 Existing Interior Wall and Ceiling Finish.

Existing interior wall and ceiling finish materials complying with Section 12.5 shall be permitted as follows:

(1) Exit enclosures — Class A or Class B
(2) Lobbies and corridors — Class A or Class B
(3) Other spaces — Class A, Class B, or Class C

[101:31.3.3.2]

20.9.3.4 New Interior Floor Finish.

20.9.3.4.1

New interior floor finish shall comply with Section 12.5. [101:30.3.3.3.1]

20.9.3.4.2

New interior floor finish in exit enclosures and exit access corridors and spaces not separated from them by walls complying with 30.3.6 of NFPA 101 shall be not less than Class II. [101:30.3.3.3.2]

20.9.3.4.3

New interior floor finish shall comply with 12.5.8.1 or 12.5.8.2, as applicable. [101:30.3.3.3.3]

20.9.3.5 Existing Interior Floor Finish.

In buildings utilizing Option 1 or Option 2, as defined in 31.1.1.1 of NFPA 101, newly installed interior floor finish in exits and exit access corridors shall be not less than Class II in accordance with 12.5.8. [101:31.3.3.3]

20.9.4 Contents and Furnishings.

20.9.4.1

Contents and furnishings shall not be required to comply with Section 12.6. [101:30.7.2.1; 101:31.7.2.1]
Furnishings or decorations of an explosive or highly flammable character shall not be used outside of dwelling units. [101:30.7.2.2; 101:31.7.2.2]

20.9.4.3 Fire-retardant coatings shall be maintained to retain the effectiveness of the treatment under service conditions encountered in actual use. [101:30.7.2.3; 101:31.7.2.3]

20.10 Lodging or Rooming Houses.
20.10.1 Application.
New and existing lodging or rooming houses shall comply with Section 20.10 and NFPA 101.

20.10.2 Fuel-Fired Heaters.
Unvented fuel-fired heaters, other than gas space heaters in compliance with NFPA 54, shall not be used. [101:26.5.2.2]

20.10.3 Interior Finish.
20.10.3.1 General.
Interior finish shall be in accordance with Section 12.5. [101:26.3.3.1]

20.10.3.2 Interior Wall and Ceiling Finish.
Interior wall and ceiling finish materials complying with Section 12.5 shall be Class A, Class B, or Class C. [101:26.3.3.2]

20.10.3.3 Interior Floor Finish.
20.10.3.3.1 Newly installed interior floor finish shall comply with Section 12.5. [101:26.3.3.3.1]

20.10.3.3.2 Newly installed interior floor finish shall comply with 12.5.8.1 or 12.5.8.2, as applicable. [101:26.3.3.3.2]

20.10.4 Contents and furnishings shall not be required to comply with Section 12.6. [101:26.7.1.1]

20.10.4.1 Furnishings or decorations of an explosive or highly flammable character shall not be used. [101:26.7.1.2]

20.10.4.2 Fire-retardant coatings shall be maintained to retain the effectiveness of the treatment under service conditions encountered in actual use. [101:26.7.1.3]

20.11 One- and Two-Family Dwellings and Manufactured Housing.
20.11.1 Application.
New and existing one- and two-family dwellings shall comply with Section 20.11 and NFPA 101.

20.11.2 Fuel-Fired Heaters.
Unvented fuel-fired heaters shall not be used, unless they are listed and approved. [101:24.5.1.2]

20.11.3 Interior Finish.
20.11.3.1 General.
Interior finish shall be in accordance with Section 12.5. [101:24.3.3.1]

20.11.3.2 Interior Wall and Ceiling Finish.
Interior wall and ceiling finish materials complying with Section 12.5 shall be Class A, Class B, or Class C. [101:24.3.3.2]

20.11.3.3 Interior Floor Finish. (Reserved) [101:24.3.3.3]

20.11.4 Fire Protection of Floors.
In new construction, floor assemblies shall be provided with a continuous membrane of gypsum wallboard having a nominal thickness of not less than 1 in. (13 mm), or equivalent, to protect the floor framing members from a fire exposure from below.

20.11.4.1
Protection in accordance with 20.11.4 shall not be required where the building is protected by an approved automatic sprinkler system installed in accordance with 13.3.1.2.

20.11.4.2
Protection in accordance with 20.11.4 shall not be required for floor assemblies located directly over a crawl space not intended for storage or fuel-fired equipment.

20.11.4.3
Portions of floor assemblies shall be permitted to be unprotected where the aggregate area of the unprotected portions does not exceed 80 ft² (7.4 m²) per story and where fire blocking is installed along the perimeter of the unprotected portion to separate the unprotected portion from the remainder of the floor assembly.

20.11.4.4*
Protection in accordance with 20.11.4 shall not be required in floor assemblies using wood joists with nominal dimensions not less than 2 in. (51 mm) in thickness by 10 in. (254 mm) in width, or other approved floor assemblies providing equivalent performance.

20.11.4.5
Protection in accordance with 20.11.4 shall not be required in floor assemblies using wood joist structural composite lumber that are compliant with ASTM D5456 and that have dimensions not less than 1½ in. (38 mm) in thickness by 9½ in. (235 mm) in width.

20.11.4.6
Penetrations by mechanical, plumbing, fire protection, and electrical systems through the membrane protection required by 20.11.4 shall not be required to be protected.

20.11.5 Manufactured Housing.
New manufactured housing shall comply with Section 20.11 and NFPA 501.

20.12 Mercantile Occupancies.
20.12.1 Application.
New and existing mercantile occupancies shall comply with Section 20.12 and NFPA 101.

20.12.2 Operating Features.
20.12.2.1 Emergency Plans.
Emergency plans complying with Section 10.8 shall be provided in high-rise buildings. [101:36.7.1; 101:37.7.1]

20.12.2.2 Drills.
In every Class A or Class B mercantile occupancy, employees shall be periodically trained in accordance with Section 10.5. [101:36.7.2; 101:37.7.2]

20.12.2.3 Extinguisher Training.
Employees of mercantile occupancies shall be periodically instructed in the use of portable fire extinguishers. [101:36.7.3; 101:37.7.3]

20.12.4 Food Service Operations.
Food service operations shall comply with Chapter 50. [101:36.7.4; 101:37.7.4]

20.12.5 Inspection of Door Openings.
Door openings shall be inspected in accordance with 7.2.1.15 of NFPA 101. [101:36.7.7; 101:37.7.7]
In new apartment buildings, integrated fire protection systems shall be tested in accordance with 13.1.3. \([101]:38.7.8; \[101]:37.7.8\)

20.12.3 Interior Finish.

20.12.3.1 General.  
Interior finish shall be in accordance with Section 12.5. \([101]:36.3.3.1; \[101]:37.3.3.1\]

20.12.3.2 Interior Wall and Ceiling Finish.  
Interior wall and ceiling finish materials complying with Section 12.5 shall be Class A, Class B, or Class C. \([101]:36.3.3.2; \[101]:37.3.3.2\]

20.12.3.3 Interior Floor Finish.

20.12.3.3.1 New interior floor finish shall comply with Section 12.5. \([101]:36.3.3.3.1\]

20.12.3.3.2 New interior floor finish in exit enclosures shall be Class I or Class II. \([101]:36.3.3.3.2\]

20.12.3.3.3 New interior floor finish shall comply with 12.5.8.1 or 12.5.8.2, as applicable. \([101]:36.3.3.3.3\]

20.12.3.3.4 Existing Interior Floor Finish. (Reserved) \([101]:37.3.3.3\]

20.13 Business Occupancies.

20.13.1 Application.  
New and existing business occupancies shall comply with Section 20.13 and NFPA 101.

20.13.2 Operating Features.

20.13.2.1 Emergency Plans.  
Emergency plans complying with Section 10.8 shall be provided in high-rise buildings. \([101]:38.7.1; \[101]:39.7.1\]

20.13.2.2 Drills.  
In all business occupancy buildings occupied by more than 500 persons, or by more than 100 persons above or below the street level, employees and supervisory personnel shall be periodically instructed in accordance with Section 10.5 and shall hold drills periodically where practicable. \([101]:38.7.2; \[101]:39.7.2\]

20.13.2.3 Extinguisher Training.  
Designated employees of business occupancies shall be periodically instructed in the use of portable fire extinguishers. \([101]:38.7.3; \[101]:39.7.3\]

20.13.2.4 Food Service Operations.  
Food service operations shall comply with Chapter 50. \([101]:38.7.4; \[101]:39.7.4\]

20.13.2.5 Inspection of Door Openings.  
Door openings shall be inspected in accordance with 7.2.1.15 of NFPA 101. \([101]:38.7.7; \[101]:39.7.7\]

20.13.2.6 Integrated Fire Protection Systems.  
In new apartment buildings, integrated fire protection systems shall be tested in accordance with 13.1.3. \([101]:38.7.8; \[101]:39.7.8\)

20.13.3 Interior Finish.

20.13.3.1 General.  
Interior finish shall be in accordance with Section 12.5. \([101]:38.3.3.1; \[101]:39.3.3.1\]

20.13.3.2 Interior Wall and Ceiling Finish.  
Interior wall and ceiling finish materials complying with Section 12.5 shall be Class A, Class B, or Class C. \([101]:36.3.3.2; \[101]:37.3.3.2\]

20.13.3.3 Interior Floor Finish.

20.13.3.3.1 New interior floor finish shall comply with Section 12.5. \([101]:36.3.3.3.1\]

20.13.3.3.2 New interior floor finish in exit enclosures shall be Class I or Class II. \([101]:36.3.3.3.2\]

20.13.3.3.3 New interior floor finish shall comply with 12.5.8.1 or 12.5.8.2, as applicable. \([101]:36.3.3.3.3\]

20.13.3.3.4 Existing Interior Floor Finish. (Reserved) \([101]:37.3.3.3\]
Interior wall and ceiling finish material complying with Section 12.5 shall be Class A or Class B in exits and in exit access corridors. [101:38.3.3.2.1; 101:39.3.3.2.1]

20.13.3.2 Interior wall and ceiling finishes shall be Class A, Class B, or Class C in areas other than those specified in 20.13.3.2.1. [101:38.3.3.2.2; 101:39.3.3.2.2]

20.13.3.3 Interior Floor Finish.

20.13.3.3.1 New interior floor finish shall comply with Section 12.5. [101:38.3.3.3.1]

20.13.3.3.2 New interior floor finish in exit enclosures shall be Class I or Class II. [101:38.3.3.3.2]

20.13.3.3.3 New interior floor finish shall comply with 12.5.8.1 or 12.5.8.2, as applicable. [101:38.3.3.3.3]

20.13.3.3.4 Existing Interior Floor Finish. (Reserved) [101:39.3.3.3]

20.14 Industrial Occupancies.

20.14.1 Application.

New and existing industrial occupancies shall comply with Section 20.14 and NFPA 101.


Permits, where required, shall comply with Section 1.12.

20.14.3 Operating Features.

20.14.3.1 Inspection of Door Openings.
Door openings shall be inspected in accordance with 7.2.1.15 of NFPA 101. [101:40.3.3.1]

Integrated fire protection systems shall be tested in accordance with 13.1.3. [101:40.7.4]


20.14.3.4.1 General.
Interior finish shall be in accordance with Section 12.5. [101:40.3.3.1]

20.14.3.4.2 Interior Wall and Ceiling Finish.
Interior wall and ceiling finish materials complying with Section 12.5 shall be Class A, Class B, or Class C in operating areas and shall be as required by 7.1.4 of NFPA 101 in exit enclosures. [101:40.3.3.2]

20.14.3.4.3 Interior Floor Finish.

20.14.3.4.3.1 Interior floor finish in exit enclosures and in exit access corridors shall be Class I or Class II in accordance with 12.5.8.4. [101:40.3.3.3.1]

20.14.3.4.3.2 Interior floor finish in areas other than those specified in 20.14.3.3.1 shall not be required to comply with 12.5.8. [101:40.3.3.2]

20.15 Storage Occupancies.

20.15.1 Application.

New and existing storage occupancies shall comply with NFPA 101, Chapter 34, appropriate codes or standards referenced in Chapter 2, and Section 20.15.

20.15.2 Permits.

Permits, where required, shall comply with Section 1.12.
20.15.3 Operating Features
20.14.3.1 Inspection of Door Openings.
Door openings shall be inspected in accordance with 7.2.1.15 of NFPA 101. [101:42.9.3]

20.15.3.2 Integrated Fire Protection Systems.
Integrated fire protection systems shall be tested in accordance with 13.1.3. [101:42.9.4]

20.15.4 Interior Finish.
20.15.34.1 General.
Interior finish shall be in accordance with Section 12.5. [101:42.3.3.1]

20.15.34.2 Interior Wall and Ceiling Finish.
Interior wall and ceiling finish materials shall be Class A, Class B, or Class C in accordance with 12.5 in storage areas and shall be as required by 7.1.4 of NFPA 101 in exit enclosures. [101:42.3.3.2]

20.15.34.3 Interior Floor Finish.
20.15.34.3.1 Interior floor finish in exit enclosures and in exit access corridors shall be Class I or Class II. [101:42.3.3.3.1]

20.15.34.3.2 Interior floor finish in areas other than those specified in 20.15.3.3.1 shall not be required to comply with 12.5.8. [101:42.3.3.3.2]

20.15.4 Storage, Arrangement, Protection, and Quantities of Hazardous Commodities.
The storage, arrangement, protection, and quantities of hazardous commodities shall be in accordance with the applicable provisions of the following:
(1) NFPA 13, Standard for the Installation of Sprinkler Systems
(2) NFPA 30, Flammable and Combustible Liquids Code
(3) NFPA 30, Code for the Manufacture and Storage of Aerosol Products
(4) NFPA 400, Hazardous Materials Code, Chapter 14, for organic peroxide formulations
(5) NFPA 400, Hazardous Materials Code, Chapter 15, for oxidizer solids and liquids
(6) NFPA 400, Hazardous Materials Code, various chapters, depending on characteristics of a particular pesticide
[101:36.4.5.3]

Chapter 25

25.1.4.1 Where required by the provisions of Chapters 11 through 43 in NFPA 101, occupancies with storage and handling of hazardous materials shall comply with the following codes unless otherwise modified by other provisions of NFPA 101: Chapter 66 for flammable and combustible liquids, NFPA 54, Chapter 66 for compressed gases and cryogenic fluids, Chapter 69 for liquefied petroleum gases and liquefied
natural gases, NFPA 400, and NFPA 495. The storage and handling of flammable liquids or gases shall be in accordance with the following applicable standards and chapters below:

1. Chapter 66 for flammable and combustible liquids
2. NFPA 54
3. Chapter 69 for liquefied petroleum gases and liquefied natural gases

25.1.4.2*
No storage, use or handling of flammable liquids or gases or hazardous materials shall be permitted in any location where such storage, use or handling would jeopardize egress from the structure, unless otherwise permitted by a document listed in 25.1.4.1.

25.1.5.2
Where prohibited by the AHJ, smoking shall not be permitted in any temporary membrane structure.

25.1.9.1 Electrical Systems.
Electrical wiring and equipment shall be in accordance with Section 11.1, unless such installations are approved existing installations, which shall be permitted to be continued in service.

25.1.10.1.2
Only labeled heating devices shall be used.

25.1.10.1.3
Fuel-fired heaters and their installation shall be approved by the AHJ.

Air-conditioning, heating, ventilating ductwork, and related equipment shall be in accordance with 11.2.1, as applicable, unless such installations are approved existing installations, which shall be permitted to be continued in service.

25.1.10.1.5 Ventilating or Heat-Producing Equipment.
Ventilating or heat-producing equipment shall be in accordance with 11.2.2, as applicable, unless such installations are approved existing installations, which shall be permitted to be continued in service.

25.1.10.2.2
Only labeled heaters shall be permitted.

25.1.10.2.3
Electric heaters, their placement, and their installation shall be approved by the AHJ.
Heaters shall be connected to electricity by electric cable that is suitable for outside use and is of sufficient size to handle the electrical load. [101:11.9.5.2.3]

25.2.1.1
Tents shall be permitted only on a temporary basis. [101:11.11.1.2]

25.2.1.2
Tents shall be erected to cover not more than 75 percent of the premises, unless otherwise approved by the AHJ. [101:11.11.1.3]

25.2.2.1
All tent fabric shall meet the flame propagation performance criteria contained in Test Method 2 of NFPA 701. [101:11.11.2.1]

25.2.2.2
One of the following shall serve as evidence that the tent fabric materials have the required flame propagation performance:

1. The AHJ shall require a certificate or other evidence of acceptance by an organization acceptable to the AHJ.
2. The AHJ shall require a report of tests made by other inspection authorities or organizations acceptable to the AHJ. [101:11.11.2.2]

25.2.2.3
Where required by the AHJ, confirmatory field tests shall be conducted using test specimens from the original material, which shall have been affixed at the time of manufacture to the exterior of the tent. [101:11.11.2.3]

25.2.3.1
There shall be a minimum of 10 ft (3050 mm) between stake lines. [101:11.11.3.1]

25.2.3.2
Adjacent tents shall be spaced to provide an area to be used as a means of emergency egress. Where 10 ft (3050 mm) between stake lines does not meet the requirements for means of egress, the distance necessary for means of egress shall govern. [101:11.11.3.2]

25.2.3.3
Tents not occupied by the public and not used for the storage of combustible material shall be permitted to be erected less than 10 ft (3050 mm) from other structures where the AHJ deems such close spacing to be safe from hazard to the public. [101:11.11.3.3]

25.2.3.4
Tents, each not exceeding 1200 ft² (112 m²) in ground area and located in fairgrounds or similar open spaces, shall not be required to be separated from each other, provided that safety precautions meet the approval of the AHJ. [101:11.11.3.4]
25.2.3.5
The placement of tents relative to other structures shall be at the discretion of the AHJ, with consideration given to occupancy, use, opening, exposure, and other similar factors. \[101:11.11.3.5\]

25.2.4.1
The finished ground level enclosed by any tent, and the finished ground level for a reasonable distance, but for not less than 10 ft (3050 mm) outside of such a tent, shall be cleared of all flammable or combustible material or vegetation that is not used for necessary support equipment. The clearing work shall be accomplished to the satisfaction of the AHJ prior to the erection of such a tent. The premises shall be kept free from such flammable or combustible materials during the period for which the premises are used by the public. \[101:11.11.4.1\]

25.2.4.2.1
Smoking shall not be permitted in any tent, unless approved by the AHJ. \[101:11.11.4.2.1\]

25.2.4.2.2
In rooms or areas where smoking is prohibited, plainly visible signs shall be posted that read as follows:

**NO SMOKING**
\[101:11.11.4.2.2\]

25.2.5 Fire-Extinguishing Equipment.
Portable fire-extinguishing equipment of approved types shall be furnished and maintained in tents in such quantity and in such locations as directed by the AHJ. \[101:11.11.5\]

25.3.1.1
Where grandstand seating without backs is used indoors, rows of seats shall be spaced not less than 22 in. (560 mm) back-to-back. \[101:12.4.9.2.1\]

25.3.1.2
The depth of footboards and seat boards in grandstands shall be not less than 9 in. (230 mm); where the same level is not used for both seat foundations and footrests, footrests independent of seats shall be provided. \[101:12.4.9.2.2\]

25.3.1.3
Seats and footrests of grandstands shall be supported securely and fastened in such a manner that they cannot be displaced inadvertently. \[101:12.4.9.2.3\]

25.3.1.4
Individual seats or chairs shall be permitted only if secured in rows in an approved manner, unless seats do not exceed 16 in number and are located on level floors and within railed-in enclosures, such as boxes. \[101:12.4.9.2.4\]

25.3.1.5
The maximum number of seats permitted between the farthest seat in an aisle in grandstands and bleachers shall not exceed that shown in Table 25.3.1.5. [101:12.4.9.2.5]

Table 25.3.1.5 Maximum Number of Seats Between Farthest Seat and an Aisle

<table>
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[101:Table 12.4.9.2.5]

25.3.2.1

An outdoor wood grandstand shall be erected within not less than two-thirds of its height and, in no case, within not less than 10 ft (3050 mm) of a building, unless otherwise permitted by the following:

1. The distance requirement shall not apply to buildings having minimum 1-hour fire resistance-rated construction with openings protected against the fire exposure hazard created by the grandstand.
2. The distance requirement shall not apply where a wall having minimum 1-hour fire resistance-rated construction separates the grandstand from the building. [101:12.4.9.3.1]

25.3.2.2

An outdoor wood grandstand unit shall not exceed 10,000 ft² (929 m²) in ground area or 200 ft (61 m) in length, and the following requirements also shall apply:

1. Grandstand units of the maximum size shall be placed not less than 20 ft (6100 mm) apart or shall be separated by walls having a minimum 1-hour fire resistance rating.
2. The number of grandstand units erected in any one group shall not exceed three.
3. Each group of grandstand units shall be separated from any other group by a wall having minimum 2-hour fire resistance-rated construction extending 24 in. (610 mm) above the seat platforms or by an open space of not less than 50 ft (15 m). [101:12.4.9.3.2]

25.3.2.3

The finished ground level area or length required by 25.3.2.2 shall be permitted to be doubled where one of the following criteria is met:

1. Where the grandstand is constructed entirely of labeled fire-retardant-treated wood that has passed the standard rain test, ASTM D2898, Standard Test Methods for Accelerated Weathering of Fire-Retardant-Treated Wood for Fire Testing
2. Where the grandstand is constructed of members conforming to dimensions of heavy timber construction [Type IV (2HH)] [101:12.4.9.3.3]

25.3.2.4

The highest level of seat platforms above the finished ground level or the surface at the front of any wood grandstand shall not exceed 20 ft (6100 mm). [101:12.4.9.3.4]
25.3.2.5
The highest level of seat platforms above the finished ground level, or the surface at the front of a portable grandstand within a tent or membrane structure, shall not exceed 12 ft (3660 mm). [101:12.4.9.3.5]

25.3.2.6
The height requirements specified in 25.3.2.4 and 25.3.2.5 shall be permitted to be doubled where constructed entirely of labeled fire-retardant-treated wood that has passed the standard rain test, ASTM D2898, or where constructed of members conforming to dimensions for heavy timber construction [Type IV (2HH)]. [101:12.4.9.3.6]

25.3.3.1
Portable grandstands shall conform to the requirements of Section 25.3 for grandstands and the requirements of 25.3.3.2 through 25.3.3.7. [101:12.4.9.4.1]

25.3.3.2
Portable grandstands shall be self-contained and shall have within them all necessary parts to withstand and restrain all forces that might be developed during human occupancy. [101:12.4.9.4.2]

25.3.3.3
Portable grandstands shall be designed and manufactured so that, if any structural members essential to the strength and stability of the structure have been omitted during erection, the presence of unused connection fittings shall make the omissions self-evident. [101:12.4.9.4.3]

25.3.3.4
Portable grandstand construction shall be skillfully accomplished to produce the strength required by the design. [101:12.4.9.4.4]

25.3.3.5
Portable grandstands shall be provided with base plates, sills, floor runners, or sleepers of such area that the permitted bearing capacity of the supporting material is not exceeded. [101:12.4.9.4.5]

25.3.3.6
Where portable grandstands rest directly on a base of such character that it is incapable of supporting the load without appreciable settlement, mud sills of suitable material, having sufficient area to prevent undue or dangerous settlement, shall be installed under base plates, runners, or sleepers. [101:12.4.9.4.6]

25.3.3.7
All bearing surfaces of portable grandstands shall be in contact with each other. [101:12.4.9.4.7]

25.3.4 Spaces Underneath Grandstands.
Spaces underneath a grandstand shall be kept free of flammable or combustible materials, unless protected by an approved, supervised automatic sprinkler system in accordance with Section 13.3 or unless otherwise permitted by the following:

1. This requirement shall not apply to accessory uses of 300 ft² (28 m²) or less, such as ticket booths, toilet facilities, or concession booths where constructed of noncombustible or fire-resistive construction in otherwise nonsprinklered facilities.
2. This requirement shall not apply to rooms that are enclosed in not less than 1-hour fire resistance-rated construction and are less than 1000 ft² (93 m²) in otherwise nonsprinklered facilities. [101:12.4.9.5]

25.3.5.1
Railings or guards not less than 42 in. (1065 mm) above the aisle surface or footrest or not less than 36 in. (915 mm) vertically above the center of the seat or seat board surface, whichever is adjacent, shall be provided along those portions of the backs and ends of all grandstands where the seats are more than 48 in. (1220 mm) above the floor or the finished ground level. [101:12.4.9.6.1]

25.3.5.2
The requirement of 25.3.5.1 shall not apply where an adjacent wall or fence affords equivalent safeguard. [101:12.4.9.6.2]

25.3.5.3
Where the front footrest of any grandstand is more than 24 in. (610 mm) above the floor, railings or guards not less than 33 in. (825 mm) above such footrests shall be provided. [101:12.4.9.6.3]

25.3.5.4
The railings required by 25.3.5.3 shall be permitted to be not less than 26 in. (660 mm) high in grandstands or where the front row of seats includes backrests. [101:12.4.9.6.4]

25.3.5.5
Cross aisles located within the seating area shall be provided with rails not less than 26 in. (660 mm) high along the front edge of the cross aisle. [101:12.4.9.6.5]

25.3.5.6
The railings specified by 25.3.5.5 shall not be required where the backs of the seats in front of the cross aisle project 24 in. (610 mm) or more above the surface of the cross aisle. [101:12.4.9.6.6]

25.3.5.7
Vertical openings between guardrails and footboards or seat boards shall be provided with intermediate construction so that a 4 in. (100 mm) diameter sphere cannot pass through the opening. [101:12.4.9.6.7]

25.3.5.8
An opening between the seat board and footboard located more than 30 in. (760 mm) above the finished ground level shall be provided with intermediate construction so that a 4 in. (100 mm) diameter sphere cannot pass through the opening. [101:12.4.9.6.8]

25.3.6.1
The owner shall provide for not less than annual inspection and required maintenance of each outdoor grandstand to ensure safe conditions. [101:12.7.10.1]

25.3.6.2
At least biennially, the inspection shall be performed by a professional engineer, registered architect, or individual certified by the manufacturer. [101:12.7.10.2]

25.3.6.3
Where required by the AHJ, the owner shall provide a copy of the inspection report and certification that the inspection required by 25.3.6.2 has been performed. [101:12.7.10.3]

25.4.1.1
The horizontal distance of seats, measured back-to-back, shall be not less than 22 in. (560 mm) for seats without backs, and the following requirements shall also apply:

1. There shall be a space of not less than 12 in. (305 mm) between the back of each seat and the front of each seat immediately behind it.
2. If seats are of the chair type, the 12 in. (305 mm) dimension shall be measured to the front edge of the rear seat in its normal unoccupied position.
3. All measurements shall be taken between plumb lines. [101:12.4.10.2.1]

25.4.1.2
The depth of footboards (footrests) and seat boards in folding and telescopic seating shall be not less than 9 in. (230 mm). [101:12.4.10.2.2]

25.4.1.3
Where the same level is not used for both seat foundations and footrests, footrests independent of seats shall be provided. [101:12.4.10.2.3]

25.4.1.4
Individual chair-type seats shall be permitted in folding and telescopic seating only if firmly secured in groups of not less than three. [101:12.4.10.2.4]

25.4.1.5
The maximum number of seats permitted between the farthest seat in an aisle in folding and telescopic seating shall not exceed that shown in Table 25.3.1.5. [101:12.4.10.2.5]

25.4.2.1
Railings or guards not less than 42 in. (1065 mm) above the aisle surface or footrest or not less than 36 in. (915 mm) vertically above the center of the seat or seat board surface, whichever is
adjacent, shall be provided along those portions of the backs and ends of all folding and
telescopic seating where the seats are more than 48 in. (1220 mm) above the floor or the finished
ground level. [101:12.4.10.3.1]

25.4.2.2
The requirement of 25.4.2.1 shall not apply where an adjacent wall or fence affords equivalent
safeguard. [101:12.4.10.3.2]

25.4.2.3
Where the front footrest of folding or telescopic seating is more than 24 in. (610 mm) above the
floor, railings or guards not less than 33 in. (825 mm) above such footrests shall be provided.
[101:12.4.10.3.3]

25.4.2.4
The railings required by 25.4.2.3 shall be permitted to be not less than 26 in. (660 mm) high
where the front row of seats includes backrests. [101:12.4.10.3.4]

25.4.2.5
Cross aisles located within the seating area shall be provided with rails not less than 26 in. (660
mm) high along the front edge of the cross aisle. [101:12.4.10.3.5]

25.4.2.6
The railings specified by 25.4.2.5 shall not be required where the backs of the seats in front of
the cross aisle project 24 in. (610 mm) or more above the surface of the cross aisle.
[101:12.4.10.3.6]

25.4.2.7
Vertical openings between guardrails and footboards or seat boards shall be provided with
intermediate construction so that a 4 in. (100 mm) diameter sphere cannot pass through the
opening. [101:12.4.10.3.7]

25.4.2.8
An opening between the seat board and footboard located more than 30 in. (760 mm) above the
finished ground level shall be provided with intermediate construction so that a 4 in. (100 mm)
diameter sphere cannot pass through the opening. [101:12.4.10.3.8]

25.4.3.1
Instructions in both maintenance and operation shall be transmitted to the owner by the
manufacturer of the seating or his or her representative. [101:12.7.11.1]

25.4.3.2
Maintenance and operation of folding and telescopic seating shall be the responsibility of the
owner or his or her duly authorized representative and shall include the following:
1. During operation of the folding and telescopic seats, the opening and closing shall be supervised by responsible personnel who shall ensure that the operation is in accordance with the manufacturer's instructions.
2. Only attachments specifically approved by the manufacturer for the specific installation shall be attached to the seating.
3. An annual inspection and required maintenance of each grandstand shall be performed to ensure safe conditions.
4. At least biennially, the inspection shall be performed by a professional engineer, registered architect, or individual certified by the manufacturer. [101:12.7.11.2]

25.5.1.1 Use of Membrane Roofs.
Membrane roofs shall be used in accordance with the following:

1. Membrane materials shall not be used where fire resistance ratings are required for walls or roofs.
2. Where every part of the roof, including the roof membrane, is not less than 20 ft (6100 mm) above any floor, balcony, or gallery, a noncombustible or limited-combustible membrane shall be permitted to be used as the roof in any construction type.
3. With approval of the AHJ, membrane materials shall be permitted to be used where every part of the roof membrane is sufficiently above every significant fire potential, such that the imposed temperature cannot exceed the capability of the membrane, including seams, to maintain its structural integrity. [101:11.9.1.2]

25.5.1.2 Testing.
Testing of membrane materials for compliance with the requirements of Section 25.5 for use of the categories of noncombustible and limited-combustible materials shall be performed on weathered-membrane material as defined in 3.3.171.5 of NFPA 101. [101:11.9.1.3]

25.5.1.3 Flame Spread Index.
The flame spread index of all membrane materials exposed within the structure shall be Class A in accordance with Section 12.5. [101:11.9.1.4]

25.5.1.4 Roof Covering Classification.
Roof membranes shall have a roof covering classification, as required by the applicable building codes, when tested in accordance with ASTM E108, Standard Test Methods for Fire Tests of Roof Coverings; or ANSI/UL 790, Test Methods for Fire Tests of Roof Coverings. [101:11.9.1.5]

25.5.1.5 All membrane structure fabric shall meet the flame propagation performance criteria contained in Test Method 2 of NFPA 701. [101:11.9.1.6.1]

25.5.1.5.2
One of the following shall serve as evidence that the fabric materials have the required flame propagation performance:
1. The AHJ shall require a certificate or other evidence of acceptance by an organization acceptable to the AHJ.
2. The AHJ shall require a report of tests made by other inspection authorities or organizations acceptable to the AHJ. [101:11.9.1.6.2]

25.5.1.5.3
Where required by the AHJ, confirmatory field tests shall be conducted using test specimens from the original material, which shall have been affixed at the time of manufacture to the exterior of the structure. [101:11.9.1.6.3]

25.5.2.1
The design, materials, and construction of the building shall be based on plans and specifications prepared by a licensed architect or engineer knowledgeable in tensioned-membrane construction. [101:11.9.2.1]

25.5.2.2
Material loads and strength shall be based on physical properties of the materials verified and certified by an approved testing laboratory. [101:11.9.2.2]

25.5.2.3
The membrane roof for structures in climates subject to freezing temperatures and ice buildup shall be composed of two layers separated by an air space through which heated air can be moved to guard against ice accumulation. As an alternative to the two layers, other approved methods that protect against ice accumulation shall be permitted. [101:11.9.2.3]

25.5.2.4
Roof drains shall be equipped with electrical elements to protect against ice buildup that can prevent the drains from functioning. Such heating elements shall be served by on-site standby electrical power in addition to the normal public service. As an alternative to such electrical elements, other approved methods that protect against ice accumulation shall be permitted. [101:11.9.2.4]

25.5.3.1 General.
In addition to the general provisions of 25.5.1, the requirements of 25.5.3 shall apply to air-supported and air-inflated structures. [101:11.9.3.1]

25.5.3.2 Pressurization (Inflation) System.
The pressurization system shall consist of one or more operating blower units. The system shall include automatic control of auxiliary blower units to maintain the required operating pressure. Such equipment shall meet the following requirements:

1. Blowers shall be powered by continuous-rated motors at the maximum power required.
2. Blowers shall have personnel protection, such as inlet screens and belt guards.
3. Blower systems shall be weather protected.
4. Blower systems shall be equipped with backdraft check dampers.
5. Not less than two blower units shall be provided, each of which has capacity to maintain full inflation pressure with normal leakage.
6. The blowers shall be designed to be incapable of overpressurization.
7. The auxiliary blower unit(s) shall operate automatically if there is any loss of internal pressure or if an operating blower unit becomes inoperative.
8. The design inflation pressure and the capacity of each blower system shall be certified by a professional engineer. [101:11.9.3.2]

25.5.3.3.1*
A fully automatic standby power system shall be provided. The system shall be either an auxiliary engine generator set capable of running the blower system or a supplementary blower unit that is sized for 1 times the normal operating capacity and is powered by an internal combustion engine. [101:11.9.3.3.1]

25.5.3.3.2
The standby power system shall be fully automatic to ensure continuous inflation in the event of any failure of the primary power. The system shall be capable of operating continuously for a minimum of 4 hours. [101:11.9.3.3.2]

25.5.3.3.3
The sizing and capacity of the standby power system shall be certified by a professional engineer. [101:11.9.3.3.3]

25.5.4.1
Instructions in both operation and maintenance shall be transmitted to the owner by the manufacturer of the tensioned-membrane, air-supported, or air-inflated structure. [101:11.9.4.1]

25.5.4.2
Annual inspection and required maintenance of each structure shall be performed to ensure safety conditions. At least biennially, the inspection shall be performed by a professional engineer, registered architect, or individual certified by the manufacturer. [101:11.9.4.2]

25.6.1.1 Required Approval.
Membrane structures designed to meet all the requirements of Section 25.6 shall be permitted to be used as temporary buildings subject to the approval of the AHJ. [101:11.10.1.2]

25.6.1.2 Alternative Requirements.
Temporary tensioned-membrane structures shall be permitted to comply with Section 25.2 instead of Section 25.6. [101:11.10.1.3]

25.6.1.3 Roof Covering Classification.
Roof membranes shall have a roof covering classification, as required by the applicable building codes, when tested in accordance with ASTM E108 or ANSI/UL 790. [101:11.10.1.4]

25.6.1.4.1
All membrane structure fabric shall meet the flame propagation performance criteria contained in Test Method 2 of NFPA 701. [101:11.10.1.5.1]

25.6.1.4.2
One of the following shall serve as evidence that the fabric materials have the required flame propagation performance:

1. The AHJ shall require a certificate or other evidence of acceptance by an organization acceptable to the AHJ.
2. The AHJ shall require a report of tests made by other inspection authorities or organizations acceptable to the AHJ. [101:11.10.1.5.2]

25.6.1.4.3
Where required by the AHJ, confirmatory field tests shall be conducted using test specimens from the original material, which shall have been affixed at the time of manufacture to the exterior of the structure. [101:11.10.1.5.3]

25.6.2.1
The finished ground level enclosed by any temporary membrane structure, and the finished ground level for a reasonable distance but for not less than 10 ft (3050 mm) outside of such a structure, shall be cleared of all flammable or combustible material or vegetation that is not used for necessary support equipment. The clearing work shall be accomplished to the satisfaction of the AHJ prior to the erection of such a structure. The premises shall be kept free from such flammable or combustible materials during the period for which the premises are used by the public. [101:11.10.2.1]

25.6.2.2
Where prohibited by the AHJ, smoking shall not be permitted in any temporary membrane structure. [101:11.10.2.2]

25.6.3 Fire-Extinguishing Equipment.
Portable fire-extinguishing equipment of approved types shall be furnished and maintained in temporary membrane structures in such quantity and in such locations as directed by the AHJ. [101:11.10.3]

25.6.4.1
The design, materials, and construction of the building shall be based on plans and specifications prepared by a licensed architect or engineer knowledgeable in tensioned-membrane construction. [101:11.10.4.1]

25.6.4.2
Material loads and strength shall be based on physical properties of the materials verified and certified by an approved testing laboratory. [101:11.10.4.2]

25.6.4.3
The membrane roof for structures in climates subject to freezing temperatures and ice buildup shall be composed of two layers separated by an air space through which heated air can be moved to guard against ice accumulation. As an alternative to the two layers, other approved methods that protect against ice accumulation shall be permitted. [101:11.10.4.3]

25.6.4.4 Roof drains shall be equipped with electrical elements to protect against ice buildup that can prevent the drains from functioning. Such heating elements shall be served by on-site standby electrical power in addition to the normal public service. As an alternative to such electrical elements, other approved methods that protect against ice accumulation shall be permitted. [101:11.10.4.4]

25.6.5.1 General. In addition to the general provisions of 25.6.1, the requirements of 25.6.5 shall apply to air-supported and air-inflated structures. [101:11.10.5.1]

25.6.5.2 Pressurization (Inflation) System. The pressurization system shall consist of one or more operating blower units. The system shall include automatic control of auxiliary blower units to maintain the required operating pressure. Such equipment shall meet the following requirements:

1. Blowers shall be powered by continuous-rated motors at the maximum power required.
2. Blowers shall have personnel protection, such as inlet screens and belt guards.
3. Blower systems shall be weather protected.
4. Blower systems shall be equipped with backdraft check dampers.
5. Not less than two blower units shall be provided, each of which has capacity to maintain full inflation pressure with normal leakage.
6. The blowers shall be designed to be incapable of overpressurization.
7. The auxiliary blower unit(s) shall operate automatically if there is any loss of internal pressure or if an operating blower unit becomes inoperative.
8. The design inflation pressure and the capacity of each blower system shall be certified by a professional engineer. [101:11.10.5.2]

25.6.5.3.1 A fully automatic standby power system shall be provided. The system shall be either an auxiliary engine generator set capable of running the blower system or a supplementary blower unit that is sized for 1 times the normal operating capacity and is powered by an internal combustion engine. [101:11.10.5.3.1]

25.6.5.3.2 The standby power system shall be fully automatic to ensure continuous inflation in the event of any failure of the primary power. The system shall be capable of operating continuously for a minimum of 4 hours. [101:11.10.5.3.2]

25.6.5.3.3
The sizing and capacity of the standby power system shall be certified by a professional engineer. [101:11.10.5.3.3]

25.6.6.1
Instructions in both operation and maintenance shall be transmitted to the owner by the manufacturer of the tensioned-membrane, air-supported, or air-inflated structure. [101:11.10.6.1]

25.6.6.2
Annual inspection and required maintenance of each structure shall be performed to ensure safety conditions. At least biennially, the inspection shall be performed by a professional engineer, registered architect, or individual certified by the manufacturer. [101:11.10.6.2]

Chapter 60

60.5.2
Where permitted by Chapters 11 through 43 of NFPA 101 alcohol-based hand-rub dispensers shall be permitted provided they meet all of the following criteria:

1. The maximum individual dispenser fluid capacity shall be as follows:
   1. 0.32 gal (1.2 L) for dispensers in corridors and areas open to corridors
   2. 0.53 gal (2.0 L) for dispensers in rooms or suites of rooms separated from corridors
2. Where aerosol containers are used, the maximum capacity of the aerosol dispenser shall be 18 oz. (0.51 kg) and shall be limited to Level 1 aerosols as defined in NFPA 30B.
3. Dispensers shall be separated from each other by horizontal spacing of not less than 48 in. (1220 mm).
4. Not more than an aggregate 10 gal (37.8 L) of alcohol-based hand-rub solution or 1135 oz (32.2 kg) of Level 1 aerosols, or a combination of liquids and Level 1 aerosols not to exceed, in total, the equivalent of 10 gal (37.8 L) or 1135 oz (32.2 kg,) shall be in use outside of a storage cabinet in a single smoke compartment or fire compartment or story, whichever is less in area. One dispenser complying with 60.5.2(1) per room and located in that room shall not be included in the aggregated quantity.
5. Storage of quantities greater than 5 gal (18.9 L) in a single smoke compartment or fire compartment or story, whichever is less in area, shall meet the requirements of NFPA 30.
6. Dispensers shall not be installed in the following locations:
   1. Above an ignition source for a horizontal distance of 1 in. (25 mm) to each side of the ignition source
   2. To the side of an ignition source within a 1 in. (25 mm) horizontal distance from the ignition source
   3. Beneath an ignition source within a 1 in. (25 mm) vertical distance from the ignition source
7. Dispensers installed directly over carpeted floors shall be permitted only in sprinklered areas of the building.
8. The alcohol-based hand-rub solution shall not exceed 95 percent alcohol content by volume.
9. Operation of the dispenser shall comply with the following criteria:
   1. The dispenser shall not release its contents except when the dispenser is activated, 
      either manually or automatically by touch-free activation.
   2. Any activation of the dispenser shall only occur when an object is placed within 4 
      in. (100 mm) of the sensing device.
   3. An object placed within the activation zone and left in place shall not cause more 
      than one activation.
   4. The dispenser shall not dispense more solution than the amount required for hand 
      hygiene consistent with label instructions.
   5. The dispenser shall be designed, constructed, and operated in a manner that 
      ensures accidental or malicious activation of the dispensing device is minimized.
   6. The dispenser shall be tested in accordance with the manufacturer’s care and use 
      instructions each time a new refill is installed.

[101:8.7.3.3]
Annex A

A.3.3.29  Building.
The term building is to be understood as if followed by the words or portions thereof. (See also A.3.3.256, Structure.) [101:A.3.3.36]

A.3.3.29.5  Existing Building.
With respect to judging whether a building should be considered existing, the deciding factor is not when the building was designed or when construction started but, rather, the date plans were approved for construction by the appropriate AHJ. [101:A.3.3.36.5]

A.3.3.29.10  Special Amusement Building.
Special amusement buildings include amusements such as a haunted house, a roller coaster-type ride within a building, a multilevel play structure within a building, a submarine ride, and similar amusements where the occupants are not in the open air. [101:A.3.3.36.10]

A.3.3.65  Common Path of Travel.
Common path of travel is measured in the same manner as travel distance but terminates at that point where two separate and distinct routes become available. Paths that merge are common paths of travel. [101:A.3.3.47]

A.3.3.66.1  Fire Compartment.
Additional fire compartment information is contained in 8.2.2 of NFPA 101. [101:A.3.3.48.1]
In the provisions for fire compartments utilizing the outside walls of a building, it is not intended that the outside wall be specifically fire resistance rated, unless required by other standards. Likewise, it is not intended that outside windows or doors be protected, unless specifically required for exposure protection by another section of this Code, NFPA 101, or by other standards. [101:A.3.3.48.1]

A.3.3.66.2  Smoke Compartment.
Where smoke compartments using the outside walls or the roof of a building are provided, it is not intended that outside walls or roofs, or any openings therein, be capable of resisting the passage of smoke. Application of smoke compartment criteria where required elsewhere in NFPA 101, should be in accordance with Section 8.5 of NFPA 101. [101:A.3.3.48.2]

A.3.3.101  Existing.
See A.3.3.29.5, Existing Building. [101:A.3.3.81]

A.3.3.103  Exit.
Exits include exterior exit doors, exit passageways, horizontal exits, exit stairs, and exit ramps. In the case of a stairway, the exit includes the stair enclosure, the door to the stair enclosure, stairs and landings inside the enclosure, the door from the stair enclosure to the outside or to the level of exit discharge, and any exit passageway and its associated doors, if such are provided, so as to discharge the stair directly to the outside. In the case of a door leading directly from the street floor to the street or open air, the exit comprises only the door. [101:A.3.3.83]
Doors of small individual rooms, as in hotels, while constituting exit access from the room, are not referred to as exits, except where they lead directly to the outside of the building from the street floor. [101:A.3.3.83]

A.3.3.103.1 Horizontal Exit.
Horizontal exits should not be confused with egress through doors in smoke barriers. Doors in smoke barriers are designed only for temporary protection against smoke, whereas horizontal exits provide protection against serious fire for a relatively long period of time in addition to providing immediate protection from smoke. (See 7.2.4 of NFPA 101.) [101:A.3.3.83.1]

A.3.3.113.2 Interior Finish.
Interior finish is not intended to apply to surfaces within spaces such as those that are concealed or inaccessible. Furnishings that, in some cases, might be secured in place for functional reasons should not be considered as interior finish. [101:A.3.3.92.2]

A.3.3.113.3 Interior Floor Finish.
Interior floor finish includes coverings applied over a normal finished floor or stair treads and risers. [101:A.3.3.92.3]

A.3.3.113.4 Interior Wall Finish.
Such partitions are intended to include washroom water closet partitions. [101:A.3.3.95.4]

A.3.3.128 Flame Spread.
See Section 10.2 of NFPA 101. [101:A.3.3.112]

A.3.3.144.2 Low Hazard Contents.
Chapter 42 of NFPA 101 recognizes storage of noncombustible materials as low hazard. In other occupancies, it is assumed that, even where the actual contents hazard is normally low, there is sufficient likelihood that some combustible materials or hazardous operations will be introduced in connection with building repair or maintenance, or some psychological factor might create conditions conducive to panic, so that the egress facilities cannot safely be reduced below those specified for ordinary hazard contents. [101:A.6.2.2.2]

A.3.3.144.3 Ordinary Hazard Contents.
Ordinary hazard classification represents the conditions found in most buildings and is the basis for the general requirements of NFPA 101. [101:A.6.2.2.3]
The fear of poisonous fumes or explosions is necessarily a relative matter to be determined on a judgment basis. All smoke contains some toxic fire gases but, under conditions of ordinary hazard, there should be no unduly dangerous exposure during the period necessary to escape from the fire area, assuming there are proper exits. [101:A.6.2.2.3]

A.3.3.177 Means of Egress.
A means of egress comprises the vertical and horizontal travel and includes intervening room spaces, doorways, hallways, corridors, passageways, balconies, ramps, stairs, elevators, enclosures, lobbies, escalators, horizontal exits, courts, and yards. [101:A.3.3.172]
A.3.3.185.1 Ambulatory Health Care Occupancy.
It is not the intent that occupants be considered to be incapable of self-preservation just because
they are in a wheelchair or use assistive walking devices, such as a cane, a walker, or crutches.
Rather it is the intent to address emergency care treatment centers that receive patients who have
been rendered incapable of self-preservation due to the emergency, such as being rendered
unconscious as a result of an accident or being unable to move due to sudden illness.
[101:A.3.3.190.1]
It is not the intent that the term anesthesia be limited to general anesthesia. [101:A.3.3.190.1]

A.3.3.185.2 Apartment Building.
The Code specifies that, wherever there are three or more living units in a building, the building
is considered an apartment building and is required to comply with Chapter 30 or Chapter 31
of NFPA 101, as appropriate. Townhouse units are considered to be apartment buildings if there
are three or more units in the building. The type of wall required between units in order to consider
them to be separate buildings is normally established by the AHJ. If the units are separated by a
wall of sufficient fire resistance and structural integrity to be considered as separate buildings,
then the provisions of Chapter 24 of NFPA 101, apply to each townhouse. Condominium status
is a form of ownership, not occupancy; for example, there are condominium warehouses,
condominium apartments, and condominium offices. [101:A.3.3.36.3]

A.3.3.185.3 Assembly Occupancy.
Assembly occupancies might include the following:

1. Armories
2. Assembly halls
3. Auditoriums
4. Bowling lanes
5. Club rooms
6. College and university classrooms, 50 persons and over
7. Conference rooms
8. Courtrooms
9. Dance halls
10. Drinking establishments
11. Exhibition halls
12. Gymnasiums
13. Libraries
14. Mortuary chapels
15. Motion picture theaters
16. Museums
17. Passenger stations and terminals of air, surface, underground, and marine public
   transportation facilities
18. Places of religious worship
19. Pool rooms
20. Recreation piers
21. Restaurants
22. Skating rinks
23. Special amusement buildings, regardless of occupant load
24. Theaters

[101:A.3.3.190.2]
Assembly occupancies are characterized by the presence or potential presence of crowds with attendant panic hazard in case of fire or other emergency. They are generally open or occasionally open to the public, and the occupants, who are present voluntarily, are not ordinarily subject to discipline or control. Such buildings are ordinarily occupied by able-bodied persons and are not used for sleeping purposes. Special conference rooms, snack areas, and other areas incidental to, and under the control of, the management of other occupancies, such as offices, fall under the 50-person limitation. [101:A.3.3.190.2]
Restaurants and drinking establishments with an occupant load of fewer than 50 persons should be classified as mercantile occupancies. [101:A.3.3.190.2]
For special amusement buildings, see 12.4.8 and 13.4.8 of NFPA 101. [101:A.3.3.190.2]

A.3.3.185.5 Business Occupancy.
Business occupancies include the following:

1. Airport traffic control towers (ATCTs)
2. City halls
3. College and university instructional buildings, classrooms under 50 persons, and instructional laboratories
4. Courthouses
5. Dentists’ offices
6. Doctors’ offices
7. General offices
8. Outpatient Clinics (ambulatory)
9. Town halls

[101:A.3.3.190.3]
Doctors’ and dentists’ offices are included, unless of such character as to be classified as ambulatory health care occupancies. (See 3.3.185.1.) [101:A.3.3.190.3]
Birth centers should be classified as business occupancies if they are occupied by fewer than four patients, not including infants, at any one time; do not provide sleeping facilities for four or more occupants; and do not provide treatment procedures that render four or more patients, not including infants, incapable of self-preservation at any one time. For birth centers occupied by patients not meeting these parameters, see Chapter 18 or Chapter 19 of NFPA 101, as appropriate. [101:A.3.3.190.3]
Service facilities common to city office buildings such as newsstands, lunch counters serving fewer than 50 persons, barber shops, and beauty parlors are included in the business occupancy group. [101:A.3.3.190.3]
City halls, town halls, and courthouses are included in the business occupancy group insofar as their principal function is the transaction of public business and the keeping of books and records. Insofar as they are used for assembly purposes, they are classified as assembly occupancies. [101:A.3.3.190.3]
A.3.3.185.6 Day-Care Home.
A day-care home is generally located within a dwelling unit. [101:A.3.3.142.1]

A.3.3.185.7 Day-Care Occupancy.
Day-care occupancies include the following:

1. Adult day-care occupancies, except where part of a health care occupancy
2. Child day-care occupancies
3. Day-care homes
4. Kindergarten classes that are incidental to a child day-care occupancy
5. Nursery schools

[101:A.3.3.190.4]
In areas where public schools offer only half-day kindergarten programs, many child day-care occupancies offer state-approved kindergarten classes for children who need full-day care. Because these classes are normally incidental to the day-care occupancy, the requirements of the day-care occupancy should be followed. [101:A.3.3.190.4]

A.3.3.185.8 Detention and Correctional Occupancy.
Detention and correctional occupancies include the following:

1. Adult and juvenile substance abuse centers
2. Adult and juvenile work camps
3. Adult community residential centers
4. Adult correctional institutions
5. Adult local detention facilities
6. Juvenile community residential centers
7. Juvenile detention facilities
8. Juvenile training schools

[101:A.3.3.190.5]
It is not the intent to classify as detention and correctional occupancies the areas of health care occupancies where doors are locked against patient egress where needed for the clinical needs of the patients. For example, a dementia treatment center can be adequately protected by the health care occupancies requirements of Chapter 19 of NFPA 101. [See 19.1.1.1.7, 19.2.2.2.2, 19.2.2.2.4(1), and 19.2.2.2.6 of NFPA 101.] [101:A.23.1.1.1.6]
The one-resident threshold requirement of 23.1.1.1.6 of NFPA 101 is not meant to force a residential occupancy, where security is imposed on one or more occupants, to be reclassified as a detention and correctional occupancy. [101:A.23.1.1.1.6]

A.3.3.185.9 Dormitory.
Rooms within dormitories intended for the use of individuals for combined living and sleeping purposes are guest rooms or guest suites. Examples of dormitories are college dormitories, fraternity and sorority houses, and military barracks. [101:A.3.3.65]
A.3.3.185.10 Educational Occupancy.
Educational occupancies include the following:

1. Academies
2. Kindergartens
3. Schools

[101:A.3.3.190.6]
An educational occupancy is distinguished from an assembly occupancy in that the same occupants are regularly present. [101:A.3.3.190.6]

A.3.3.185.11 Health Care Occupancy.
Health care occupancies include the following:

1. Hospitals
2. Limited care facilities
3. Nursing homes

[101:A.3.3.190.7]
Occupants of health care occupancies typically have physical or mental illness, disease, or infirmity. They also include infants, convalescents, or infirm aged persons. [101:A.3.3.190.6]
It is not the intent to consider occupants incapable of self-preservation because they are in a wheelchair or use assistive walking devices, such as a cane, a walker, or crutches. [101:A.3.3.190.7]

A.3.3.185.14 Hotel.
So-called apartment hotels should be classified as hotels, because they are potentially subject to the same transient occupancy as hotels. Transients are those who occupy accommodations for less than 30 days. [101:A.3.3.145]

A.3.3.185.15 Industrial Occupancy.
Industrial occupancies include the following:

1. Drycleaning plants
2. Factories of all kinds
3. Food processing plants
4. Gas plants
5. Hangars (for servicing/maintenance)
6. Laundries
7. Power plants
8. Pumping stations
9. Refineries
10. Sawmills
11. Telephone exchanges

[101:A.3.3.190.8]
In evaluating the appropriate classification of laboratories, the AHJ should treat each case individually, based on the extent and nature of the associated hazards. Some laboratories are classified as occupancies other than industrial; for example, a physical therapy laboratory or a computer laboratory. [101:A.3.3.190.8]

A.3.3.185.16 Limited Care Facility.
Limited care facilities and residential board and care occupancies both provide care to people with physical and mental limitations. However, the goals and programs of the two types of occupancies differ greatly. The requirements in NFPA 101 for limited care facilities are based on the assumption that these are medical facilities, that they provide medical care and treatment, and that the patients are not trained to respond to the fire alarm; that is, the patients do not participate in fire drills but, rather, await rescue. (See Section 18.7 of NFPA 101.) [101:A.3.3.90.2]
The requirements for residential board and care occupancies are based on the assumption that the residents are provided with personal care and activities that foster continued independence, that the residents are encouraged and taught to overcome their limitations, and that most residents, including all residents in prompt and slow homes, are trained to respond to fire drills to the extent they are able. Residents are required to participate in fire drills. (See Section 32.7 of NFPA 101.) [101:A.3.3.90.2]
Persons with Alzheimer’s and related illnesses might be located in a nursing home, limited care facility, or board and care facility. For such persons, it is the level of care provided, not the medical diagnosis, that matters for the purposes of determining whether the facility should meet the requirements for limited care. Where personal care is provided but medical or custodial care is not, the limited care definition does not typically apply. It is the intent of this definition that it not apply to persons not receiving medical or custodial care, provided they are able to assist in their own evacuation, regardless of their medical diagnosis. [101:A.3.3.90.2]

A.3.3.185.19 Mercantile Occupancy.
Mercantile occupancies include the following:

1. Auction rooms
2. Department stores
3. Drugstores
4. Restaurants with fewer than 50 persons
5. Shopping centers
6. supermarkets

[101:A.3.3.190.9]
Office, storage, and service facilities incidental to the sale of merchandise and located in the same building should be considered part of the mercantile occupancy classification. [101:A.3.3.190.9]

A.3.3.185.28 Residential Board and Care Occupancy.
The following are examples of facilities that are classified as residential board and care occupancies:
1. Group housing arrangement for physically or mentally handicapped persons who normally attend school in the community, attend worship in the community, or otherwise use community facilities
2. Group housing arrangement for physically or mentally handicapped persons who are undergoing training in preparation for independent living, for paid employment, or for other normal community activities
3. Group housing arrangement for the elderly that provides personal care services but that does not provide nursing care
4. Facilities for social rehabilitation, alcoholism, drug abuse, or mental health problems that contain a group housing arrangement and that provide personal care services but do not provide acute care
5. Assisted living facilities
6. Other group housing arrangements that provide personal care services but not nursing care

[A.3.3.190.12]

A.3.3.185.31 Storage Occupancy. Storage occupancies include the following:

1. Barns
2. Bulk oil storage
3. Cold storage
4. Freight terminals
5. Grain elevators
6. Hangars (for storage only)
7. Parking structures
8. Truck and marine terminals
9. Warehouses

[A.3.3.190.15] Storage occupancies are characterized by the presence of relatively small numbers of persons in proportion to the area.

[A.3.3.190.15]
Personal care involves responsibility for the safety of the resident while inside the building. Personal care might include daily awareness by management of the resident's functioning and whereabouts, making and reminding a resident of appointments, the ability and readiness for intervention in the event of a resident experiencing a crisis, supervision in the areas of nutrition and medication, and actual provision of transient medical care. [101:A.3.3.208]

A.3.3.218 Ramp. See 7.2.5 of NFPA 101. [101:A.3.3.221]

A.3.3.237 Smoke Partition. A smoke partition is not required to have a fire resistance rating. [101:A.3.3.256]

A.3.3.252.1 Occupiable Story. A story occupied by people on a regular basis. [101:A.3.3.269.1]

A.3.3.256 Structure. The term structure is to be understood as if followed by the words or portion thereof. (See also 3.3.29, Building.) [101:A.3.3.272]

A.3.4.7 Exposure Fire. An exposure fire usually refers to a fire that starts outside a building, such as a wildlands fire or vehicle fire, and that, consequently, exposes the building to a fire. [101:A.3.3.288]

A.3.4.8 Fire Model. Due to the complex nature of the principles involved, models are often packaged as computer software. Any relevant input data, assumptions, and limitations needed to properly implement the model will be attached to the fire models. [101:A.3.3.298]

A.3.4.9 Fire Scenario. A fire scenario defines the conditions under which a proposed design is expected to meet the fire safety goals. Factors typically include fuel characteristics, ignition sources, ventilation, building characteristics, and occupant locations and characteristics. The term fire scenario includes more than the characteristics of the fire itself but excludes design specifications and any characteristics that do not vary from one fire to another; the latter are called assumptions. The term fire scenario is used here to mean only those specifications required to calculate the fire's development and effects, but, in other contexts, the term might be used to mean both the initial specifications and the subsequent development and effects (i.e., a complete description of fire from conditions prior to ignition to conditions following extinguishment). [101:A.3.3.298]

A.3.4.14 Performance Criteria. Performance criteria are stated in engineering terms. Engineering terms include temperatures, radiant heat flux, and levels of exposure to fire products. Performance criteria provide threshold values used to evaluate a proposed design. [101:A.3.3.206]

A.3.4.15 Proposed Design.
The design team might develop a number of trial designs that will be evaluated to determine whether they meet the performance criteria. One of the trial designs will be selected from those that meet the performance criteria for submission to the AHJ as the proposed design.

The proposed design is not necessarily limited to fire protection systems and building features. It also includes any component of the proposed design that is installed, established, or maintained for the purpose of life safety, without which the proposed design could fail to achieve specified performance criteria. Therefore, the proposed design often includes emergency procedures and organizational structures that are needed to meet the performance criteria specified for the proposed design.

A.4.5.8.3
Examples of such features include automatic sprinklers, fire alarm systems, standpipes, and portable fire extinguishers. The presence of a life safety feature, such as sprinklers or fire alarm devices, creates a reasonable expectation by the public that these safety features are functional. When systems are inoperable or taken out of service but the devices remain, they present a false sense of safety. Also, before taking any life safety features out of service, extreme care needs to be exercised to ensure that the feature is not required, was not originally provided as an alternative or equivalent, or is no longer required due to other new requirements in the current Code. It is not intended that the entire system or protection feature be removed. Instead, components such as sprinklers, initiating devices, notification appliances, standpipe hose, and exit systems should be removed to reduce the likelihood of relying on inoperable systems or features. Conversely, equipment, such as fire or smoke dampers, that is not obvious to the public should be able to be taken out of service if no longer required by this Code. Where a door that is not required to be fire protection-rated is equipped with a fire protection listing label, it is not the intent of 4.5.8.3 to require such door to be self- or automatic-closing due merely to the presence of the label.

A.4.5.8.4
In some cases, the requirements for new construction are less restrictive, and it might be justifiable to permit an existing building to use the less restrictive requirements. However, extreme care needs to be exercised when granting such permission, because the less restrictive provision might be the result of a new requirement elsewhere in the Code. For example, in editions of the Code prior to 1991, corridors in new health care occupancies were required to have a 1-hour fire resistance rating. Since 1991, such corridors have been required only to resist the passage of smoke. However, this provision is based on the new requirement that all new health care facilities be protected throughout by automatic sprinklers. (See A.4.5.8.5.)

A.4.5.8.5
An example of what is intended by 4.5.8.4 and 4.5.8.5 follows. In a hospital that has 6 ft (1830 mm) wide corridors, such corridors cannot be reduced in width, even though the provisions for existing hospitals do not require 6 ft (1830 mm) wide corridors. However, if a hospital has 10 ft (3050 mm) wide corridors, they are permitted to be reduced to 8 ft (2440 mm) in width, which is the requirement for new construction. If the hospital corridor is 36 in. (915 mm) wide, it would
have to be increased to 48 in. (1220 mm), which is the requirement for existing hospitals. [101:A.4.6.7.5]

A.6.1.2.1 
**Assembly Occupancy.** Assembly occupancies might include the following:

1. Armories
2. Assembly halls
3. Auditoriums
4. Bowling lanes
5. Club rooms
6. College and university classrooms, 50 persons and over
7. Conference rooms
8. Courtrooms
9. Dance halls
10. Drinking establishments
11. Exhibition halls
12. Gymnasiums
13. Libraries
14. Mortuary chapels
15. Motion picture theaters
16. Museums
17. Passenger stations and terminals of air, surface, underground, and marine public transportation facilities
18. Places of religious worship
19. Pool rooms
20. Recreation piers
21. Restaurants
22. Skating rinks
23. Special amusement buildings, regardless of occupant load
24. Theaters

[101:A.6.1.2.1] Assembly occupancies are characterized by the presence or potential presence of crowds with attendant panic hazard in case of fire or other emergency. They are generally or occasionally open to the public, and the occupants, who are present voluntarily, are not ordinarily subject to discipline or control. Such buildings are ordinarily not used for sleeping purposes. Special conference rooms, snack areas, and other areas incidental to, and under the control of, the management of other occupancies, such as offices, fall under the 50-person limitation. [101:A.6.1.2.1]

Restaurants and drinking establishments with an occupant load of fewer than 50 persons should be classified as mercantile occupancies. [101:A.6.1.2.1] Occupancy of any room or space for assembly purposes by fewer than 50 persons in another occupancy, and incidental to such other occupancy, should be classified as part of the other occupancy and should be subject to the provisions applicable thereto. [101:A.6.1.2.1] For special amusement buildings, see 12.4.7 and 13.4.7 of NFPA 101. [101:A.6.1.2.1]
A.6.1.3.1
**Educational Occupancy.** Educational occupancies include the following:

1. Academies
2. Kindergartens
3. Schools

An educational occupancy is distinguished from an assembly occupancy in that the same occupants are regularly present.

A.6.1.4.1
**Day-Care Occupancy.** Day-care occupancies include the following:

1. Adult day-care occupancies, except where part of a health care occupancy
2. Child day-care occupancies
3. Day-care homes
4. Kindergarten classes that are incidental to a child day-care occupancy
5. Nursery schools

In areas where public schools offer only half-day kindergarten programs, many child day-care occupancies offer state-approved kindergarten classes for children who need full-day care. Because these classes are normally incidental to the day-care occupancy, the requirements of the day-care occupancy should be followed.

A.6.1.5.1
**Health Care Occupancy.** Health care occupancies include the following:

1. Hospitals
2. Limited care facilities
3. Nursing homes

Occupants of health care occupancies typically have physical or mental illness, disease, or infirmity. They also include infants, convalescents, or infirm aged persons.

A.6.1.6.1
**Ambulatory Health Care Occupancy.** It is not the intent that occupants be considered to be incapable of self-preservation just because they are in a wheelchair or use assistive walking devices, such as a cane, a walker, or crutches. Rather, it is the intent to address emergency care centers that receive patients who have been rendered incapable of self-preservation due to the emergency, such as being rendered unconscious as a result of an accident or being unable to move due to sudden illness.
A.6.1.7.1

**Detention and Correctional Occupancy.** Detention and correctional occupancies include the following:

1. Adult and juvenile substance abuse centers
2. Adult and juvenile work camps
3. Adult community residential centers
4. Adult correctional institutions
5. Adult local detention facilities
6. Juvenile community residential centers
7. Juvenile detention facilities
8. Juvenile training schools

[A.6.1.7.1]

See A.22.1.1.6 and A.23.1.1.1.6 of NFPA 101. [A.6.1.7.1]

A.6.1.7.2

Chapters 22 and 23 of NFPA 101 address the residential housing areas of the detention and correctional occupancy as defined in 3.3.178.5 of NFPA 101. Examples of uses, other than residential housing, include gymnasiums or industries. [A.6.1.7.2]

A.6.1.8.1.1

**One- and Two-Family Dwelling Unit.** The application statement of 24.1.1.1 of NFPA 101 limits each dwelling unit to being “occupied by members of a single family with not more than three outsiders.” This Code and NFPA 101 do not define the term family. The definition of family is subject to federal, state, and local regulations and might not be restricted to a person or a couple (two people) and their children. The following examples aid in differentiating between a single-family dwelling and a lodging or rooming house:

1. An individual or a couple (two people) who rent a house from a landlord and then sublease space for up to three individuals should be considered a family renting to a maximum of three outsiders, and the house should be regulated as a single-family dwelling in accordance with Chapter 24 of NFPA 101.
2. A house rented from a landlord by an individual or a couple (two people) in which space is subleased to four or more individuals, but not more than 16, should be considered and regulated as a lodging or rooming house in accordance with Chapter 26 of NFPA 101.
3. A residential building that is occupied by four or more individuals, but not more than 16, each renting from a landlord, without separate cooking facilities, should be considered and regulated as a lodging or rooming house in accordance with Chapter 26 of NFPA 101.

[A.6.1.8.1.1]

A.6.1.8.1.3
Hotel. So-called apartment hotels should be classified as hotels, because they are potentially subject to the same transient occupancy as hotels. Transients are those who occupy accommodations for less than 30 days. [101:A.6.1.8.1.3]

A.6.1.8.1.4 Dormitory. Rooms within dormitories intended for the use of individuals for combined living and sleeping purposes are guest rooms or guest suites. Examples of dormitories include college dormitories, fraternity and sorority houses, and military barracks. [101:A.6.1.8.1.4]

A.6.1.9.1 Residential Board and Care Occupancy. The following are examples of facilities classified as residential board and care occupancies:

1. Group housing arrangement for physically or mentally handicapped persons who normally attend school in the community, attend worship in the community, or otherwise use community facilities
2. Group housing arrangement for physically or mentally handicapped persons who are undergoing training in preparation for independent living, for paid employment, or for other normal community activities
3. Group housing arrangement for the elderly that provides personal care services but that does not provide nursing care
4. Facilities for social rehabilitation, alcoholism, drug abuse, or mental health problems that contain a group housing arrangement and that provide personal care services but do not provide acute care
5. Assisted living facilities
6. Other group housing arrangements that provide personal care services but not nursing care

[101:A.6.1.9.1]

A.6.1.10.1 Mercantile Occupancy. Mercantile occupancies include the following:

1. Auction rooms
2. Department stores
3. Drugstores
4. Restaurants with fewer than 50 persons
5. Shopping centers
6. Supermarkets

[101:A.6.1.10.1]

Office, storage, and service facilities incidental to the sale of merchandise and located in the same building should be considered part of the mercantile occupancy classification. [101:A.6.1.10.1]
A.6.1.11.1  
**Business Occupancy.** Business occupancies include the following:

1. Airport traffic control towers (ATCTs)
2. City halls
3. College and university instructional buildings, classrooms under 50 persons, and instructional laboratories
4. Courthouses
5. Dentists’ offices
6. Doctors’ offices
7. General offices
8. Outpatient clinics (ambulatory)
9. Town halls

[101:A.6.1.11.1] Doctors’ and dentists’ offices are included, unless of such character as to be classified as ambulatory health care occupancies. *(See 3.3.188.1 of NFPA 101.)* [101:A.6.1.11.1] Birth centers should be classified as business occupancies if they are occupied by fewer than four patients, not including infants, at any one time; do not provide sleeping facilities for four or more occupants; and do not provide treatment procedures that render four or more patients, not including infants, incapable of self-preservation at any one time. For birth centers occupied by patients not meeting these parameters, see Chapter 18 or Chapter 19 of NFPA 101, as appropriate. [101:A.6.1.11.1] Service facilities common to city office buildings, such as newsstands, lunch counters serving fewer than 50 persons, barber shops, and beauty parlors are included in the business occupancy group. [101:A.6.1.11.1] City halls, town halls, and courthouses are included in this occupancy group, insofar as their principal function is the transaction of public business and the keeping of books and records. Insofar as they are used for assembly purposes, they are classified as assembly occupancies. [101:A.6.1.11.1]

A.6.1.12.1  
**Industrial Occupancy.** Industrial occupancies include the following:

1. Drycleaning plants
2. Factories of all kinds
3. Food processing plants
4. Gas plants
5. Hangars (for servicing/maintenance)
6. Laundries
7. Power plants
8. Pumping stations
9. Refineries
10. Sawmills
11. Telephone exchanges
In evaluating the appropriate classification of laboratories, the AHJ should treat each case individually, based on the extent and nature of the associated hazards. Some laboratories are classified as occupancies other than industrial; for example, a physical therapy laboratory or a computer laboratory.

A.6.1.13.1

**Storage Occupancy.** Storage occupancies include the following:

1. Barns
2. Bulk oil storage
3. Cold storage
4. Freight terminals
5. Grain elevators
6. Hangars (for storage only)
7. Parking structures
8. Truck and marine terminals
9. Warehouses

Storage occupancies are characterized by the presence of relatively small numbers of persons in proportion to the area.

A.6.1.14.1.3

Examples of uses that might be incidental to another occupancy include the following:

1. Newsstand (mercantile) in an office building
2. Giftshop (mercantile) in a hotel
3. Small storage area (storage) in any occupancy
4. Minor office space (business) in any occupancy
5. Maintenance area (industrial) in any occupancy

A.6.1.14.1.3(2)

Examples of uses that have occupant loads below the occupancy classification threshold levels include the following:

1. Assembly use with fewer than 50 persons within a business occupancy
2. Educational use with fewer than 6 persons within an apartment building.

A.6.1.14.4.5

Where the Code text states that the provision has applicability to the building, rather than just to the occupancy, the provision applies to the entire building, regardless of whether the separated
occupancies form of protection is used. For example, the provision of 18.3.5.1 of NFPA 101 requires that the entire building housing a health care occupancy be sprinklered. Contrast that with the requirement of 20.3.4.1 of NFPA 101 which requires an ambulatory health care facility, and not the entire building, to be provided with a fire alarm system. [101:A.6.1.14.4.5]

A.10.5
The purpose of emergency egress and relocation drills is to educate the participants in the fire safety features of the building, the egress facilities available, and the procedures to be followed. Speed in emptying buildings or relocating occupants, while desirable, is not the only objective. Prior to an evaluation of the performance of an emergency egress and relocation drill, an opportunity for instruction and practice should be provided. This educational opportunity should be presented in a nonthreatening manner, with consideration given to the prior knowledge, age, and ability of audience. [101:A.4.7]
The usefulness of an emergency egress and relocation drill, and the extent to which it can be performed, depends on the character of the occupancy. [101:A.4.7]
In buildings where the occupant load is of a changing character, such as hotels or department stores, no regularly organized emergency egress and relocation drill is possible. In such cases, the emergency egress and relocation drills are to be limited to the regular employees, who can be thoroughly schooled in the proper procedure and can be trained to properly direct other occupants of the building in case of emergency evacuation or relocation. In occupancies such as hospitals, regular employees can be rehearsed in the proper procedure in case of fire; such training is always advisable in all occupancies, regardless of whether regular emergency egress and relocation drills can be held. [101:A.4.7]

A.10.5.2
If an emergency egress and relocation drill is considered merely as a routine exercise from which some persons are allowed to be excused, there is a grave danger that, in an actual emergency, the evacuation and relocation will not be successful. However, there might be circumstances under which all occupants do not participate in an emergency egress and relocation drill, for example, infirm or bedridden patients in a health care occupancy. [101:A.4.7.2]

A.10.5.4
Fire is always unexpected. If the drill is always held in the same way at the same time, it loses much of its value. When, for some reason during an actual fire, it is not possible to follow the usual routine of the emergency egress and relocation drill to which occupants have become accustomed, confusion and panic might ensue. Drills should be carefully planned to simulate actual fire conditions. Not only should drills be held at varying times, but different means of exit or relocation areas should be used, based on an assumption that fire or smoke might prevent the use of normal egress and relocation avenues. [101:A.4.7.4]

A.10.5.6
The written record required by this paragraph should include such details as the date, time, participants, location, and results of that drill. [101:A.4.7.6]

A.10.8.2.1
Items to be considered in preparing an emergency plan should include the following:
1. Purpose of plan
2. Building description, including certificate of occupancy
3. Appointment, organization, and contact details of designated building staff to carry out
   the emergency duties
4. Identification of events (man-made and natural) considered life safety hazards impacting
   the building
5. Responsibilities matrix (role-driven assignments)
6. Policies and procedures for those left behind to operate critical equipment
7. Specific procedures to be used for each type of emergency
8. Requirements and responsibilities for assisting people with disabilities
9. Procedures for accounting for employees
10. Training of building staff, building emergency response teams, and other occupants in
    their responsibilities
11. Documents, including diagrams, showing the type, location, and operation of the building
    emergency features, components, and systems
12. Practices for controlling life safety hazards in the building
13. Inspection and maintenance of building facilities that provide for the safety of occupants
14. Conducting fire and evacuation drills
15. Interface between key building management and emergency responders
16. Names or job titles of persons who can be contacted for further information or
    explanation of duties
17. Post-event (including drill) critique/evaluation, as addressed in Chapter 9 of NFPA
1600
18. Means to update the plan, as necessary

[A.4.8.2.1]

A.10.8.2.1(3)
It is assumed that a majority of buildings will use a total evacuation strategy during a fire. It
should be noted that evacuation from a building could occur for reasons other than a fire, but
such other reasons are not the primary focus of the Code. As used herein, total evacuation is
defined as the process in which all, or substantially all, occupants leave a building or facility in
either an unmanaged or managed sequence or order. An alternative to total evacuation, is partial
evacuation, which can be defined as the process in which a select portion of a building or facility
is cleared or emptied of its occupants while occupants in other portions mostly carry on normal
activity. In either case, the evacuation process can be ordered or managed in accordance with an
established priority in which some or all occupants of a building or facility clear their area and
utilize means of egress routes. This is typically done so that the more endangered occupants are
removed before occupants in less endangered areas. Alternative terms describing this sequencing
or ordering of evacuation are staged evacuation and phased evacuation. [A.4.8.2.1(3)]
Table A.10.8.2.1(3) illustrates options for extent of management and extent of evacuation. Some
of the options shown might not be appropriate. As noted in Table A.10.8.2.1(3), either total or
partial evacuation can include staged (zoned) evacuation or phased evacuation, which is referred
to as managed or controlled evacuation. It should also be noted that the evacuation process might
not include relocation to the outside of the building but might instead include relocation to an
area of refuge or might defend the occupants in place to minimize the need for evacuation.

Table A.10.8.2.1(3) Occupant Evacuation Strategies

<table>
<thead>
<tr>
<th>Extent of Evacuation</th>
<th>Managed Sequence</th>
<th>Unmanaged Sequence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shelter in place</td>
<td>No movement — shelter in place upon direction</td>
<td>No movement — shelter in place per prior instruction</td>
</tr>
<tr>
<td></td>
<td>Managed or controlled partial evacuation</td>
<td></td>
</tr>
<tr>
<td>Relocation or partial</td>
<td>In-building relocation on same floor</td>
<td>Unmanaged movement</td>
</tr>
<tr>
<td>evacuation</td>
<td>In-building relocation to different floors</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Occupants of some floors leave building</td>
<td></td>
</tr>
<tr>
<td>Total evacuation</td>
<td>Managed or controlled total evacuation</td>
<td>Unmanaged or uncontrolled total evacuation</td>
</tr>
</tbody>
</table>

The different methods of evacuation are also used in several contexts throughout NFPA 101. Though most of the methods of evacuation are not specifically defined or do not have established criteria, various sections of NFPA 101 promulgate them as alternatives to total evacuation. The following sections of NFPA 101 discuss these alternatives in more detail:

1. Section 4.7 — Provides requirements for fire and relocation drills
2. 7.2.12 — Provides requirements for area of refuge
3. 7.2.4 — Provides requirements for horizontal exits
4. 9.6.3.6 — Provides the alarm signal requirements for different methods of evacuation
5. 9.6.3.9 — Permits automatically transmitted or live voice evacuation or relocation instructions to occupants and requires them in accordance with NFPA 72
6. 14.3.4.2.3 (also Chapter 15) — Describes alternative protection systems in educational occupancies
7. 18.1.1.2/18.1.1.3/Section 18.7 (also Chapter 19) — Provide methods of evacuation for health care occupancies
8. Chapters 22 and 23 — Provide methods of evacuation for detention and correctional occupancies, including the five groups of resident user categories
9. Chapters 32 and 33 — Provide methods of evacuation for residential board and care occupancies
10. 32.1.5/33.1.5 — For residential board and care occupancies, state that “no means of escape or means of egress shall be considered as complying with the minimum criteria for acceptance, unless emergency evacuation drills are regularly conducted”
11. 40.2.5.2.2 — For industrial occupancies, states that “ancillary facilities in special-purpose industrial occupancies where delayed evacuation is anticipated shall have not less than a 2-hour fire resistance–rated separation from the predominant industrial occupancy and shall have one means of egress that is separated from the predominant industrial occupancy by 2-hour fire resistance–rated construction”
The method of evacuation should be accomplished in the context of the physical facilities, the type of activities undertaken, and the provisions for the capabilities of occupants (and staff, if available). Therefore, in addition to meeting the requirements of the Code, or when establishing an equivalency or a performance-based design, the following recommendations and general guidance information should be taken into account when designing, selecting, executing, and maintaining a method of evacuation:

1. When choosing a method of evacuation, the available safe egress time (ASET) must always be greater than the required safe egress time (RSET).

2. The occupants’ characteristics will drive the method of evacuation. For example, occupants might be incapable of evacuating themselves because of age, physical or mental disabilities, physical restraint, or a combination thereof. However, some buildings might be staffed with people who could assist in evacuating. Therefore, the method of evacuation is dependent on the ability of occupants to move as a group, with or without assistance. For more information, see the definitions under the term Evacuation Capability in Chapter 3 of NFPA 101.

3. An alternative method of evacuation might or might not have a faster evacuation time than a total evacuation. However, the priority of evacuation should be such that the occupants in the most danger are given a higher priority. This prioritization will ensure that occupants more intimate with the fire will have a faster evacuation time.

4. Design, construction, and compartmentation are also variables in choosing a method of evacuation. The design, construction, and compartmentation should limit the development and spread of a fire and smoke and reduce the need for occupant evacuation. The fire should be limited to the room or compartment of fire origin. Therefore, the following factors need to be considered:
   1. Overall fire resistance rating of the building
   2. Fire-rated compartmentation provided with the building
   3. Number and arrangement of the means of egress

5. Fire safety systems should be installed that complement the method of evacuation and should include consideration of the following:
   1. Detection of fire
   2. Control of fire development
   3. Confinement of the effects of fire
   4. Extinguishment of fire
   5. Provision of refuge or evacuation facilities, or both

6. One of the most important fire safety systems is the fire alarm and communication system, particularly the notification system. The fire alarm system should be in accordance with NFPA 72 and should take into account the following:
   1. Initial notification of only the occupants in the affected zone(s) (e.g., zone of fire origin and adjacent zones)
   2. Provisions to notify occupants in other unaffected zones to allow orderly evacuation of the entire building
   3. Need for live voice communication
   4. Reliability of the fire alarm and communication system
7. The capabilities of the staff assisting in the evacuation process should be considered in determining the method of evacuation.
8. The ability of the fire department to interact with the evacuation should be analyzed. It is important to determine if the fire department can assist in the evacuation or if fire department operations hinder the evacuation efforts.
9. Evacuation scenarios for hazards that are normally outside of the scope of the Code should be considered to the extent practicable. (See 4.3.1 of NFPA 101.)
10. Consideration should be given to the desire of the occupants to self-evacuate, especially if the nature of the building or the fire warrants evacuation in the minds of the occupants. Self-evacuation might also be initiated by communication between the occupants themselves through face-to-face contact, mobile phones, and so forth.
11. An investigation period, a delay in the notification of occupants after the first activation of the fire alarm, could help to reduce the number of false alarms and unnecessary evacuations. However, a limit to such a delay should be established before a general alarm is sounded, such as positive alarm sequence as defined in NFPA 72.
12. Consideration should be given to the need for an evacuation that might be necessary for a scenario other than a fire (e.g., bomb threat, earthquake).
13. Contingency plans should be established in the event the fire alarm and communication system fail, which might facilitate the need for total evacuation.
14. The means of egress systems should be properly maintained to ensure the dependability of the method of evacuation.
15. Fire prevention policies or procedures, or both, should be implemented that reduce the chance of a fire (e.g., limiting smoking or providing fire-safe trash cans).
16. The method of evacuation should be properly documented, and written forms of communication should be provided to all of the occupants, which might include sign postings throughout the building. Consideration should be given to the development of documentation for an operation and maintenance manual or a fire emergency plan, or both.
17. Emergency egress drills should be performed on a regular basis. For more information, see Section 4.7 of NFPA 101.
18. The AHJ should also be consulted when developing the method of evacuation.

[101:A.4.8.2.1(3)] Measures should be in place and be employed to sequence or control the order of a total evacuation, so that such evacuations proceed in a reasonably safe, efficient manner. Such measures include special attention to the evacuation capabilities and needs of occupants with disabilities, either permanent or temporary. For comprehensive guidance on facilitating life safety for such populations, go to www.nfpa.org. For specific guidance on stair travel devices, see ANSI/RESNA ED-1, Emergency Stair Travel Devices Used by Individuals with Disabilities. [101:A.4.8.2.1(3)] In larger buildings, especially high-rise buildings, it is recommended that all evacuations — whether partial or total — be managed to sequence or control the order in which certain occupants are evacuated from their origin areas and to make use of available means of egress. In high-rise buildings, the exit stairs, at any level, are designed to accommodate the egress flow of only a very small portion of the occupants — from only one or a few stories, and within a relatively short time period — on the order of a few minutes. In case of a fire, only the
immediately affected floor(s) should be given priority use of the means of egress serving that floor(s). Other floors should then be given priority use of the means of egress, depending on the anticipated spread of the fire and its combustion products, and for the purpose of clearing certain floors to facilitate eventual fire service operations. Typically, this means that the one or two floors above and below a fire floor will have secondary priority immediately after the fire floor. Depending on where combustion products move, for example, upward through a building with cool-weather stack effect, the next priority floors will be the uppermost occupied floors in the building. [101:A.4.8.2.1(3)]

Generally, in order to minimize evacuation time for most or all of a relatively tall building to be evacuated, occupants from upper floors should have priority use of exit stairs. For people descending many stories of stairs, this priority will maximize their opportunity to take rest stops without unduly extending their overall time to evacuate a building. Thus, the precedence behavior of evacuees should be that people already in an exit stair should normally not defer to people attempting to enter the exit stair from lower floors, except for those lower floors most directly impacted by a fire or other imminent danger. Notably, this is contrary to the often observed behavior of evacuees in high-rise building evacuations where lower floor precedence behavior occurs. (Similarly, in the most commonly observed behavior of people normally disembarking a passenger airliner, people within the aisle defer to people entering the aisle, so that the areas closest to the exit typically clear first.) Changing, and generally managing, the sequence or order within which egress occurs will require effectively informing building occupants and evaluating resulting performance in a program of education, training, and drills. [101:A.4.8.2.1(3)]

When designing the method of evacuation for a complex building, all forms of egress should be considered. For example, consideration could be given to an elevator evacuation system. An elevator evacuation system involves an elevator design that provides protection from fire effects so that elevators can be used safely for egress. See 7.2.13 and A.7.2.12.2.4 of NFPA 101 for more information. [101:A.4.8.2.1(3)]

For further guidance, see the following publications:

1. *SFPE Engineering Guide to Human Behavior in Fire*, which provides information on occupant characteristics, response to fire cues, decision making in fire situations, and methods for predicting evacuation time
2. *NFPA Fire Protection Handbook*, 20th edition, Section 1, Chapter 9, which provides good methodology for managing exposures and determining the method of evacuation
3. *NFPA Fire Protection Handbook*, 20th edition, Section 20, which provides further commentary on methods of evacuation for different occupancies
4. *SFPE Handbook of Fire Protection Engineering*, Section 3, Volume II, Chapters 11–1358–61, which provide an overview of some of the research on methods of evacuation and methods for predicting evacuation times

[101:A.4.8.2.1(3)]

A.10.8.2.3

Emergency action plans are a critical component of assuring life safety in buildings. Life safety is the result of an interaction of technical and social systems within the building and in the community. Gathering information to evaluate the performance and effectiveness of emergency
action plans is important for verifying system performance and as a basis for improvement. Such reports should be retained by building management and used to inform the process for revision of the building emergency action plan. [101:A.4.8.2.3]

Following any drill or actual emergency or reported emergency occurring in the building, an after action report should be prepared by the building owner or designated representative to document the function of the building's life safety hardware, procedures, and occupant emergency organization. [101:A.4.8.2.3]

For ordinary drills and reported emergencies, areas of success and areas for improvement should be identified. [101:A.4.8.2.3]

For actual emergencies in the building, where there is major occupant movement, damage, or casualties, additional information should be collected. This includes questions concerning the event, as well as performance of life safety systems. It also identifies improvements in areas such as training, maintenance, interaction with local emergency response organizations, or occupant management. The reports from these significant events should be shared with the local emergency response organization. [101:A.4.8.2.3]

A.10.11.3
Figure A.10.11.3 shows an example of a stairway marking sign. [101:A.7.2.2.5.4]

Figure A.10.11.3 Example of a Stairway Marking Sign. [101:A.7.2.2.5.4]

A.10.11.3.1.13
It is not the intent to require a sign that reads ROOF ACCESS, as such message might be misinterpreted by building occupants as an alternative egress route. However, signs that read ROOF ACCESS are not prohibited, as many such signs have been installed in existing buildings.
so as to make a requirement for removal impractical. Historically, the ROOF ACCESS sign has provided information for the fire department. Where there is no roof access, such information will be posted via a NO ROOF ACCESS sign. The absence of the NO ROOF ACCESS sign should be understood by the fire department to mean that roof access is possible.

A.10.11.3.3
Where environmental conditions (such as illumination levels and directionality or a complex visual field that draws a person’s attention away from stair treads) lead to a hazardous reduction in one’s ability to perceive stair treads, they should be made of a material that allows ready discrimination of the number and position of treads. In all cases, the leading edges of all treads should be readily visible during both ascent and descent. A major factor in injury-producing stair accidents, and in the ability to use stairs efficiently in conditions such as egress, is the clarity of the stair treads as separate stepping surfaces.

For stair nosing marking, surface-applied material, such as adhesive-backed tape and magnetic strips, should not be used, as it is not durable under the scuffing from users’ feet and, in coming loose, it creates a tripping hazard. While a carefully applied and consistently maintained coating is acceptable, contrasting color or photoluminescent material integral with the nosings is preferable because of its permanence. See also 7.1.6.4 and 7.2.2.3.6 of NFPA 101 for slip resistance uniformity requirements, as well as prohibition of projections on the treads.

Guidance on the use of photoluminescent marking is provided by ASTM E2030, Guide for Recommended Uses of Photoluminescent (Phosphorescent) Safety Markings. Additional marking, for example, at the side boundaries of the stair, should be applied in accordance with the guidance provided therein.

A.10.11.3.4
Coatings and other applied markings, if used, should be durable for the expected usage, especially at end terminations of the marking and at changes in stair direction where usage is more extensive and hand forces are larger.

A.10.14.3.1
Life safety evaluations are examples of performance-based approaches to life safety. In this respect, significant guidance in the form and process of life safety evaluations is provided by Chapter 5 of NFPA 101, keeping in mind the fire safety emphasis in Chapter 5 of NFPA 101. Performance criteria, scenarios, evaluation, safety factors, documentation, maintenance, and periodic assessment (including a warrant of fitness) all apply to the broader considerations in a life safety evaluation. A life safety evaluation deals not only with fire but also with storms, collapse, crowd behavior, and other related safety considerations for which a checklist is provided in A.10.14.3.3. Chapter 5 of NFPA 101 provides guidance, based on fire safety requirements, for establishing a documented case showing that products of combustion in all conceivable fire scenarios will not significantly endanger occupants using means of egress in the facility (for example, due to fire detection, automatic suppression, smoke control, large-volume space, or management procedures). Moreover, means of egress facilities plus facility management capabilities should be adequate to cope with scenarios where certain egress routes are blocked for some reason.
In addition to making realistic assumptions about the capabilities of persons in the facility (e.g., an assembled crowd including many disabled persons or persons unfamiliar with the facility), the life safety evaluation should include a factor of safety of not less than 2.0 in all calculations relating to hazard development time and required egress time (the combination of flow time and other time needed to detect and assess an emergency condition, initiate egress, and move along the egress routes). The factor of safety takes into account the possibility that half of the egress routes might not be used (or be usable) in certain situations. \[101\]:A.12.4.1.1

Regarding crowd behavior, the potential hazards created by larger masses of people and greater crowd densities (which can be problematic during ingress, occupancy, and egress) demand that technology be used by designers, managers, and authorities responsible for buildings to compensate for the relaxed egress capacity provisions of Table 12.4.2.3 of NFPA 101. In very large buildings for assembly use, the hazard of crowd crushes can exceed that of fire or structural failure. Therefore, the building designers, managers, event planners, security personnel, police authorities, and fire authorities, as well as the building construction authorities, should understand the potential problems and solutions, including coordination of their activities. For crowd behavior, this understanding includes factors of space, energy, time, and information, as well as specific crowd management techniques, such as metering. Published guidance on these factors and techniques is found in the SFPE Handbook of Fire Protection Engineering, Section 3, Chapter 13, pp. 3-342–3-366 (Proulx, G., “Movement of People”), and the publications referenced therein. \[101\]:A.12.4.1.1

Table 12.2.3.2 and Table 12.4.2.3 of NFPA 101 are based on a linear relationship between number of seats and nominal flow time, with not less than 200 seconds (3.3 minutes) for 2000 seats plus 1 second for every additional 50 seats up to 25,000. Beyond 25,000 total seats, the nominal flow time is limited to 660 seconds (11 minutes). Nominal flow time refers to the flow time for the most able group of patrons; some groups less familiar with the premises or less able groups might take longer to pass a point in the egress system. Although three or more digits are noted in the tables, the resulting calculations should be assumed to provide only two significant figures of precision. \[101\]:A.12.4.1.1

A.10.14.3.3
Factors to be considered in a life safety evaluation include the following:

1. Nature of the events being accommodated, including the following:
   1. Ingress, intra-event movement, and egress patterns
   2. Ticketing and seating policies/practices
   3. Event purpose (e.g., sports contest, religious meeting)
   4. Emotional qualities (e.g., competitiveness) of event
   5. Time of day when event is held
   6. Time duration of single event
   7. Time duration of attendees’ occupancy of the building
2. Occupant characteristics and behavior, including the following:
   1. Homogeneity
   2. Cohesiveness
   3. Familiarity with building
   4. Familiarity with similar events
   5. Capability (as influenced by factors such as age, physical abilities)
6. Socioeconomic factors
7. Small minority involved with recreational violence
8. Emotional involvement with the event and other occupants
9. Use of alcohol or drugs
10. Food consumption
11. Washroom utilization

3. Management, including the following:
   1. Clear, contractual arrangements for facility operation/use as follows:
      1. Between facility owner and operator
      2. Between facility operator and event promoter
      3. Between event promoter and performer
      4. Between event promoter and attendee
      5. With police forces
      6. With private security services
      7. With ushering services
   2. Experience with the building
   3. Experience with similar events and attendees
   4. Thorough, up-to-date operations manual
   5. Training of personnel
   6. Supervision of personnel
   7. Communications systems and utilization
   8. Ratios of management and other personnel to attendees
   9. Location/distribution of personnel
   10. Central command location
   11. Rapport between personnel and attendees
   12. Personnel support of attendee goals
   13. Respect of attendees for personnel due to the following:
      1. Dress (uniform) standards
      2. Age and perceived experience
      3. Personnel behavior, including interaction
      4. Distinction between crowd management and control
      5. Management concern for facility quality (e.g., cleanliness)
      6. Management concern for entire event experience of attendees (i.e., not just during the occupancy of the building)

4. Emergency management preparedness, including the following:
   1. Complete range of emergencies addressed in operations manual
   2. Power loss
   3. Fire
   4. Severe weather
   5. Earthquake
   6. Crowd incident
   7. Terrorism
   8. Hazardous materials
   9. Transportation accident (e.g., road, rail, air)
   10. Communications systems available
   11. Personnel and emergency forces ready to respond
12. Attendees clearly informed of situation and proper behavior

5. Building systems, including the following:
   1. Structural soundness
   2. Normal static loads
   3. Abnormal static loads (e.g., crowds, precipitation)
   4. Dynamic loads (e.g., crowd sway, impact, explosion, wind, earthquake)
   5. Stability of nonstructural components (e.g., lighting)
   6. Stability of movable (e.g., telescoping) structures
   7. Fire protection
   8. Fire prevention (e.g., maintenance, contents, housekeeping)
   9. Compartmentation
   10. Automatic detection and suppression of fire
   11. Smoke control
   12. Alarm and communications systems
   13. Fire department access routes and response capability
   14. Structural integrity
   15. Weather protection
   16. Wind
   17. Precipitation (attendees rush for shelter or hold up egress of others)
   18. Lightning protection
   19. Circulation systems
   20. Flowline or network analysis
   21. Waywinding and orientation
   22. Merging of paths (e.g., precedence behavior)
   23. Decision/branching points
   24. Route redundancies
   25. Counterflow, crossflow, and queuing situations
   26. Control possibilities, including metering
   27. Flow capacity adequacy
   28. System balance
   29. Movement time performance
   30. Flow times
   31. Travel times
   32. Queuing times
   33. Route quality
   34. Walking surfaces (e.g., traction, discontinuities)
   35. Appropriate widths and boundary conditions
   36. Handrails, guardrails, and other rails
   37. Ramp slopes
   38. Step geometries
   39. Perceptual aspects (e.g., orientation, signage, marking, lighting, glare, distractions)
   40. Route choices, especially for vertical travel
   41. Resting/waiting areas
   42. Levels of service (overall crowd movement quality)
   43. Services
44. Washroom provision and distribution
45. Concessions
46. First aid and EMS facilities
47. General attendee services

[101:A.12.4.1.3] A scenario-based approach to performance-based fire safety is addressed in Chapter 5 of NFPA 101. In addition to using such scenarios and, more generally, the attention to performance criteria, evaluation, safety factors, documentation, maintenance, and periodic assessment required when the Chapter 5 of NFPA 101 option is used, life safety evaluations should consider scenarios based on characteristics important in assembly occupancies. These characteristics include the following:

1. Whether there is a local or mass awareness of an incident, event, or condition that might provoke egress
2. Whether the incident, event, or condition stays localized or spreads
3. Whether or not egress is desired by facility occupants
4. Whether there is a localized start to any egress or mass start to egress
5. Whether exits are available or not available

[101:A.12.4.1.3] Examples of scenarios and sets of characteristics that might occur in a facility follow.

Scenario 1. Characteristics: mass start, egress desired (by management and attendees), exits not available, local awareness. Normal egress at the end of an event occurs just as a severe weather condition induces evacuees at the exterior doors to retard or stop their egress. The backup that occurs in the egress system is not known to most evacuees, who continue to press forward, potentially resulting in a crowd crush.

Scenario 2. Characteristics: mass start, egress not desired (by management), exits possibly not available, mass awareness. An earthquake occurs during an event. The attendees are relatively safe in the seating area. The means of egress outside the seating areas are relatively unsafe and vulnerable to aftershock damage. Facility management discourages mass egress until the means of egress can be checked and cleared for use.

Scenario 3. Characteristics: local start, incident stays local, egress desired (by attendees and management), exits available, mass awareness. A localized civil disturbance (e.g., firearms violence) provokes localized egress, which is seen by attendees, generally, who then decide to leave also.

Scenario 4. Characteristics: mass start, egress desired (by attendees), incident spreads, exits not available, mass awareness. In an open-air facility unprotected from wind, precipitation, and lightning, sudden severe weather prompts egress to shelter, but not from the facility. The means of egress congest and block quickly as people in front stop once they are under shelter while people behind them continue to press forward, potentially resulting in a crowd crush.
These scenarios illustrate some of the broader factors to be taken into account when assessing the capability of both building systems and management features on which reliance is placed in a range of situations, not just fire emergencies. Some scenarios also illustrate the conflicting motivations of management and attendees, based on differing perceptions of danger and differing knowledge of hazards, countermeasures, and capabilities. Mass egress might not be the most appropriate life safety strategy in some scenarios, such as Scenario 2. [101:A.12.4.1.3]

Table A.10.14.3.3 summarizes the characteristics in the scenarios and provides a framework for developing other characteristics and scenarios that might be important for a particular facility, hazard, occupant type, event, or management. [101:A.12.4.1.3]

Table A.10.14.3.3 Life Safety Evaluation Scenario Characteristics Matrix

<table>
<thead>
<tr>
<th>Scenario</th>
<th>Management</th>
<th>Occupants</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Local</td>
<td>Mass</td>
</tr>
<tr>
<td></td>
<td>Awareness</td>
<td>Awareness</td>
</tr>
<tr>
<td>1</td>
<td>X</td>
<td>—</td>
</tr>
<tr>
<td>2</td>
<td>—</td>
<td>X</td>
</tr>
<tr>
<td>3</td>
<td>—</td>
<td>X</td>
</tr>
<tr>
<td>4</td>
<td>—</td>
<td>X</td>
</tr>
</tbody>
</table>

[101: Table A.12.4.1.3]

A.11.3.3

Continued operation of solid-state elevator equipment is contingent on maintaining the ambient temperature in the range specified by the elevator manufacturer. If the machine room ventilation/air conditioning is connected to the general building system, and that system is shut down during a fire, the fire department might lose the use of elevators due to excessive heat in the elevator machine room. [101:A.9.4.5]

A.12.5

The requirements pertaining to interior finish are intended to restrict the spread of fire over the continuous surface forming the interior portions of a building.

The requirements are based on fire testing to NFPA 286 (with the criteria of 12.5.4.2), which apply to all interior finish materials. Many interior finish materials are permitted to be tested based on other fire tests, such as ASTM E84, Standard Test Method for Surface Burning Characteristics of Building Materials, ANSI/UL 723, Standard for Test for Surface Burning Characteristics of Building Materials, or NFPA 265 as provided in the relevant subsection of Section 10.2. [101:A.10.2]

A.12.5.2

The requirements pertaining to interior finish are intended to restrict the spread of fire over the continuous surface forming the interior portions of a building. The presence of multiple paint layers has the potential for paint delamination and bubbling or blistering of paint. Testing (NFPA Fire Technology, August 1974, “Fire Tests of Building Interior Covering Systems,” David Waksman and John Ferguson, Institute for Applied Technology, National Bureau of Standards)
has shown that adding up to two layers of paint with a dry film thickness of about 0.007 in. (0.18 mm) will not change the fire properties of surface-covering systems. Testing has shown that the fire properties of the surface-covering systems are highly substrate dependent and that thin coatings generally take on the characteristics of the substrate. When exposed to fire, the delamination on, bubbling, and blistering of paint can result in an accelerated rate of flame spread. [101:A.10.2.1]

A.12.5.3
Table A.12.5.3 provides a compilation of the interior finish requirements of 7.1.4 of NFPA 101 and the occupancy chapters (Chapters 12 through 42) of NFPA 101. [101:A.10.2.2]

Table A.12.5.3 Interior Finish Classification Limitations

<table>
<thead>
<tr>
<th>Occupancy</th>
<th>Exits</th>
<th>Exit Access Corridors</th>
<th>Other Spaces</th>
</tr>
</thead>
<tbody>
<tr>
<td>Assembly — new</td>
<td>A</td>
<td>A or B</td>
<td>A or B</td>
</tr>
<tr>
<td>&gt;300 occupant load</td>
<td>1 or II</td>
<td>I or II</td>
<td>NA</td>
</tr>
<tr>
<td>&lt;300 occupant load</td>
<td>A</td>
<td>A or B</td>
<td>A, B, or C</td>
</tr>
<tr>
<td>Assembly — existing</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>&gt;300 occupant load</td>
<td>A</td>
<td>A or B</td>
<td>A or B</td>
</tr>
<tr>
<td>&lt;300 occupant load</td>
<td>A</td>
<td>A or B</td>
<td>A, B, or C</td>
</tr>
<tr>
<td>Educational — new</td>
<td>A</td>
<td>A or B</td>
<td>A or B; C on low</td>
</tr>
<tr>
<td>Educational — existing</td>
<td>A</td>
<td>A or B</td>
<td>A, B, or C</td>
</tr>
<tr>
<td>Day-care centers — new</td>
<td>A</td>
<td>A</td>
<td>A or B</td>
</tr>
<tr>
<td>Day-care centers — existing</td>
<td>A or B</td>
<td>A or B</td>
<td>A or B</td>
</tr>
<tr>
<td>Day-care homes — new</td>
<td>A or B</td>
<td>A or B</td>
<td>A, B, or C</td>
</tr>
<tr>
<td>Day-care homes — existing</td>
<td>A or B</td>
<td>A, B, or C</td>
<td>A, B, or C</td>
</tr>
<tr>
<td>Health care — new</td>
<td>A</td>
<td>A</td>
<td>A</td>
</tr>
<tr>
<td>-</td>
<td>NA</td>
<td>B on lower portion of</td>
<td>B in small individual</td>
</tr>
<tr>
<td>Health care — existing</td>
<td>A</td>
<td>I or II</td>
<td>corridor wall</td>
</tr>
<tr>
<td>Detention and correctional — new</td>
<td>A or B</td>
<td>A or B</td>
<td>A or B</td>
</tr>
<tr>
<td>Detention and correctional — existing (sprinklers mandatory)</td>
<td>A or B</td>
<td>A or B</td>
<td>A, B, or C</td>
</tr>
<tr>
<td>One- and two-family dwellings and lodging or rooming houses</td>
<td>A, B, or C</td>
<td>A, B, or C</td>
<td>A, B, or C</td>
</tr>
<tr>
<td>Hotels and dormitories — new</td>
<td>A</td>
<td>A or B</td>
<td>A, B, or C</td>
</tr>
</tbody>
</table>

* |
<table>
<thead>
<tr>
<th>Occupancy</th>
<th>Exits</th>
<th>Exit Access Corridors</th>
<th>Other Spaces</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hotels and dormitories — existing</td>
<td>A or B</td>
<td>A or B</td>
<td>A, B, or C</td>
</tr>
<tr>
<td></td>
<td>I or II*</td>
<td>I or II*</td>
<td>NA</td>
</tr>
<tr>
<td>Apartment buildings — new</td>
<td>A</td>
<td>A or B</td>
<td>A, B, or C</td>
</tr>
<tr>
<td></td>
<td>I or II</td>
<td>I or II</td>
<td>NA</td>
</tr>
<tr>
<td>Apartment buildings — existing</td>
<td>A or B</td>
<td>A or B</td>
<td>A, B, or C</td>
</tr>
<tr>
<td></td>
<td>I or II*</td>
<td>I or II*</td>
<td>NA</td>
</tr>
<tr>
<td>Residential board and care — (See Chapters 32 and 33.)</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Mercantile — new</td>
<td>A or B</td>
<td>A or B</td>
<td>A or B</td>
</tr>
<tr>
<td></td>
<td>I or II</td>
<td>A</td>
<td>NA</td>
</tr>
<tr>
<td>Mercantile — existing</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Class A or class B stores</td>
<td>A or B</td>
<td>A or B</td>
<td>A, B, or C</td>
</tr>
<tr>
<td>Class C stores</td>
<td>A, B, or C</td>
<td>A, B, or C</td>
<td>A, B, or C</td>
</tr>
<tr>
<td>Business and ambulatory health care — new</td>
<td>A or B</td>
<td>A or B</td>
<td>A, B, or C</td>
</tr>
<tr>
<td>Business and ambulatory health care — existing</td>
<td>A or B</td>
<td>A or B</td>
<td>A, B, or C</td>
</tr>
<tr>
<td>Industrial</td>
<td>A or B</td>
<td>A, B, or C</td>
<td>A, B, or C</td>
</tr>
<tr>
<td>Storage</td>
<td>A or B</td>
<td>A, B, or C</td>
<td>A, B, or C</td>
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<tr>
<td></td>
<td>I or II</td>
<td>I or II</td>
<td>NA</td>
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*See corresponding chapters for details.
NA: Not applicable.

Notes:
(1) Class A interior wall and ceiling finish — flame spread index, 0–25 (new applications); smoke developed index, 0–450.
(2) Class B interior wall and ceiling finish — flame spread index, 26–75 (new applications); smoke developed index, 0–450.
(3) Class C interior wall and ceiling finish — flame spread index, 76–200 (new applications); smoke developed index, 0–450.
(4) Class I interior floor finish — critical radiant flux, not less than 0.45 W/cm².
(5) Class II interior floor finish — critical radiant flux, not more than 0.22 W/cm², but less than 0.45 W/cm².
(6) Automatic sprinklers — where a complete standard system of automatic sprinklers is installed, interior wall and ceiling finish with a flame spread rating not exceeding Class C is permitted to be used in any location where Class B is required, and Class B interior wall and ceiling finish is permitted to be used in any location where Class A is required; similarly, Class II interior floor finish is permitted to be used in any location where Class I is required, and no interior floor finish classification is required where Class II is required. These provisions do not apply to new detention and correctional occupancies.
(7) Exposed portions of structural members complying with the requirements for heavy timber construction are permitted.
This paragraph recognizes that traditional finish floors and floor coverings, such as wood flooring and resilient floor coverings, have not proved to present an unusual hazard.

ASTM E84, Standard Test Method of Surface Burning Characteristics of Building Materials, and UL 723, Standard for Test for Surface Burning Characteristics of Building Materials, are considered nationally recognized consensus standard test methods for determining the flame spread index and smoke developed index of building materials and are likely to yield equivalent test results. (See also A.12.5.4.1.)

It has been shown that the method of mounting interior finish materials usually affects actual performance. The use of standard mounting methods will be helpful in determining appropriate fire test results. Where materials are tested in intimate contact with a substrate to determine a classification, such materials should be installed in intimate contact with a similar substrate. Such details are especially important for “thermally thin” materials. For further information, see ASTM E84, Standard Test Method for Surface Burning Characteristics of Building Materials.

Some interior wall and ceiling finish materials, such as fabrics not applied to a solid backing, do not lend themselves to a test made in accordance with ASTM E84. In such cases, the large-scale test outlined in NFPA 701 is permitted to be used. In 1989 the NFPA Technical Committee on Fire Tests eliminated the so-called “small-scale test” from NFPA 701 because the results had been shown not to represent a fire performance that corresponded to what happened in real scale. Since then, NFPA 701 no longer contains a “small-scale test” but it now contains two tests (Test 1 and Test 2), which apply to materials as a function of their areal density. Thus NFPA 701 Test 1 applies to fabrics (other than vinyl-coated fabric blackout linings) having an areal density less than or equal to 21 oz/yd² (700 g/m²), while NFPA 701 Test 2 applies to fabrics with an areal density greater than 21 oz/yd² (700 g/m²), vinyl-coated fabric blackout linings, decorative objects, and films. Representations that materials or products have been tested to the small-scale test in NFPA 701 normally refer to the pre-1989 small-scale test, which no longer exists and which does not represent acceptable fire performance.

Prior to 1978, the test report described by ASTM E84 included an evaluation of the fuel contribution as well as the flame spread index and the smoke developed index. However, it is now recognized that the measurement on which the fuel contribution is based does not provide a valid measure. Therefore, although the data are recorded during the test, the information is no longer normally reported. Classification of interior wall and ceiling finish thus relies only on the flame spread index and smoke developed index.

The 450 smoke developed index limit is based solely on obscuration. (See A.10.2.4.4.)
A.12.5.5 Surface nonmetallic raceway products, as permitted by NFPA 70 are not interior finishes and are not subject to the provisions of Chapter 10. [101:A.10.2.4]

A.12.5.5.2 Paragraph 12.5.5.2 does not require Type IV (2HH), heavy timber, other than that used in interior exit stairs, interior exit ramps, and exit passageways be tested by either ASTM E84 or ANSI/UL 723 to determine a flame spread rating. Taller wood buildings and new technology, primarily new “mass timber,” make taller buildings of Type IV possible. To that end, the requirements for Type IV have been changed to require the testing for components in the egress system such that they too need to be tested and meet the appropriate classification required in this section. This means that Type IV is “presumed” to comply with the finish requirements in this section for the purpose of meeting the requirements of this section for any wall or ceiling finish of elements other than interior exit stairways, interior exit ramps, and exit passageways. [101:A.10.2.4.2]

A.12.5.5.3.3 See A.12.5.5.3.3.2. [101:A.10.2.4.3.3]

A.12.5.5.3.3.2 Both NFPA 286 and ANSI/UL 1715, Standard for Fire Test of Interior Finish Material, contain smoke obscuration criteria. ANSI/UL 1040, Standard for Fire Test of Insulated Wall Construction, and FM 4880, Approval Standard for Class I Insulated Wall or Wall and Roof/Ceiling Panels: Plastic Interior Finish Materials; Plastic Exterior Building Panels; Wall/Ceiling Coating Systems; Interior or Exterior Finish Systems, do not. Smoke obscuration is an important component of the fire performance of cellular or foamed plastic materials. [101:A.10.2.4.3.3.2]

A.12.5.5.4 Previous editions of the Code have regulated textile materials on walls and ceilings using ASTM E84, Standard Test Method for Surface Burning Characteristics of Building Materials, or ANSI/UL 723, Standard for Test for Surface Burning Characteristics of Building Materials. Full-scale room/corner fire test research has shown that flame spread indices produced by ASTM E84 or ANSI/UL 723 might not reliably predict all aspects of the fire behavior of textile wall and ceiling coverings. [101:A.10.2.4.4]

NFPA 265 and NFPA 286, both known as room/corner tests, were developed for assessing the fire and smoke obscuration performance of textile wall coverings and interior wall and ceiling finish materials, respectively. As long as an interior wall or ceiling finish material is tested by NFPA 265 or NFPA 286, as appropriate, using a mounting system, substrate, and adhesive (if appropriate) that are representative of actual use, the room/corner test provides an adequate evaluation of a product’s flammability and smoke obscuration behavior. Manufacturers, installers, and specifiers should be encouraged to use NFPA 265 or NFPA 286, as appropriate (but not both), because each of these standard fire tests has the ability to characterize actual
product behavior, as opposed to data generated by tests using ASTM E84 or ANSI/UL 723, which only allow comparisons of one product's performance with another. If a manufacturer or installer chooses to test a wall finish in accordance with NFPA 286, additional testing in accordance with ASTM E84 or ANSI/UL 723 is not necessary. [101:A.10.2.4.4]

The test results from ASTM E84 or ANSI/UL 723 are suitable for classification purposes but should not be used as input into fire models, because they are not generated in units suitable for engineering calculations. Actual test results for heat, smoke, and combustion product release from NFPA 265, and from NFPA 286, are suitable for use as input into fire models for performance-based design. [101:A.10.2.4.4]

A.12.5.5.4.1
The methodology specified in NFPA 265 includes provisions for measuring smoke obscuration. [101:A.10.2.4.4.1]

A.12.5.5.4.2
See A.12.5.5.4.1 and A.12.5.5.4. [101:A.10.2.4.4.2]

A.12.5.5.5
Expanded vinyl wall covering consists of a woven textile backing, an expanded vinyl base coat layer, and a nonexpanded vinyl skin coat. The expanded base coat layer is a homogeneous vinyl layer that contains a blowing agent. During processing, the blowing agent decomposes, which causes this layer to expand by forming closed cells. The total thickness of the wall covering is approximately 0.055 in. to 0.070 in. (1.4 mm to 1.8 mm). [101:A.10.2.4.5]

A.12.5.5.15
Light-transmitting plastics are used for a variety of purposes, including light diffusers, exterior wall panels, skylights, canopies, glazing, and the like. Previous editions of the Code have not addressed the use of light-transmitting plastics. Light-transmitting plastics will not normally be used in applications representative of interior finishes. Accordingly, ASTM E84, Standard Test Method for Surface Burning Characteristics of Building Materials, or ANSI/UL 723, Standard for Test for Surface Burning Characteristics of Building Materials, can produce test results that might or might not apply. [101:A.10.2.4.15]

Light-transmitting plastics are regulated by model building codes such as NFPA 5000. Model building codes provide adequate regulation for most applications of light-transmitting plastics. Where an authority having jurisdiction determines that a use is contemplated that differs from uses regulated by model building codes, light-transmitting plastics in such applications can be substantiated by fire tests that demonstrate the combustibility characteristics of the light-transmitting plastics for the use intended under actual fire conditions. [101:A.10.2.4.15]

For additional information on light transmitting plastics, see Section 48.7 of NFPA 5000. [101:A.10.2.4.15]

A.12.5.7
Fire-retardant coatings need to be applied to surfaces properly prepared for the material, and application needs to be consistent with the product listing. Deterioration of coatings applied to interior finishes can occur due to repeated cleaning of the surface or painting over applied coatings. [101:A.10.2.6]

A.12.5.7.1
It is the intent of the Code to mandate interior wall and ceiling finish materials that obtain their fire performance and smoke developed characteristics in their original form. However, in renovations, particularly those involving historic buildings, and in changes of occupancy, the required fire performance or smoke developed characteristics of existing surfaces of walls, partitions, columns, and ceilings might have to be secured by applying approved fire-retardant coatings to surfaces having higher flame spread ratings than permitted. Such treatments should comply with the requirements of NFPA 703. When fire-retardant coatings are used, they need to be applied to surfaces properly prepared for the material, and application needs to be consistent with the product listing. Deterioration of coatings applied to interior finishes can occur due to repeated cleaning of the surface or painting over applied coatings, but permanency must be assured in some appropriate fashion. Fire-retardant coatings must possess the desired degree of permanency and be maintained so as to retain the effectiveness of the treatment under the service conditions encountered in actual use. [101:A.10.2.6.1]

A.12.5.7.2
The intent of this section is that factory-applied fire-retardant-coated products, such as panels or tiles applied to walls or ceilings, replace the existing finish and are not applied on top of the existing finish. [101:A.10.2.6.2]

A.12.5.8
The flooring radiant panel provides a measure of a floor covering’s tendency to spread flames when located in a corridor and exposed to the flame and hot gases from a room fire. The flooring radiant panel test method is to be used as a basis for estimating the fire performance of a floor covering installed in the building corridor. Floor coverings in open building spaces and in rooms within buildings merit no further regulation, provided that it can be shown that the floor covering is at least as resistant to spread of flame as a material that meets the U.S. federal flammability standard 16 CFR 1630, “Standard for the Surface Flammability of Carpets and Rugs” (FF 1-70). All carpeting sold in the United States since 1971 is required to meet this standard and, therefore, is not likely to become involved in a fire until a room reaches or approaches flashover. Therefore, no further regulations are necessary for carpet, other than carpet in exitways and corridors. [101:A.10.2.7]

It has not been found necessary or practical to regulate interior floor finishes on the basis of smoke development. [101:A.10.2.7]

Full-scale fire tests and fire experience have shown that floor coverings in open building spaces merit no regulation beyond the U.S. federally mandated DOC FF 1-70 “pill test.” This is because floor coverings meeting the pill test will not spread flame significantly until a room fire approaches flashover. At flashover, the spread of flame across a floor covering will have minimal impact on the already existing hazard. The minimum critical radiant flux of a floor covering that will pass the FF 1-70 test has been determined to be approximately 0.04 W/cm².
Tu, King-Mon and Davis, Sanford, “Flame Spread of Carpet Systems Involved in Room Fires,” NFSIR 76-1013, Center for Fire Research, National Bureau of Standards, June 1976. The flooring radiant panel is only able to determine critical radiant flux values to 0.1 W/cm². This provision will prevent use of a noncomplying material, which can create a problem, especially when the Code is used outside the United States where U.S. federal regulation FF 1-70 (16 CFR 1630) is not mandated. [101]:A.10.2.7

A.12.5.8.1
Compliance with 16 CFR 1630, “Standard for the Surface Flammability of Carpets and Rugs” (FFI-70), is considered equivalent to compliance with ASTM D2859, Standard Test Method for Ignition Characteristic of Finished Textile Floor Covering Materials. [101]:A.10.2.7.1

A.12.5.8.2
The fire performance of some floor finishes has been tested, and traditional finish floors and floor coverings, such as wood flooring and resilient floor coverings, have not proved to present an unusual hazard. [101]:A.10.2.7.2

A.12.5.8.3
ASTM E648, Standard Test Method for Critical Radiant Flux of Floor Covering Systems Using a Radiant Heat Energy Source, and NFPA 253 are considered nationally recognized consensus standard test methods for determining the critical radiant flux from floor covering systems and are likely to yield equivalent test results. [101]:A.10.2.7.3

A.12.6.1
Testing per NFPA 701 applies to textiles and films used in a hanging configuration. If the textiles are to be applied to surfaces of buildings or backing materials as interior finishes for use in buildings, they should be treated as interior wall and ceiling finishes in accordance with Section 12.5.2 of this Code, and they should then be tested for flame spread index and smoke developed index values in accordance with ASTM E84, Standard Test Method for Surface Burning Characteristics of Building Materials, or ANSI/UL 723, Standard for Test for Surface Burning Characteristics of Building Materials, or for flame spread and flashover in accordance with NFPA 265. Films and other materials used as interior finish applied to surfaces of buildings should be tested for flame spread index and smoke developed index values in accordance with ASTM E84 or ANSI/UL 723 or for heat and smoke release and flashover in accordance with NFPA 286. [101]:A.10.3.1

The test results from NFPA 701 are suitable for classification purposes but should not be used as input into fire models, because they are not generated in units suitable for engineering calculations. [101]:A.10.3.1

A.12.6.2.1
The Class I requirement associated with testing in accordance with NFPA 260 and the char length of not more than 1 1/2 in. (38 mm) required with testing in accordance with NFPA 261 are indicators that the furniture item or mattress is resistant to a cigarette ignition. A fire that smolders for an excessive period of time without flaming can reduce the tenability within the
room or area of fire origin without developing the temperatures necessary to operate automatic sprinklers. [101:A.10.3.2.1]

The test results from NFPA 260 and from NFPA 261 are suitable for classification purposes but should not be used as input into fire models because they are not generated in units suitable for engineering calculations. [101:A.10.3.2.1]

Until recently, NFPA 260 was equivalent to ASTM E1353, Standard Test Methods for Cigarette Ignition Resistance of Components of Upholstered Furniture, and NFPA 261 was equivalent to ASTM E1352, Standard Test Method for Cigarette Ignition Resistance of Mock-Up Upholstered Furniture Assemblies. However, that changed when NFPA 260 and NFPA 261 adopted the new NIST standard reference material (SRM 1196) as the igniting cigarette and ASTM E1352 and ASTM E1353 did not, meaning that ASTM E1352 and ASTM E1353 use commercial cigarettes that are low-ignition propensity and have a low likelihood of properly assessing smoldering potential. [101:A.10.3.2.2]

A.12.6.2.2

The char length of not more than 2 in. (51 mm) required in 16 CFR 1632, “Standard for the Flammability of Mattresses and Mattress Pads” (FF 4-72), is an indicator that the mattress is resistant to a cigarette ignition. United States federal regulations require mattresses in this country to comply with 16 CFR 1632. [101:A.10.3.2.2]

A.12.6.3

The intent of the provisions of 12.6.3 is as follows:

1. The peak heat release rate of not more than 80 kW by a single upholstered furniture item was chosen based on maintaining a tenable environment within the room of fire origin, and the sprinkler exception was developed because the sprinkler system helps to maintain tenable conditions, even if the single upholstered furniture item were to have a peak rate of heat release in excess of 80 kW.

2. The total heat release of not more than 25 MJ by the single upholstered furniture item during the first 10 minutes of the test was established as an additional safeguard to protect against the adverse conditions that would be created by an upholstered furniture item that released its heat in other than the usual measured scenario, and the following should also be noted:
   1. During the test for measurement of rate of heat release, the instantaneous heat release value usually peaks quickly and then quickly falls off, so as to create a triangle-shaped curve.
   2. In the atypical case, if the heat release were to peak and remain steady at that elevated level, as opposed to quickly falling off, the 80 kW limit would not ensure safety.
   3. Only a sprinkler exception is permitted in lieu of the test because of the ability of the sprinkler system to control the fire.

Actual test results for heat, smoke, and combustion product release from ASTM E1537, Standard Test Method for Fire Testing of Upholstered Furniture, might be suitable for use as
input into fire models for performance-based design. Furthermore, California Technical Bulletin 133, “Flammability Test Procedure for Seating Furniture for Use in Public Occupancies,” includes pass/fail criteria for a single upholstered furniture item of 80 kW peak heat release rate and 25 MJ total heat release over the first 10 minutes of the test.

A.12.6.3.2
The intent of the provisions of 12.6.3.2 is as follows:

1. The peak heat release rate of not more than 100 kW by a single mattress was chosen based on maintaining a tenable environment within the room of fire origin, and the sprinkler exception was developed because the sprinkler system helps to maintain tenable conditions, even if the single mattress were to have a peak rate of heat release in excess of 100 kW.
2. The total heat release of not more than 25 MJ by the single mattress during the first 10 minutes of the test was established as an additional safeguard to protect against the adverse conditions that would be created by a mattress that released its heat in other than the usual measured scenario, and the following should also be noted:
   1. During the test for measurement of rate of heat release, the instantaneous heat release value usually peaks quickly and then quickly falls off, so as to create a triangle-shaped curve.
   2. In the atypical case, if the heat release were to peak and remain steady at that elevated level, as opposed to quickly falling off, the 100 kW limit would not ensure safety.
   3. Only a sprinkler exception is permitted in lieu of the test because of the ability of the sprinkler system to control the fire.


A.12.6.4
Christmas trees that are not effectively flame-retardant treated, ordinary crepe paper decorations, and pyroxylin plastic decorations might be classified as highly flammable.

A.12.6.6
Neither UL 1975, Standard for Fire Tests for Foamed Plastics Used for Decorative Purposes, nor NFPA 289 is intended for evaluating interior wall and ceiling finish materials. Actual test results for heat, smoke, and combustion product release from UL 1975 or from NFPA 289 might be suitable for use as input into fire models intended for performance-based design.
A.12.8.1
Although a smoke partition is intended to limit the free movement of smoke, it is not intended to provide an area that would be free of smoke. [101:A.8.4.1]

A.12.8.2(2)
The provision for terminating the smoke partition at the ceiling is not intended to prevent the wall from extending above the ceiling.

An architectural, exposed, suspended-grid acoustical tile ceiling with penetrations for sprinklers, ducted HVAC supply and return-air diffusers, speakers, and recessed light fixtures is capable of limiting the transfer of smoke. [101:A.8.4.2(2)]

A.12.8.3.4
Gasketing of doors should not be necessary, as the clearances in NFPA 80 effectively achieve resistance to the passage of smoke if the door is relatively tight-fitting. [101:A.8.4.3.4]

A.12.8.6.2
An air-transfer opening, as defined in NFPA 90A, is an opening designed to allow the movement of environmental air between two contiguous spaces. [101:A.8.4.6.2]

A.12.9.1
Wherever smoke barriers and doors therein require a degree of fire resistance, as specified by requirements in the various occupancy chapters (Chapter 12 through Chapter 42 of NFPA 101), the construction should be a fire barrier that has been specified to limit the spread of fire and restrict the movement of smoke. [101:A.8.5.1]
Although a smoke barrier is intended to restrict the movement of smoke, it might not result in tenability throughout the adjacent smoke compartment. The adjacent smoke compartment should be safer than the area on the fire side, thus allowing building occupants to move to that area. Eventually, evacuation from the adjacent smoke compartment might be required. [101:A.8.5.1]

A.12.9.2
To ensure that a smoke barrier is continuous, it is necessary to seal completely all openings where the smoke barrier abuts other smoke barriers, fire barriers, exterior walls, the floor below, and the floor or ceiling above. It is not the intent to prohibit a smoke barrier from stopping at a fire barrier if the fire barrier meets the requirements of a smoke barrier (that is, the fire barrier is a combination smoke barrier/fire barrier). [101:A.8.5.2]

A.12.9.4.1
For additional information on the installation of smoke-control door assemblies, see NFPA 105. [101:A.8.5.4.1]

A.12.9.4.4
Where, because of operational necessity, it is desired to have smoke barrier doors that are usually open, such doors should be provided with hold-open devices that are activated to close the doors by means of the operation of smoke detectors and other alarm functions. [101:A.8.5.4.4]
A.13.1.3
NFPA 4 requires that integrated fire protection and life safety systems be periodically retested as specified in the integrated system test plan. In addition, for existing systems, an integrated system test plan must be developed within 5 years of adoption of NFPA 4. [101:A.9.11.4]

A.13.2.2.4
Prior editions of the Code required stages to be protected by a Class III standpipe system in accordance with NFPA 14. NFPA 14 requires that Class II and Class III standpipes be automatic—not manual—because they are intended to be used by building occupants. Automatic standpipe systems are required to provide not less than 500 gpm (1890 L/min) at 100 psi (689 kN). This requirement often can be met only if a fire pump is installed. Installation of a fire pump presents an unreasonable burden for the system supplying the two hose outlets at the side of the stage. The revised wording of 13.2.2.4 offers some relief by permitting the hose outlets to be in accordance with NFPA 13. [101::A.12.4.5.12]

A.13.3.1.6
Properly designed automatic sprinkler systems provide the dual function of both automatic alarms and automatic extinguishment. Dual function is not provided in those cases where early detection of incipient fire and early notification of occupants are needed to initiate actions in behalf of life safety earlier than can be expected from heat-sensitive fire detectors. [101:A.9.7.1.4]

A.13.3.1.8.1
NFPA 72 provides details of standard practice in sprinkler supervision. Subject to the approval of the AHJ, sprinkler supervision is also permitted to be provided by direct connection to municipal fire departments or, in the case of very large establishments, to a private headquarters providing similar functions. NFPA 72 covers such matters. System components and parameters that are required to be monitored should include, but should not be limited to, control valves, water tank levels and temperatures, tank pressure, and air pressure on dry-pipe valves. [101:A.9.7.2.1] Where municipal fire alarm systems are involved, reference should also be made to NFPA 1221. [101:A.9.7.2.1]

A.13.3.2.7.3(1)
It is the intent to permit a single multipurpose room of less than 12,000 ft² (1115 m²) to have certain small rooms as part of the single room. These rooms could be a kitchen, office, equipment room, and the like. It is also the intent that an addition could be made to an existing building without requiring that the existing building be sprinklered, where both the new and existing buildings have independent means of egress and a fire-rated separation is provided to isolate one building from the other. [101:A.12.3.5.3(1)]
A school gymnasium with egress independent of, and separated from, the school would be included in this exception, as would a function hall attached to a church with a similar egress arrangement. [101:A.12.3.5.3(1)]
A.13.3.2.7.3(3)
Examples of low fire hazard uses include spectator sporting events, concerts, and performances on platforms.
The following uses are not low fire hazard uses: concerts and performances on stages; tradeshows; exhibition and display of combustible items; displays of vehicles, boats, or similar items; or events using open flames or pyrotechnic effects. [101:A.12.3.5.3(3)]

A.13.3.2.9.1
It is the intent to permit use of the criteria of 8.2.1.3(1) of NFPA 101 to create separate buildings for purposes of limiting educational occupancy building area to not more than 12,000 ft² (1120 m²). [101:A.14.3.5.1]

A.13.3.2.11.1
In areas where the replenishment of water supplies is not immediately available from on-site sources, alternate provisions for the water-fill rate requirements of NFPA 13 and NFPA 22 that are acceptable to the AHJ should be provided. Appropriate means for the replenishment of these supplies from other sources, such as fire department tankers, public safety organizations, or other independent contractors should be incorporated into the overall fire safety plan of the facility. [101:A.18.3.5.1]

With automatic sprinkler protection required throughout new health care facilities and quick-response sprinklers required in smoke compartments containing patient sleeping rooms, a fire and its life-threatening byproducts can be reduced, thereby allowing the defend-in-place concept to continue. The difficulty in maintaining the proper integrity of life safety elements has been considered and it has been judged that the probability of a sprinkler system operating as designed is equal to or greater than other life safety features. [101:A.18.3.5.1]

A.13.3.2.11.4
The requirements for use of quick-response sprinklers intend that quick-response sprinklers be the predominant type of sprinkler installed in the smoke compartment. It is recognized, however, that quick-response sprinklers might not be approved for installation in all areas such as those where NFPA 13 requires sprinklers of the intermediate- or high-temperature classification. It is not the intent of the 13.3.2.11.4 requirements to prohibit the use of standard sprinklers in limited areas of a smoke compartment where intermediate- or high-temperature sprinklers are required. [101:A.18.3.5.6]

Residential sprinklers are considered acceptable in patient sleeping rooms of all health care facilities, even though not specifically listed for this purpose in all cases. [101:A.18.3.5.6]
Where the installation of quick-response sprinklers is impracticable in patient sleeping room areas, appropriate equivalent protection features acceptable to the AHJ should be provided. It is recognized that the use of quick-response sprinklers might be limited in facilities housing certain types of patients or by the installation limitations of quick-response sprinklers. [101:A.18.3.5.6]

A.13.3.2.11.5
This exception is limited to hospitals, as nursing homes and many limited care facilities might have more combustibles within the closets. The limited amount of clothing found in the small clothes closets in hospital patient rooms is typically far less than the amount of combustibles in
casework cabinets that do not require sprinkler protection, such as nurse servers. In many hospitals, especially new hospitals, it is difficult to make a distinction between clothes closets and cabinet work. The exception is far more restrictive than similar exceptions for hotels and apartment buildings. NFPA 13 already permits the omission of sprinklers in wardrobes [see 8.1.1(7) of NFPA 13]. It is not the intent of 13.3.2.11.5 to affect the wardrobe provisions of NFPA 13. It is the intent that the sprinkler protection in the room covers the closet as if there were no door on the closet. (See 8.5.3.2.3 of NFPA 13.) [101:A.18.3.5.10]

A.13.3.2.11.6
For the proper operation of sprinkler systems, cubicle curtains and sprinkler locations need to be coordinated. Improperly designed systems might obstruct the sprinkler spray from reaching the fire or might shield the heat from the sprinkler. Many options are available to the designer including, but not limited to, hanging the cubicle curtains 18 in. (455 mm) below the sprinkler deflector; using a 1/2 in. (13 mm) diagonal mesh or a 70 percent open weave top panel that extends 18 in. (455 mm) below the sprinkler deflector; or designing the system to have a horizontal and minimum vertical distance that meets the requirements of NFPA 13. The test data that form the basis of the NFPA 13 requirements are from fire tests with sprinkler discharge that penetrated a single privacy curtain. [101:A.18.3.5.11]

A.13.3.2.12.6
It is not the intent to require existing standard sprinklers in existing sprinkler systems to be replaced with listed quick-response or listed residential sprinklers. It is the intent that new sprinkler systems installed in existing buildings comply with the requirements of Chapter 18 of NFPA 101, including 18.3.5.6. [101:A.19.3.5.4]

A.13.3.2.12.8
It is intended that any valve that controls automatic sprinklers in the building or portions of the building, including sectional and floor control valves, be electrically supervised. Valves that control isolated sprinkler heads, such as in laundry and trash chutes, are not required to be electrically supervised. Appropriate means should be provided to ensure that valves that are not electrically supervised remain open. [101:A.19.3.5.7]

A.13.3.2.12.9
The provisions of 13.3.2.12.9(6) and (7) are not intended to supplant NFPA 13, which requires that residential sprinklers with more than a 10°F (5.6°C) difference in temperature rating not be mixed within a room. Currently there are no additional prohibitions in NFPA 13 on the mixing of sprinklers having different thermal response characteristics. Conversely, there are no design parameters to make practical the mixing of residential and other types of sprinklers. [101:A.19.3.5.8]

Residential sprinklers are considered acceptable in patient sleeping rooms of all health care facilities, even through not specifically listed for this purpose in all cases. [101:A.19.3.5.8]

A.13.3.2.12.11
This exception is limited to hospitals, as nursing homes and many limited care facilities might have more combustibles within the closets. The limited amount of clothing found in the small clothes closets in hospital patient rooms is typically far less than the amount of combustibles in
casework cabinets that do not require sprinkler protection, such as nurse servers. In many hospitals, especially new hospitals, it is difficult to make a distinction between clothes closets and cabinet work. The exception is far more restrictive than similar exceptions for hotels and apartment buildings. NFPA 13 already permits the omission of sprinklers in wardrobes [see 8.1.1(7) of NFPA 13]. It is not the intent of 13.3.2.12.11 to affect the wardrobe provisions of NFPA 13. It is the intent that the sprinkler protection in the room covers the closet as if there were no door on the closet. (See 8.5.3.2.3 of NFPA 13.) \[101\]:A.19.3.5.10]

A.13.3.2.12.12
For the proper operation of sprinkler systems, cubicle curtains and sprinkler locations need to be coordinated. Improperly designed systems might obstruct the sprinkler spray from reaching the fire or might shield the heat from the sprinkler. Many options are available to the designer including, but not limited to, hanging the cubicle curtains 18 in. (455 mm) below the sprinkler deflector; using 1/2 in. (13 mm) diagonal mesh or a 70 percent open weave top panel that extends 18 in. (455 mm) below the sprinkler deflector; or designing the system to have a horizontal and minimum vertical distance that meets the requirements of NFPA 13. The test data that forms the basis of the NFPA 13 requirements is from fire tests with sprinkler discharge that penetrated a single privacy curtain. \[101\]:A.19.3.5.11]

A.13.3.2.14.1
Where the openings in ceilings or partitions are 1/4 in. (6.3 mm) or larger in the smallest dimension, where the thickness or depth of the material does not exceed the smallest dimension of the openings, and where such openings constitute not less than 70 percent of the area of the ceiling or partition material, the disruption of sprinkler spray patterns is permitted to be disregarded. \[101\]:A.23.3.5.2]

A.13.3.2.16.2
Although not required by NFPA \[101\], the use of residential sprinklers or quick-response sprinklers is encouraged for new installations of sprinkler systems within dwelling units, apartments, and guest rooms. Caution should be exercised, as the system needs to be designed for the sprinkler being used. \[101\]:A.29.3.5.3]

A.13.3.2.18.1
Although not required by NFPA \[101\], the use of residential sprinklers or quick-response sprinklers is encouraged for new installations of sprinkler systems within dwelling units, apartments, and guest rooms. Caution should be exercised, because the system needs to be designed for the sprinkler being used. \[101\]:A.31.3.5.2]

A.13.3.2.18.3
The provision of 13.3.2.18.3 differs from NFPA 13 because fire data shows that in apartment fires where sprinklers were present, bathrooms were the area of origin in 1 percent of the total fires, and resulted in no civilian deaths, civilian injuries, or property loss. \[101\]:A.31.3.5.4]

A.13.3.2.18.7
For example, if an Option 3 sprinkler system were being used to justify use of Class C wall finish in an exit enclosure, the sprinkler system would need to be extended into the exit
enclosure, even if the rest of the requirements for Option 3 did not require the sprinklers in the exit enclosure. [101:A.3.3.5.11]

A.13.3.2.19.2.3
The decision to permit the use of the criteria from NFPA 13D in these occupancies is based on the following:

1. The desire to obtain a level of fire suppression and control that is approximately equivalent to that delivered by residential facilities protected by such systems (see A.1.1 in NFPA 13D)
2. The fact that potential fire exposure and challenge to the suppression system in a small lodging and rooming occupancy is of the same nature and no more severe than that found in residences

[101:A.3.6.2.3]

A.13.3.2.21.2.1
Where any provision requires the use of an automatic sprinkler system in accordance with 13.3.2.21.2, the provision of 13.3.2.21.2.2 is not permitted to be used. [101:A.32.2.3.5.1]

A.13.3.2.21.2.2
Where a facility utilizing the provision of 13.3.2.21.2.2 contains residents who can no longer comply with the 3-minute evacuation response, 33.1.8 of NFPA 101 requires the facility to comply with the requirements for new construction, including automatic sprinkler protection. (See also A.33.1.8 of NFPA 101.) [101:A.32.2.3.5.2]

A.13.3.2.21.2.3.2
The decision to permit the use of the criteria from NFPA 13D in these occupancies is based on the following:

1. The desire to obtain a level of fire suppression and control approximately equivalent to that delivered by residential facilities protected by such systems (See A.1.1 in NFPA 13D.)
2. The fact that potential fire exposure and challenge to the suppression system in a small board and care facility are of the same nature and are no more severe than those found in residences

[101:A.32.2.3.5.3.2]

Chapter 13 permits the use of NFPA 13D and NFPA 13R outside of their scopes. This permission is based on a review of the occupancy and a recognition that the fires in board and care facilities are similar to those of other residential occupancies and that the level of protection is appropriate. The requirements of NFPA 13D and NFPA 13R have been supplemented with requirements for additional water supplies to compensate for the special needs of the board and care occupancy. [101:A.32.2.3.5.3.2]

NFPA 13D contains additional requirements for a piping system serving both sprinkler and domestic needs. [101:A.32.2.3.5.3.2]
A.13.3.2.22.1.1
It is intended that this requirement apply to existing small facilities that are converted to large facilities. [101:A.33.3.3.5.1]
Chapter 13 permits the use of NFPA 13D and NFPA 13R outside of their scopes. This permission is based on a review of the occupancy and a recognition that the fires in board and care facilities are similar to those of other residential occupancies and that the level of protection is appropriate. In some circumstances, such as those for impractical evacuation capabilities, the requirements of NFPA 13D and NFPA 13R have been supplemented with requirements for additional water supplies to compensate for the special needs of the board and care occupancy. [101:A.33.3.3.5.1]

A.13.3.2.22.2.1.1
The decision to permit the use of the criteria from NFPA 13D in these occupancies is based on the following:

1. The desire to obtain a level of fire suppression and control approximately equivalent to that delivered by residential facilities protected by such systems (See A.1.1 in NFPA 13D.)
2. The fact that potential fire exposure and challenge to the suppression system in a small board and care facility are of the same nature and are no more severe than those found in residences.

[101:A.32.2.3.5.3.1]

Chapter 13 permits the use of NFPA 13D and NFPA 13R outside of their scopes. This permission is based on a review of the occupancy and a recognition that the fires in board and care facilities are similar to those of other residential occupancies and that the level of protection is appropriate. In some circumstances, such as those for impractical evacuation capabilities, the requirements of NFPA 13D and NFPA 13R have been supplemented with requirements for additional water supplies to compensate for the special needs of the board and care occupancy. [101:A.33.3.3.5.1]

A.13.6.4.3.3.1
Persons performing maintenance operations usually come from two major groups:

1. Fire extinguisher service agencies
2. Trained industrial safety or maintenance personnel

[104110:A.7.3.3.1]

A.13.7.1.4.2
Records of conducted maintenance and testing and a copy of the certificate of compliance should be maintained. [101:A.9.6.1.4]

A.13.7.1.4.3
A fire watch should at least involve some special action beyond normal staffing, such as assigning an additional security guard(s) to walk the areas affected. Such individuals should be specially trained in fire prevention and in occupant and fire department notification techniques, and they should understand the particular fire safety situation for public education purposes. (Also see NFPA 601.) [101:A.9.6.1.6]

The term out of service in 13.7.1.4.3 is intended to imply that a significant portion of the fire alarm system is not in operation, such as an entire initiating device, signaling line, or notification appliance circuit. It is not the intent of the Code to require notification of the AHJ, or evacuation of the portion of the building affected, for a single nonoperating device or appliance. [101:A.9.6.1.5]

A.13.7.1.7.5
It is not the intent of 13.7.1.7.5 to require manual fire alarm boxes to be attached to movable partitions or to equipment, nor is it the intent to require the installation of permanent structures for mounting purposes only. [101:A.9.6.2.5]

A.13.7.1.7.6
The manual fire alarm box required by 13.7.1.7.6 is intended to provide a means to manually activate the fire alarm system when the automatic fire detection system or waterflow devices are out of service due to maintenance or testing, or where human discovery of the fire precedes automatic sprinkler system or automatic detection system activation. Where the fire alarm system is connected to a monitoring facility, the manual fire alarm box required by 13.7.1.7.6 should be connected to a separate circuit that is not placed “on test” when the detection or sprinkler system is placed on test. The manual fire alarm box should be located in an area that is accessible to occupants of the building and should not be locked. [101:A.9.6.2.6]

A.13.7.1.7.7
Manual fire alarm boxes can include those with key-operated locks for detention areas or psychiatric hospitals, manual fire alarm boxes in areas where explosive vapors or dusts might be a hazard, or manual fire alarm boxes in areas with corrosive atmospheres. The appearance of manual fire alarm boxes for special uses often differs from those used in areas of normal occupancy. Manual fire alarm boxes, such as those with locks, that are located in areas where the general public has limited access might need to have signage advising persons to seek assistance from staff in the event a fire is noted. [101:A.9.6.2.7]

A.13.7.1.8.3
NFPA 72 mandates smoke alarms in all sleeping rooms, and interconnection of smoke alarms is required for both new and existing installations. Per 13.7.1.8.1, the residential occupancy requirements determine whether smoke alarms are needed within sleeping rooms. Paragraph 13.7.1.8.3 limits the requirement for interconnection of smoke alarms to those in new construction. This Code does not intend to require compliant, existing smoke alarm installations
to be interconnected. This Code is periodically revised to add retrospective requirements only where the need is clearly substantiated. [101:A.9.6.2.10.3]

A.13.7.1.8.8
A dwelling unit is that structure, area, room, or combination of rooms, including hotel rooms/suites, in which a family or individual lives. A dwelling unit includes living areas only and not common usage areas in multifamily buildings, such as corridors, lobbies, and basements. [101:A.9.6.2.10.8]

A.13.7.1.9.2.1
Elevator lobbies have been considered areas subject to unwanted alarms due to factors such as low ceilings and smoking. In the past several years, new features have become available to reduce this problem. These features are, however, not necessarily included in any specific installation. [101:A.9.6.3.2.1]

A.13.7.1.9.2.2
The concept addressed is that detectors used for releasing service, such as door or damper closing and fan shutdown, are not required to sound the building alarm. [101:A.9.6.3.2.2]

A.13.7.1.9.2.3
The concept addressed is that detectors used for releasing service, such as door or damper closing and fan shutdown, are not required to sound the building alarm. [101:A.9.6.3.2.3]

A.13.7.1.9.5.7
Visual notification appliances installed in large volume spaces, such as arenas, stadiums, malls, mall concourses and atriums, can be alternative devices which are not listed as visible notification appliances for fire alarm systems provided that the notification objective of the visual signal is reasonably achieved. Examples of alternative devices include, but are not limited to, scoreboards, message boards, and other electronic devices that meet the performance objectives of visible fire alarm appliances in large volume spaces. [101:A.9.6.3.5.7]

It is the intent to permit the omission of visible notification appliances as identified in 13.7.1.9.5.7 provided that the adjacent areas that have not been specifically designated as exempt are provided with visible notification as required by 13.7.1.9.5. [101:A.9.6.3.5.7]

A.13.7.1.9.5.8
Documentation should be maintained with the as-built drawings so that inspection and testing personnel understand that the visible appliances have been exempted from certain areas and, therefore, can note the deviation on the acceptance test documentation and ongoing inspection reports. This will provide inspection and testing personnel with necessary details regarding the omission of visible notification appliances. [101:A.9.6.3.5.8]

A.13.7.1.9.6.2
To approve an evacuation plan to selectively notify building occupants, the AHJ should consider several building parameters, including building compartmentation, detection and suppression system zones, occupant loads, and the number and arrangement of the means of egress.
In high-rise buildings, it is typical to evacuate the fire floor, the floor(s) above, and the floor immediately below. Other areas are then evacuated as the fire develops. [101:A.9.6.3.6.2]

A.13.7.1.15
This section does not require mass notification systems, it only provides direction for the risk analysis. Where the risk analysis and resulting action plan identifies a need for a mass notification system, NFPA 72 should be used for design and installation requirements. [101:A.9.14]

A.13.7.1.15.3.2
These peer reviews should focus on the assumptions and methods of analysis used and on the findings. Peer reviewers should submit written assessment reports to the authority having jurisdiction. [101:A.9.14.3.2]

A.13.7.2.1.2.3
The intent is to require detectors only in nonsprinklered hazardous areas that are unoccupied. When the building is occupied, the detectors in the unoccupied, unsprinklered hazardous areas will initiate occupant notification. If the building is unoccupied, the fire in the nonsprinklered hazardous area is not a life safety issue, and the detectors, upon activation, are not required to notify anyone. The signal from a detector is permitted to be sent to a control panel in an area that is occupied when the building is occupied, but that is unoccupied when the building is unoccupied, without the need for central station monitoring or the equivalent. [101:A.12.3.4.2.3]

A.13.7.2.1.3.5
Examples of devices that might be used to provide alternative visible means include scoreboards, message boards, and other electronic devices. [101:A.12.3.4.3.5]

A.13.7.2.1.4.1(3)
The intent is to require CO detectors in occupiable spaces immediately adjacent, vertically or horizontally, to attached garages, regardless of the presence of openings between the garage and the adjacent occupiable spaces. Other occupiable spaces that are not adjacent to the attached garage do not require CO detectors. [101:A.A.12.3.4.4.1]

A.13.7.2.2.2.3
The intent is to require detectors only in nonsprinklered hazardous areas that are unoccupied. Where the building is occupied, the detectors in the unoccupied, unsprinklered hazardous areas will initiate occupant notification. If the building is unoccupied, the fire in the nonsprinklered hazardous area is not a life safety issue, and the detectors, upon activation, are not required to notify anyone. The signal from a detector is permitted to be sent to a control panel in an area that is occupied when the building is occupied, but that is unoccupied when the building is unoccupied, without the need for central station monitoring or the equivalent. [101:A.13.3.4.2.3]

A.13.7.2.3.2.3.1
Occupied portions of the building should have access to a central point for manual activation of the evacuation signal. [101:A.14.3.4.2.3.1]

A.13.7.2.3.2.3.1
Occupied portions of the building should have access to a central point for manual activation of the evacuation signal. [101:A.14.3.4.2.3.2]

A.13.7.2.4.2.3.1
Occupied portions of the building should have access to a central point for manual activation of the evacuation signal. [101:A.15.3.4.2.3.1]

A.13.7.2.4.2.3.1
The audible occupant notification signal for evacuation of an educational occupancy building should be the distinctive three-pulse temporal pattern fire alarm evacuation signal that is required of new systems by NFPA 72. The temporal pattern will help educate students to recognize the need to evacuate when they are in other occupancies. Existing fire alarm systems should be modified, as feasible, to sound the three-pulse temporal pattern. [101:A.15.3.4.3.1.1]

A.13.7.2.7.2
It is not the intent of this Code to require single-station smoke alarms that might be required by local codes to be connected to or to initiate the building fire alarm system. [101:A.18.3.4.2]

A.13.7.2.7.3.1(2)
It is the intent of this provision to permit a visible fire alarm signal instead of an audible signal to reduce interference between the fire alarm and medical equipment monitoring alarms. [101:A.18.3.4.3.1(2)]

A.13.7.2.7.5.3
The requirement for smoke detectors in spaces open to the corridors eliminates the requirements of 18.3.6.1 (1)(c), (2)(b), and (5)(b) of NFPA 101 for direct supervision by the facility staff of nursing homes. [101:A.18.3.4.5.3]

A.13.7.2.8.2
It is not the intent of this Code to require single-station smoke alarms, which might be required by local codes, to be connected to or to initiate the building fire alarm system. [101:A.19.3.4.2]

A.13.7.2.8.3.1(1)
It is the intent of this provision to permit a visible fire alarm signal instead of an audible signal to reduce interference between the fire alarm and medical equipment monitoring alarms. [101:A.19.3.4.3.1(1)]

A.13.7.2.11.3.1(2)
The staff at the constantly attended location should have the capability to promptly initiate the general alarm function and contact the fire department or have direct communication with a control room or other location that can initiate the general alarm function and contact the fire department. [101: A.22.3.4.3.1(2)]

A.13.7.2.11.4
Examples of contiguous common spaces are galleries and corridors. [101: A.22.3.4.4]

A.13.7.2.11.4.3
An open dormitory is a dormitory that is arranged to allow staff to observe the entire dormitory area at one time. [101: A.22.3.4.4.3]

A.13.7.2.12.3.1(2)
The staff at the constantly attended location should have the capability to promptly initiate the general alarm function and contact the fire department or have direct communication with a control room or other location that can initiate the general alarm function and contact the fire department. [101: A.23.3.4.3.1(2)]

A.13.7.2.12.4.3
An open dormitory is a dormitory that is arranged to allow staff to observe the entire dormitory area at one time. [101: A.23.3.4.4.3]

A.13.7.2.13.1.1
Paragraph 11.5.1.3 of NFPA 72 contains related requirements. They specify that, where the interior floor area for a given level of a dwelling unit, excluding garage areas, is greater than 1000 ft² (93 m²), smoke alarms are to be installed as follows:

1. All points on the ceiling are to have a smoke alarm within a distance of 30 ft (9.1 m), measured along a path of travel, or to have one smoke alarm per 500 ft² (46.5 m²) of floor area, which is calculated by dividing the total interior floor area per level by 500 ft² (46.5 m²).
2. Where dwelling units include great rooms or vaulted/cathedral ceilings extending over multiple floors, smoke alarms located on the upper floor that are intended to protect the aforementioned area are permitted to be considered as part of the lower floor(s) protection scheme used to meet the requirements of A.13.7.2.13.1.1(1).

[101: A.24.3.4.1.1]

A.13.7.2.13.1.1(2)
Paragraphs 11.5.1.1(2) and 11.5.1.2 of NFPA 72 contain related requirements. The requirement of 11.5.1.1(2) specifies that an alarm is to be installed outside of each separate dwelling unit sleeping area, within 21 ft (6.4 m) of any door to a sleeping room, with the distance measured along a path of travel. The requirement in 11.5.1.2 of NFPA 72 specifies that, where the area addressed in 11.5.1.1(2) of NFPA 72 is separated from the adjacent living areas by a door, a smoke alarm is to be installed in the area between the door and the sleeping rooms, and additional alarms are to be installed on the living area side of the door. [101: A.24.3.4.1.1(2)]
A.13.7.2.13.2.1
The placement requirements of NFPA 720 are modified specifically for one- and two-family dwellings as required by this Code and do not affect other regulations within a jurisdiction. [101:A.24.3.4.2.2]

A.13.7.2.14.3.1
The proprietor is the owner or owner’s agent with responsible charge. [101:A.26.3.4.3.1]

A.13.7.2.14.6.2
The placement requirements of NFPA 720 are modified to accommodate lodging or rooming house occupancies that are part of multiple occupancy buildings (e.g., an on-call physicians’ sleeping room in a hospital). The placement requirements of NFPA 720 are modified specifically for lodging or rooming houses as required by this Code and do not affect other regulations within a jurisdiction. [101:A.26.3.4.6.2]

A.13.7.2.15.3.1

A.13.7.2.15.3.3
A quantity of such rooms and suites might be required to be equipped to accommodate hearing-impaired individuals based on the total number of rooms in a transient lodging facility. (See 28 CFR 36, Appendix A, “Americans with Disabilities Act Accessibility Guidelines for Buildings and Facilities.”) [101:A.28.3.4.3.3]

A.13.7.2.15.5
Caution needs to be exercised in locating smoke alarms with regard to their proximity to bathrooms, cooking facilities, and HVAC outlets in order to prevent nuisance alarms. [101:A.28.3.4.5]

A.13.7.2.16.3.6
The provision for immediate notification of the public fire department is intended to include, but is not limited to, all of the arrangements in 13.7.1.10.2. Other arrangements that depend on a clerk or other member of the staff to notify the fire department might also be permitted. In such cases, however, it is essential that a trained staff member and an immediately available means of calling the fire department are continuously available. If a telephone is to be used, it should not be of any type or arrangement that requires a coin or the unlocking of a device to contact the fire department. [101:A.29.3.4.3.6]

A.13.7.2.16.5
Caution needs to be exercised in locating smoke alarms with regard to their proximity to bathrooms, cooking facilities, and HVAC outlets in order to prevent nuisance alarms. [101:A.29.3.4.5]
A.13.7.2.17.5
Previous editions of NFPA 101 permitted the single-station smoke alarm required by 13.7.2.17.5 to be omitted from each apartment where a complete automatic smoke detection system was installed throughout the building. With such a system, when one detector is activated, an alarm is sounded throughout the building. Experience with complete smoke detection systems in apartment buildings has shown that numerous nuisance alarms are likely to occur. Where there is a problem with frequent nuisance alarms, occupants ignore the alarm, or the system is either disconnected or otherwise rendered inoperative. [101:A.30.3.4.5]

A.13.7.2.17.6.4
Where fuel-burning appliances or fuel-burning fireplaces are located outside but attached to the dwelling unit, the area or room containing the fuel-burning appliance or fuel-burning fireplace could be considered part of the attached dwelling unit(s). In this application, either carbon monoxide alarms or carbon monoxide detectors are permitted to be installed in the attached dwelling unit(s) in accordance with 30.3.4.4. [101:A.30.3.4.6.4]

A.13.7.2.18.4.1
It is intended that a building compliant with Option 2[, as defined in Chapter 31 of NFPA 101,] function as described in the paragraph that follows. [101:A.31.3.4.4.1] Occupants within a living unit become aware of a fire emergency, either through personal awareness or through being alerted by the smoke alarm(s) installed within the living unit. Other building occupants are alerted to the fire emergency by the building fire alarm system that is initiated by manual fire alarm boxes adjacent to the exits, heat detection within the living unit where the fire emergency exists, smoke detection in the common areas outside the living unit, or a combination thereof. The installation of system heat detectors versus smoke detectors within the living unit is intended to eliminate nuisance-type alarms and reduce occupant complacency from frequent false alarms. The installation of smoke detection within the living unit should only be contemplated after a careful analysis of the goals and with the approval of the AHJ. [101:A.31.3.4.4.1]

A.13.7.2.18.5.1
NFPA 101 provides adequate, balanced fire protection and takes into consideration the passive and active systems required in a given occupancy. The level of protection prescribed by NFPA 72 which includes smoke alarms in all sleeping rooms, without exception, does not necessarily take into consideration the complete protection package mandated by NFPA 101. [101:A.31.3.4.5.1]

A.13.7.2.20.6
Positive alarm sequence applies only to emergency forces notification. Occupant notification is required to occur immediately upon activation of the detection device or system. [101:A.32.3.3.4.6]

A.13.7.2.21.3
Most often, smoke alarms sounding an alarm at 85 dBA or greater, installed outside the bedroom area, will meet the intent of this requirement. Smoke alarms remotely located from the bedroom
might not be loud enough to awaken the average person. In such cases, it is recommended that smoke alarms be interconnected so that the activation of any smoke alarm will cause all smoke alarms to activate. [101:A.33.2.3.4.3]

NFPA 101 provides adequate, balanced fire protection and takes into consideration the passive and active systems required in a given occupancy. The level of protection prescribed by NFPA 72 which includes smoke alarms in all sleeping rooms, without exception, does not necessarily take into consideration the complete protection package prescribed by NFPA 101. [101:A.33.2.3.4.3]

A.13.7.2.22.6.1
See A.13.7.2.16.3.6. [101:A.33.3.4.6.1]

A.13.7.2.25.5.2
It is not the intent of this section to require a new risk analysis where an existing risk analysis addresses the issues or arrangements associated with a new building. [101:A.38.3.4.5.2]

A.13.7.2.29..2.1
The need for voice communication can be based on a decision regarding staged or partial evacuation versus total evacuation of all floors. The determination of need is a function of occupancy classification and building height. [101:A.11.8.4.1]

A.14.3.1(1)
In existing buildings, existing walls in good repair and consisting of lath and plaster, gypsum wallboard, or masonry units can usually provide satisfactory protection for the purposes of this requirement where a 1-hour fire resistance rating is required. Further evaluation might be needed where a 2-hour fire resistance rating is required. Additional guidelines can be found in Annex O of NFPA 914. [101:A.7.1.3.2.1(1)]

A.14.3.1(3)
In existing buildings, existing walls in good repair and consisting of lath and plaster, gypsum wallboard, or masonry units can usually provide satisfactory protection for the purposes of this requirement where a 1-hour fire resistance rating is required. Further evaluation might be needed where a 2-hour fire resistance rating is required. Additional guidelines can be found in Annex O of NFPA 914 and in the SFPE Handbook of Fire Protection Engineering. [101:A.7.1.3.2.1(3)]

A.14.3.1(6)
It is not the intent to require the structural elements supporting outside stairs, or structural elements that penetrate within exterior walls or any other wall not required to have a fire resistance rating, to be protected by fire resistance–rated construction. [101:A.7.1.3.2.1(6)]

A.14.3.1(9)
Means of egress from the level of exit discharge is permitted to pass through an exit stair enclosure or exit passageway serving other floors. Doors for convenience purposes and unrelated to egress also are permitted to provide access to and from exit stair enclosures and exit passageways, provided that such doors are from corridors or normally occupied spaces. It is also
the intent of this provision to prohibit exit enclosure windows, other than approved vision panels in doors, that are not mounted in an exterior wall. [101:A.7.1.3.2.1(9)]

A.14.3.1(10)(b)  
The intent of this provision is to prevent the exit enclosure from being used as a vertical chase for building services. Penetrations for electrical wiring are permitted where the wiring serves equipment permitted by the AHJ to be located within the exit enclosure, such as security systems, public address systems, and fire department emergency communications devices. [101:A.7.1.3.2.1(10)(b)]

A.14.3.1(10)(d)  
The intent of this provision is to prevent the exit enclosure from being used as a vertical chase for building services. This provision will allow security cameras, public address systems, emergency communication systems, telephone repeaters and similar life safety devices in the exit enclosure, and wiring and similar pathways for such devices, to penetrate the fire barrier serving the exit enclosure. It is the intent of this provision to prevent the exit enclosure from being used as a vertical chase for building services. [101:A.7.1.3.2.1(10)(d)]

A.14.3.3  
This provision prohibits the use of exit enclosures for storage or for installation of equipment not necessary for safety. Occupancy is prohibited other than for egress, refuge, and access. The intent is that the exit enclosure essentially be “sterile” with respect to fire safety hazards. [101:A.7.1.3.2.3]

A.14.4.1  
A proper means of egress allows unobstructed travel at all times. Any type of barrier including, but not limited to, the accumulations of snow and ice in those climates subject to such accumulations is an impediment to free movement in the means of egress. Another example of an obstruction or impediment to full instant use of means of egress is any security device or system that emits any medium that could obscure a means of egress. It is, however, recognized that obstructions occur on a short-duration basis. In these instances, awareness training should be provided to ensure that blockages are kept to a minimum and procedures are established for the control and monitoring of the area affected. [101:A.7.1.10.1]

A.14.5.1.1  
Where doors are subject to two-way traffic, or where their opening can interfere with pedestrian traffic, an appropriately located vision panel can reduce the chance of accidents. [101:A.7.2.1.4.1]

Swinging doors in horizontal- or vertical-rolling partitions complying with the following should be permitted in a means of egress where the following criteria are met:

1. The door or doors comply with 14.5.1.
2. The partition in which the doors are mounted complies with the applicable fire protection rating and closes upon smoke detection or power failure at a speed not exceeding 9 in./s (230 mm/s) and not less than 6 in./s (150 mm/s).
3. The doors mounted in the partition are self-closing or automatic-closing in accordance with 14.5.4.1.

[101:A.7.2.1.4.1]

A.14.5.1.2
See 7.4.2.1.2 and 7.4.2.2.2 for door swing direction requirements for working space about electrical equipment.

A.14.5.1.3.1
The requirements of 14.5.1.3 are not intended to apply to the swing of cross-corridor doors, such as smoke barrier doors and horizontal exits. Neither are the requirements intended to apply to doors from rooms that are typically unoccupied such as janitor's closets, electrical closets or telecommunications closets. [101:A.7.2.1.4.3.1]

A.14.5.2.2
Some fire door assemblies are listed for use with fire pins or fusible links that render the door leaf release inoperative upon exposure to elevated temperature during a fire. The door leaf release mechanism is made inoperative where conditions in the vicinity of the door opening become untenable for human occupancy, and such door opening no longer provides a viable egress path. [101:A.7.2.1.5.2]

A.14.5.2.5.1
Where the entrance consists of an exterior vestibule, the locking arrangement should be permitted on the egress side of either the interior or exterior door of the vestibule. [101:A.7.2.1.5.5.1]

A.14.5.2.8
It is intended that the re-entry provisions apply only to enclosed exit stairs, not to outside stairs. This arrangement makes it possible to leave the stairway at such floor if the fire renders the lower part of the stair unusable during egress or if the occupants seek refuge on another floor. [101:A.7.2.1.5.8]

A.14.5.2.10
Examples of devices that might be arranged to release latches include knobs, levers, and bars. This requirement is permitted to be satisfied by the use of conventional types of hardware, whereby the door is released by turning a lever, knob, or handle or by pushing against a bar, but not by unfamiliar methods of operation such as a blow to break glass. It is also within the intent of this requirement that switches integral to traditional doorknobs, lever handles, or bars, and that interrupt the power supply to an electromagnetic lock, be permitted, provided that they are affixed to the door leaf. The operating devices should be capable of being operated with one hand and should not require tight grasping, tight pinching, or twisting of the wrist to operate. [101:A.7.2.1.5.10]

A.14.5.2.10.3
Examples of devices that, when used with a latch, can be arranged to require not more than one additional releasing operation include night latches, dead bolts, and security chains. [A.7.2.1.5.10.3]

A.14.5.2.12
Examples of devices prohibited by this requirement include locks, padlocks, hasps, bars, chains, or combinations thereof. [A.7.2.1.5.12]

A.14.5.3
None of the special locking arrangements addressed in 14.5.3 are intended to allow credentialed egress, request to exit, or similar provisions, where an occupant cannot leave the building without swiping a card through a reader. Where such an arrangement is desired to keep track of occupants, the swiping of cards needs to be procedural but not necessary for releasing the door lock or latch. Free egress needs to be available at all times. Another option to free egress is the use of a delayed-egress electrically locking system. [A.7.2.1.6]

A.14.5.3.1.1(3)
It is not the intent to require a direct physical or electrical connection between the door release device and the lock. It is the intent to allow door movement initiated by operating the door release device required in 14.5.2.10 as one option to initiate the irreversible process. [A.7.2.1.6.1.1(3)]

Several factors need to be considered in approving an increase in delay time from 15 seconds to 30 seconds. Some of those factors include occupancy, occupant density, ceiling height, fire hazards present, fire protection features provided, and the location of the delayed-egress locks. An example of a location where the increase on delay time might not be approved is at an exit stair discharge door. [A.7.2.1.6.1.1(3)]

A.14.5.3.1.1(4)
In the event that the AHJ has permitted increased operation time, the sign should reflect the appropriate time. [A.7.2.1.6.1.1(4)]

A.14.5.3.2
It is not the intent to require doors that restrict access but that comply with 14.5.2.10 to comply with the access-controlled egress door provisions of 14.5.3.2. The term access-controlled was chosen when the requirements of 14.5.3.2 were first added to the Code to describe the function in which a door is electronically locked from the inside in a manner that restricts egress. It is not the Code’s intent to prohibit methods of securing the door in a locked position from the outside with access control products, provided that the egress requirements of 14.5.3.2 are met. [A.7.2.1.6.2]

A.14.5.3.3(14)
It is not the intent to prohibit elevator lobby doors from being equipped with card access systems for gaining access, for example, to tenant spaces. It is the sensor-release of electrical locking systems access-controlled egress door system described in 14.5.3.2 that is prohibited from being installed on the same door as the lock addressed by 14.5.3.3. [A.7.2.1.6.3(14)]
A.14.5.3.4
See 7.4.2.1.2 and 7.4.2.2.2 for door unlatching requirements for working space about electrical equipment. [101]:A.7.2.1.7]

A.14.5.3.4.2
The presence of fire exit hardware on a door does not imply the door is required to be a fire protection-rated door. [101]:A.7.2.1.7.2]

A.14.5.4.1
Examples of doors designed to normally be kept closed include those to a stair enclosure or horizontal exit. [101]:A.7.2.1.8.1]

A.14.5.5
Special-purpose horizontally sliding accordion or folding door assemblies installed in accordance with 7.2.1.14 should not be considered powered doors subject to the provisions of 7.2.1.9.
Powered doors are divided into two categories — power assisted and power operated. Power-assisted doors that conform to ANSI/BHMA A156.19, Power Assist and Low Energy Power Operated Doors, use limited power to operate the door. They require fewer safeguards as compared to full power-operated doors. These door operators are for swinging doors only. Power-operated doors that conform to ANSI/BHMA A156.10, Power Operated Pedestrian Doors, require more power to operate the door and require additional safeguards to provide protection against personal injury. Power-operated doors can be swinging, sliding, or folding doors. [101]:A.7.2.1.9]

A.14.5.5.1
An example of the type of door addressed by 7.2.1.9.1 is one actuated by a motion-sensing device upon the approach of a person. [101]:A.7.2.1.9.1]

A.14.5.5.1.8
Although a single power-operated door leaf located within a two-leaf opening might alone not provide more than 30 in. (760 mm) of clear width in the emergency breakout mode, where both leaves are broken out to become side hinged, the required egress width is permitted to be provided by the width of the entire opening. [101]:A.7.2.1.9.1.8]

A.14.5.7.1.3
Security access turnstiles are designed to control security access into and out of buildings. Security access turnstiles might utilize physical barriers consisting of arms, wings, gates, or panels. The subject physical barriers come in various heights and function by retracting or opening in the direction of travel. [101]:A.7.2.1.11.1.3]

A.14.5.11.1
Door assemblies within the required means of egress (e.g., door assemblies that discharge from exit enclosures) require a higher level of care and maintenance throughout the life of their installations to ensure they perform as intended by the Code. Annual inspection and functional testing of these door assemblies is necessary to verify that they are maintained in proper working condition. Panic hardware and fire exit hardware devices are specifically required to be used in
assembly and educational occupancies. However, door leaves that are equipped with panic hardware or fire exit hardware, in areas not specifically required by the Code (e.g., stairwell entry doors and double-egress cross-corridor door assemblies not serving an assembly occupancy), should be subject to annual inspection and functional testing to ensure that the operating hardware functions correctly in accordance with 7.2.1.7, since the presence of panic hardware and fire exit hardware implies it is required by the Code. [101:A.7.2.1.15.1]

Additionally, door assemblies that are door hardware-release of electrically locked egress door assemblies in accordance with 7.2.1.5.5 and door assemblies that are equipped with special locking arrangements in accordance with 7.2.1.6 are outfitted with electrified hardware and access control devices that are susceptible to wear and abuse. Consequently, these door assemblies need to be inspected and tested on an annual basis, regardless of the occupant load being served. [101:A.7.2.1.15.1]

In cases where the authority having jurisdiction determines there is a distinct hazard to building occupant safety, the inspection requirements of 7.2.1.15 should be applied to other exit access, exit, and exit discharge door assemblies. [101:A.7.2.1.15.1]

A.14.5.11.2
See NFPA 80, Standard for Fire Doors and Other Opening Protectives, Annex J, for information pertaining to performance-based inspection, testing, and maintenance of door assemblies. [101:A.7.2.1.15.2]

A.14.5.11.7
Performing corrective action work on door assemblies frequently requires ordering replacement components that might take time to produce, ship, and install. Consideration of the time it takes to procure and install components should be included in the timeline for restoring the door assemblies to normal working condition. [101:A.7.2.1.15.7]

A.14.6.2
The purpose of this provision is to protect the exterior wall of a stairway from fires in other portions of the building. If the exterior wall of the stair is flush with the building exterior wall, the fire would need to travel around 180 degrees in order to impact the stair. This has not been a problem in existing buildings, so no protection is required. However, if the angle of exposure is less than 180 degrees, protection of either the stair wall or building wall is required. [101:A.7.2.2.5.2]

Figure A.14.6.2(a), Figure A.14.6.2(b), and Figure A.14.6.2(c) illustrate the requirement, assuming nonrated glass on the exterior wall of the stair is used. [101:A.7.2.2.5.2]

Figure A.14.6.2(a) Stairway with Nonrated Exterior Wall in Same Plane as Building Exterior Wall. [101:Figure A.7.2.2.5.2(a)]
Figure A.14.6.2(b) Stairway with Unprotected Exterior Perimeter Protruding Past Building Exterior Wall. [101:Figure A.7.2.2.5.2(b)]

Figure A.14.6.2(c) Stairway with Nonrated Exterior Wall Exposed by Adjacent Exterior Wall of Building. [101:Figure A.7.2.2.5.2(c)]
A.14.6.3
An example of a use with the potential to interfere with egress is storage. [101:A.7.2.5.3]

A.14.7
An exit passageway serves as a horizontal means of exit travel that is protected from fire in a manner similar to an enclosed interior exit stair. Where it is desired to offset exit stairs in a multistory building, an exit passageway can be used to preserve the continuity of the protected exit by connecting the bottom of one stair to the top of the stair that continues to the street floor. Probably the most important use of an exit passageway is to satisfy the requirement that at least 50 percent of the exit stairs discharge directly outside from multistory buildings (see 7.7.2 of NFPA 101). Thus, if it is impractical to locate the stair on an exterior wall, an exit passageway can be connected to the bottom of the stair to convey the occupants safely to an outside exit door. In buildings of extremely large area, such as shopping mall concourse and some factories, the exit passageway can be used to advantage where the travel distance to reach an exit would otherwise be excessive. [101:A.7.2.6]

A.14.7.1
Examples of building elements that might be arranged as exit passageways include hallways, corridors, passages, tunnels, underfloor passageways, or overhead passageways. [101:A.7.2.6.1]

A.14.7.4.1(1)
Where an exit passageway serves occupants on the level of exit discharge as well as other floors, it should not be required that the occupant loads be added, thus increasing the width of the exit passageway. The situation is the same as that in which occupants from the level of exit discharge join occupants from upper floors for a few feet of horizontal travel through a stair enclosure. [101:A.7.2.6.4.1(1)]

A.14.8.1.2
The normal occupant load is not necessarily a suitable criterion, because the greatest hazard can occur when an unusually large crowd is present, which is a condition often difficult for AHJs to
control by regulatory measures. The principle of this Code is to provide means of egress for the maximum probable number of occupants, rather than to attempt to limit occupants to a number commensurate with available means of egress. However, limits of occupancy are specified in certain special cases for other reasons. [101: A.7.3.1.2]

Suggested occupant load factors for components of large airport terminal buildings are given in Table A.14.8.1.2. However, the AHJ might elect to use different occupant load factors, provided that egress requirements are satisfied. [101: A.7.3.1.2]

<table>
<thead>
<tr>
<th>Airport Terminal Area</th>
<th>ft² (gross)</th>
<th>m² (gross)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Concourse</td>
<td>100</td>
<td>9.3</td>
</tr>
<tr>
<td>Waiting areas</td>
<td>15</td>
<td>1.4</td>
</tr>
<tr>
<td>Baggage claim</td>
<td>20</td>
<td>1.9</td>
</tr>
<tr>
<td>Baggage handling</td>
<td>300</td>
<td>27.9</td>
</tr>
</tbody>
</table>

[101: Table A.7.3.1.2 ]

The figure used in determining the occupancy load for mall shopping centers of varying sizes was arrived at empirically by surveying over 270 mall shopping centers, by studying mercantile occupancy parking requirements, and by observing the number of occupants per vehicle during peak seasons. [101: A.7.3.1.2]

These studies show that, with an increase in shopping center size, there is a decrease in the number of occupants per square foot of gross leasable area. [101: A.7.3.1.2]

This phenomenon is explained when one considers that, above a certain shopping center gross leasable area [approximately 600,000 ft² (56,000 m²)], there exists a multiplicity of the same types of stores. The purpose of duplicate types of stores is to increase the choices available to a customer for any given type of merchandise. Therefore, when shopping center size increases, the occupant load increases as well, but at a declining rate. In using Table A.14.8.1.2, the occupant load factor is applied only to the gross leasable area that uses the mall concourse as a means of egress. [101: A.7.3.1.2]

The value for concentrated business use is intended to address business use spaces with a higher density of occupants than would normally be expected in a general business occupancy. Where furnishings and floor layouts are arranged to maximize the number of occupants in the space, the value for concentrated business use should be applied. Examples of concentrated business use areas are call centers, trading floors, and data processing centers. [101: A.7.3.1.2]

A.14.8.3.2

The effective capacity of stairways has been shown by research to be proportional to the effective width of the stairway, which is the nominal width minus 12 in. (305 mm). This phenomenon, and the supporting research, were described in the chapter, “Movement of People,” in the first, second, and third editions of the SFPE Handbook of Fire Protection Engineering and was also addressed in Appendix D of the 1985 edition of NFPA 101, among several other publications. In 1988, this appendix was moved to form Chapter 2 of the 1988 edition of NFPA 101M, Alternative Approaches to Life Safety. (This document was later designated as NFPA 101A and this chapter remained in the document through the 1998 edition.) In essence, the effective width phenomenon recognizes that there is an edge or boundary effect at the sides of a circulation path. It has been best examined in relation to stairway width, where the edge effect
was estimated to be 6 in. (150 mm) on each side, but a similar phenomenon occurs with other paths, such as corridors and doors, although quantitative estimates of their edge effect are not as well established as they have been for stairways, at least those stairways studied in Canada during the late 1960s through the 1970s in office building evacuation drills and in crowd movement in a variety of buildings with assembly occupancy. [101:A.7.3.3.2]

More recent studies have not been performed to determine how the edge effect might be changing (or has changed) with demographic changes to larger, heavier occupants moving more slowly, and thus swaying laterally, to maintain balance when walking. The impact of such demographic changes, which are significant and influential for evacuation flow and speed of movement on stairs, for example, has the effect of increasing the time of evacuation in a way that affects all stair widths, but will be most pronounced for nominal widths less than 56 in. (1422 mm). [101:A.7.3.3.2]

Without taking into account occupant demographic changes in the last few decades that affect evacuation performance, especially on stairs, the formula for enhanced capacity of stairways wider than 44 in. (1120 mm) assumes that any portion of the nominal width greater than 44 in. (1120 mm) is as effective proportionally as the effective width of a nominal 44 in. (1120 mm) stair, that is, 32 in. (810 mm). Thus, the denominator (0.218) in the equation is simply the effective width of 32 in. (810 mm) divided by the capacity of 147 persons that is credited, by the 0.3 in. (7.6 mm) capacity factor in Table A.14.8.3.2, to the corresponding nominal width, 44 in. (1120 mm). [101:A.7.3.3.2]

The resulting permitted stairway capacities, based on occupant load of single stories (in accordance with 7.3.1.4 of NFPA 101), for several stairway widths are shown in Table A.14.8.3.2. [101:A.7.3.3.2]

Table A.14.8.3.2 Stairway Capacities

<table>
<thead>
<tr>
<th>Permitted Capacity (no. of persons)</th>
<th>Nominal Width Clear Width Between Handrails(^a)</th>
<th>Effective Width</th>
</tr>
</thead>
<tbody>
<tr>
<td>120(^b) 36 in. (915 mm) 28 in. (710 mm) 24 in. (610 mm)</td>
<td>147(^b) 44 in. (1120 mm) 36 in. (915 mm) 32 in. (810 mm)</td>
<td>202(^b) 56 in. (1420 mm) 48 in. (1220 mm) 44 in. (1120 mm)</td>
</tr>
<tr>
<td>257(^b) 68 in. (1725 mm) 60 in. (1525 mm)</td>
<td>257(^c) 68 in. (1725 mm) 60 in. (1525 mm)</td>
<td>257(^c) 68 in. (1725 mm) 60 in. (1525 mm)</td>
</tr>
</tbody>
</table>

\(^a\) A reasonable handrail incursion of only 4 in. (100 mm), into the nominal width, is assumed on each side of the stair, although 7.3.3.2 of NFPA 101 permits a maximum incursion of 4 1/2 in. (114 mm) on each side.

\(^b\) Other Code sections limit the occupant load for such stairs more severely, (e.g., 50 persons in 7.2.2.2.1.2 of NFPA 101). Such lower limits are partly justified by the relatively small effective width of such stairs, which, if taken into account by Table 7.3.3.1 of NFPA 101, would result in a correspondingly low effective capacity of only 110 persons (24 divided by 0.218), or a more realistic capacity factor of 0.327, applicable to nominal width.

\(^c\) A clear width of 60 in. (1525 mm) is the maximum permitted by the handrail reachability criteria of 7.2.2.4.1.2 of NFPA 101. Although some prior editions of the Code permitted wider portions of stairs [up to 88 in. (2240 mm), between handrails], such wider portions are less effective for reasonably safe crowd flow and generally should not be used for major crowd movement. To achieve the maximum possible, reasonably safe egress capacity for such stairs, retrofit of an intermediate — not necessarily central — handrail is recommended; for example, with an intermediate handrail located 36 in. (915 mm) from the closest side handrail. In this case,
the effective capacity would be 358 persons for the formerly permitted, now retrofitted, stair. This is based on a retrofitted, effective width of about 78 in. (1980 mm) [subtracting 2 in. (51 mm) from each usable side of a handrail and assuming a 2 in. (51 mm) wide, retrofitted intermediate handrail]. [101:A.7.3.3.2]

A.14.8.3.4.1.1
The criteria of 14.8.3.4.1.1, as initially written, were intended to provide for minimum widths for small spaces such as individual offices. The intent is that these reductions in required width apply to spaces formed by furniture and movable walls so that accommodations can easily be made for mobility-impaired individuals. One side of a path could be a fixed wall, provided that the other side is movable. This does not exempt the door widths or widths of fixed-wall corridors, regardless of the number of people or length. The allowance for reduction in width has been expanded to include all exit accesses serving not more than six people where the travel length along the reduced-width path does not exceed 50 ft (15 m), regardless of occupancy or use of the space. [101:A.7.3.4.1.1]

Figure A.14.8.3.4.1.1(a) and Figure A.14.8.3.4.1.1(b) present selected anthropometric data for adults. The male and female figures depicted in the figures are average, 50th percentile, in size. Some dimensions apply to very large, 97.5 percentile, adults (noted as 97.5 P). [101:A.7.3.4.1.1]

Figure A.14.8.3.4.1.1(a) Anthropometric Data (in in.) for Adults; Males and Females of Average, 50th Percentile, Size; Some Dimensions Apply to Very Large, 97.5 Percentile (97.5 P), Adults. [101:Figure A.7.3.4.1.1(a)]

Figure A.14.8.3.4.1.1(b) Anthropometric Data (in mm) for Adults; Males and Females of Average, 50th Percentile, Size; Some Dimensions Apply to Very Large, 97.5 Percentile (97.5 P), Adults. [101:Figure A.7.3.4.1.1(b)]

A.14.10.1.1.1
See A.14.10.1.5. [101:A.7.5.1.1.1.1]

A.14.10.1.3.2
Figure A.14.10.1.3.2(a) through Figure A.14.10.1.3.2(e) illustrate the method of measurement intended by 14.10.1.3.2. [101:A.7.5.1.3.2]

Figure A.14.10.1.3.2(a) Diagonal Rule for Exit Remoteness. [101:Figure A.7.5.1.3.2(a)]
A.14.10.1.3.4
Figure A.14.10.1.3.4 illustrates the method of measuring exit separation distance along the line of travel within a minimum 1-hour fire resistance–rated corridor. [101]:A.7.5.1.3.4
Figure A.14.10.1.3.4 Exit Separation Measured Along Corridor Path. [101]:A.7.5.1.3.4

A.14.10.1.4.2
It is difficult in actual practice to construct scissor stairs so that products of combustion that have entered one stairway do not penetrate into the other. Their use as separate required exits is discouraged. The term limited-combustible is intentionally not included in 14.10.1.4.2. The user’s attention is directed to the provisions for noncombustible and limited-combustible in 4.5.9 and 4.5.10, respectively. [101]:A.7.5.1.4.2
A.14.10.1.5
The terms dead end and common path of travel are commonly used interchangeably. Although the concepts of each are similar in practice, they are two different concepts. [101:A.7.5.1.5]
A common path of travel exists where a space is arranged so that occupants within that space are able to travel in only one direction to reach any of the exits or to reach the point at which the occupants have the choice of two paths of travel to remote exits. Part (a) of Figure A.14.10.1.5 is an example of a common path of travel. [101:A.7.5.1.5]
Figure A.14.10.1.5 Common Paths of Travel and Dead-End Corridors. [101:Figure A.7.5.1.5]
While a dead end is similar to a common path of travel, a dead end can exist where there is no path of travel from an occupied space but can also exist where an occupant enters a corridor thinking there is an exit at the end and, finding none, is forced to retrace his or her path to reach a choice of exits. Part (b) of Figure A.14.10.1.5 is an example of such a dead-end arrangement. [101:A.7.5.1.5]
Combining the two concepts, Part (c) of Figure A.14.10.1.5 is an example of a combined dead-end/common path of travel problem. [101:A.7.5.1.5]
Common paths of travel and dead-end travel are measured using the same principles used to measure travel distance as described in Section 7.6 of NFPA 101. Starting in the room shown in Part (d) of Figure A.14.10.1.5, measurement is made from the most remote point in the room, A, along the natural path of travel, and through the doorway along the centerline of the corridor to point C, located at the centerline of the corridor, which then provides the choice of two different paths to remote exits; this is common path of travel. The space between point B and point C is a dead end. (See 3.3.65 for the definition of common path of travel.) [101:A.7.5.1.5]

A.14.10.2.1
It is not the intent that an area with equipment such as a beverage brewpot, microwave oven, and a toaster be considered a kitchen. [101:A.7.5.2.1]

A.14.10.2.2
Doors that lead through wall paneling, and that harmonize in appearance with the rest of the wall to avoid detracting from some desired aesthetic or decorative effect, are not acceptable, because casual occupants might not be aware of such means of egress even though it is visible. [101:A.7.5.2.2]

A.14.10.4.1
An accessible means of egress should comply with the accessible route requirements of ICC/ANSI A117.1, Accessible and Usable Buildings and Facilities American National Standard for Accessible and Usable Buildings and Facilities. [101:A.7.5.4.1]

A.14.11.1
An exit from the upper stories in which the direction of egress travel is generally downward should not be arranged so that it is necessary to change to travel in an upward direction at any point before discharging to the outside. A similar prohibition of reversal of the vertical component of travel should be applied to exits from stories below the floor of exit discharge. However, an exception is permitted in the case of stairs used in connection with overhead or underfloor exit passageways that serve the street floor only. [101:A.7.7.1]
It is important that ample roadways be available from buildings in which there are large numbers of occupants so that exits will not be blocked by persons already outside. Two or more avenues of departure should be available for all but very small places. Location of a larger theater — for example, on a narrow dead-end street — might be prohibited by the AHJ under this rule, unless some alternate way of travel to another street is available. [101:A.7.7.1] Exterior walking surfaces within the exit discharge are not required to be paved and often are provided by grass or similar surfaces. Where discharging exits into yards, across lawns, or onto similar surfaces, in addition to providing the required width to allow all occupants safe access to a public way, such access also is required to meet the following:

1. Provisions of 7.1.7 of NFPA 101 with respect to changes in elevation
2. Provisions of 7.2.2 of NFPA 101 for stairs, as applicable
3. Provisions of 7.2.5 of NFPA 101 for ramps, as applicable
4. Provisions of 7.1.10 of NFPA 101 with respect to maintaining the means of egress free of obstructions that would prevent its use, such as snow and the need for its removal in some climates

[101:A.7.7.1]

A.14.11.3.3
Examples include partitions and gates. The design should not obstruct the normal movement of occupants to the exit discharge. Signs, graphics, or pictograms, including tactile types, might be permitted for existing exit enclosures where partitions or gates would obstruct the normal movement of occupants to the exit discharge. [101:A.7.7.3.4]

A.14.12.1.1
Illumination provided outside the building should be to either a public way or a distance away from the building that is considered safe, whichever is closest to the building being evacuated. [101:A.7.8.1.1]

A.14.12.1.2.2
Photoluminescent materials and battery-powered luminaires require some period of time to restore themselves to full operational capacity after being de-energized. [101:A.7.8.1.2.2] Photoluminescent products rely on nearby luminaires to maintain their full capacity. When those luminaires are de-energized, the photoluminescent product will gradually deplete its capacity. Listed photoluminescent exit signs and path markers are restored to full rated capacity within one hour and there is no known limit to the number of times they can be discharged and recharged, nor any known degradation of overall capacity or lifetime as a result of discharge/charge cycles. [101:A.7.8.1.2.2]

De-energizing the normal (utility) power source will automatically begin the battery discharge cycle of emergency luminaires, unit equipment, and exit signs provided with battery backup. Once drained, these batteries will typically require between 24 to 72 hours, depending on the battery technology and charging circuitry design, to regain full capacity. Frequent discharge/charge cycles can reduce overall battery lifetime and, depending on battery technology, might also prematurely reduce overall battery capacity. [101:A.7.8.1.2.2]
A.14.12.1.3
A consideration for the approval of automatic, motion sensor–type lighting switches, controls, timers, or controllers is whether the equipment is listed as a fail-safe device for use in the means of egress. [101]:A.7.8.1.2.3

A.14.12.1.3(4)
Some processes, such as manufacturing or handling of photosensitive materials, cannot be performed in areas provided with the minimum specified lighting levels. The use of spaces with lighting levels below 1 ft-candle (10.8 lux) might necessitate additional safety measures, such as written emergency plans, training of new employees in emergency evacuation procedures, and periodic fire drills. [101]:A.7.8.1.3(5)

A.14.12.1.4
Failure of a lighting unit is deemed to have occurred when the light output drops below 70 percent of its original level. [101]:A.7.8.1.4

A.14.13.1.1
Emergency lighting outside the building should provide illumination to either a public way or a distance away from the building that is considered safe, whichever is closest to the building being evacuated. [101]:A.7.9.1.1

A.14.14.1.2.1
Where a main entrance serves also as an exit, it will usually be sufficiently obvious to occupants so that no exit sign is needed. [101]:A.7.10.1.2.1

The character of the occupancy has a practical effect on the need for signs. In any assembly occupancy, hotel, department store, or other building subject to transient occupancy, the need for signs will be greater than in a building subject to permanent or semipermanent occupancy by the same people, such as an apartment house where the residents are presumed to be familiar with exit facilities by reason of regular use thereof. Even in a permanent residence-type building, however, there is need for signs to identify exit facilities such as outside stairs that are not subject to regular use during the normal occupancy of the building. [101]:A.7.10.1.2.1

The requirement for the locations of exit signs visible from any direction of exit access is illustrated in Figure A.14.14.1.2.1. [101]:A.7.10.1.2.1

Figure A.14.14.1.2.1 Location of Exit Signs. [101]:Figure A.7.10.1.2.1

A.14.14.1.2.2
The direction of travel to the exit discharge within a stair enclosure with horizontal components in excess of the typical landings might need additional signage to be readily visible or obvious. Exit signs should be installed above doors through which the egress path leads. Directional exit signs should be installed where the horizontal egress path changes directions. The stairway marking signs required by 10.12.3, provided within the stair enclosure at each floor landing, indicate the vertical direction to exit discharge. [101]:A.7.10.1.2.2

A.14.14.1.5.2
For externally illuminated signs in accordance with 14.14.6 and internally illuminated signs listed without a marked viewing distance, the rated viewing distance should be considered to be 100 ft (30 m). Where placing signs at their rated viewing distance requires them to be placed above the line of sight, consideration should be given to increasing the size of the exit legend to compensate for the additional straight-line distance between the viewer and the sign. [101:A.7.10.1.5.2]

A.14.14.1.6
See 14.14.3. [101:A.7.10.1.6]

A.14.14.1.7
See 3.3.145.2 of NFPA 101 for the definition of internally illuminated. [101:A.7.10.1.7]

A.14.14.1.8
In stores, for example, an otherwise adequate exit sign could be rendered inconspicuous by a high-intensity illuminated advertising sign located in the immediate vicinity. [101:A.7.10.1.8] Red is the traditional color for exit signs and is required by law in many places. However, at an early stage in the development of NFPA 101, a provision made green the color for exit signs, following the concept of traffic lights in which green indicates safety and red is the signal to stop. During the period when green signs were specified by NFPA 101, many such signs were installed, but the traditional red signs also remained. In 1949, the Fire Marshals Association of North America voted to request that red be restored as the required exit sign color, because it was found that the provision for green involved difficulties in law enactment that were out of proportion to the importance of safety. Accordingly, the 10th edition of NFPA 101 specified red where not otherwise required by law. The present text avoids any specific requirement for color on the assumption that either red or green could actually provide better visibility. [101:A.7.10.1.8]

A.14.14.3
Where graphics are used, the symbols provided in NFPA 170 should be used. Such signs need to provide equal visibility and illumination and are to comply with the other requirements of Section 14.14. [101:A.7.10.3]

A.14.14.3.2
Pictograms are permitted to be used in lieu of, or in addition to, signs with text. [101:A.7.10.3.2]

A.14.14.4
It is not the intent of this paragraph to require emergency lighting but only to have the sign illuminated by emergency lighting if emergency lighting is required and provided. [101:A.7.10.4]

It is not the intent to require that the entire stroke width and entire stroke height of all letters comprising the word EXIT be visible per the requirements of 14.14.6.3 under normal or emergency lighting operation, provided that the sign is visible and legible at a 100 ft (30 m) distance under all room illumination conditions. [101:A.7.10.4]
A.14.14.5.1
See A.14.12.1.3(4). [101:A.7.10.5.1]

A.14.14.5.2
It is the intent to prohibit a freely accessible light switch to control the illumination of either an internally or externally illuminated exit sign. [101:A.7.10.5.2]

A.14.14.5.2.2
The flashing repetition rate should be approximately one cycle per second, and the duration of the off-time should not exceed 1/4 second per cycle. During on-time, the illumination levels need to be provided in accordance with 14.14.6.3. Flashing signs, when activated with the fire alarm system, might be of assistance. [101:A.7.10.5.2.2]

A.14.14.6.1
Experience has shown that the word EXIT, or other appropriate wording, is plainly legible at 100 ft (30 m) if the letters are as large as specified in 14.14.6.1. [101:A.7.10.6.1]

A.14.14.6.2
Figure A.14.14.6.2 shows examples of acceptable locations of directional indicators with regard to left and right orientation. Directional indicators are permitted to be placed under the horizontal stroke of the letter T, provided that spacing of not less than 3/8 in. (9.5 mm) is maintained from the horizontal and vertical strokes of the letter T. [101:A.7.10.6.2]
Figure A.14.14.6.2 Directional Indicators. [101:Figure A.7.10.6.2]

A.14.14.6.3
Colors providing a good contrast are red or green letters on matte white background. Glossy background and glossy letter colors should be avoided. [101:A.7.10.6.3]
The average luminance of the letters and background is measured in footlamberts or candela per square meter. The contrast ratio is computed from these measurements by the following formula:

\[
\text{Contrast} = \frac{L_g - L_e}{L_g} \quad \text{[A.14.14.6.3]}
\]

Where \(L_g\) is the greater luminance and \(L_e\) is the lesser luminance, either the variable \(L_g\) or \(L_e\) is permitted to represent the letters, and the remaining variable will represent the background. The average luminance of the letters and background can be computed by measuring the luminance at the positions indicated in Figure A.14.14.6.3 by numbered spots. [101:A.7.10.6.3]
Figure A.14.14.6.3 Measurement of Exit Sign Luminance. [101:Figure A.7.10.6.3]
A.14.14.7.2
Photoluminescent signs need a specific minimum level of light on the face of the sign to ensure that the sign is charged for emergency operation and legibility in both the normal and emergency modes. Additionally, the type of light source (for example, incandescent, fluorescent, halogen, metal halide) is important. Each light source produces different types of visible and invisible light (for example, UV) that might affect the ability of some photoluminescent signs to charge and might also affect the amount of light output available during emergency mode. This type of sign would not be suitable where the illumination levels are permitted to decline. The charging light source should not be connected to automatic timers, because the continuous illumination of the sign is needed; otherwise, the sign illumination would not be available, because it would be discharged. [101:A.7.10.7.2]

A.14.14.8.1.1
Special signs require sufficient illumination in order for them to be readable at close proximity. They are not expected to be of a size or illumination level necessary to be readable from a distance, as is the case for an exit sign. [101:A.7.10.8.1.1]

A.14.14.8.3
The likelihood of occupants mistaking passageways or stairways that lead to dead-end spaces for exit doors and becoming trapped governs the need for exit signs. Thus, such areas should be marked with a sign that reads as follows:
NO EXIT
Supplementary identification indicating the character of the area, such as TO BASEMENT, STOREROOM, LINEN CLOSET, or the like, is permitted to be provided. [101:A.7.10.8.3]

A.16.1.3
See also NFPA 241. [101:A.4.6.10.2]

A.20.1.4
Where a special amusement building is installed inside another building, such as within an exhibit hall, the special amusement building requirements apply only to the special amusement building. For example, the smoke detectors required by 20.1.4.4 are not required to be connected
to the building's system. Where installed in an exhibit hall, such smoke detectors are also required to comply with the provisions applicable to an exhibit. [101:A.12.4.7; 101:A.13.4.7]

A.20.1.4.1
The aggregate horizontal projections of a multilevel play structure are indicative of the number of children who might be within the structure and at risk from a fire or similar emergency. The word “aggregate” is used in recognition of the fact that the platforms and tubes that make up the multilevel play structure run above each other at various levels. In calculating the area of the projections, it is important to account for all areas that might be expected to be occupied within, on top of, or beneath the components of the structure when the structure is used for its intended function. [101:A.12.4.7.1; 101:A.13.4.7.1]

A.20.1.4.2
See A.20.1.4.1. [101:A.12.4.7.2; 101:A.13.4.7.2]

A.20.1.4.7.3
Consideration should be given to the provision of directional exit marking on or adjacent to the floor. [101:A.12.4.7.7.3; 101:A.13.4.7.7.3]

A.20.1.5.3(3)(a)
Securely supported altar candles in churches that are well separated from any combustible material are permitted. On the other hand, lighted candles carried by children wearing cotton robes present a hazard too great to be permitted. There are many other situations of intermediate hazard where the AHJ will have to exercise judgment. [101:A.12.7.3(3)(a); 101:A.13.7.3(3)(a)]

A.20.1.5.4.1
Fabric applied over unused seating sections should meet the requirements of 20.1.5.4. [101:A.12.7.4.1; 101:A.13.7.4.1]

A.20.1.5.4.3
The phrase “unprotected materials containing foamed plastic” is meant to include foamed plastic items covered by “thermally thin” combustible fabrics or paint. (See A.12.5.4.4.) [101:A.12.7.4.3; 101:A.13.7.4.3]

A.20.1.5.4.7.1(3)
See A.10.14.3.1. [101:A.12.7.5.3.7.1(3); 101:A.13.7.5.3.7.1(3)]

A.20.1.5.6.2
Crowd managers and crowd manager supervisors need to clearly understand the required duties and responsibilities specific to the venue's emergency plan. The crowd management training program should include a clear appreciation of crowd dynamics factors including space, energy, time, and information, as well as specific crowd management techniques, such as metering. Training should involve specific actions necessary during normal and emergency operations, and include an assessment of people handling capabilities of a space prior to its use, the identification of hazards, an evaluation of projected levels of occupancy, the adequacy of means of ingress and egress and identification of ingress and egress barriers, the processing procedures such as ticket
collection, and the expected types of human behavior. Training should also involve the different
types of emergency evacuations and, where required by the emergency plan, relocation and
shelter-in-place operations, and the challenges associated with each. [101:A.12.7.6.2;
101:A.13.7.6.2]

A.20.1.5.6.4
In large facilities, crowd managers typically have a specific area of responsibility. In such
facilities, the requirements of 20.1.5.6.4 might apply only to the crowd managers’ area of
responsibility. [101:A.12.7.6.4; 101:A.13.7.6.4]

A.20.1.5.8
It is important that an adequate number of competent attendants are on duty at all times when the
assembly occupancy is occupied. [101:A.12.7.7; 101:A.13.7.7]

A.20.1.5.8.3
It is not the intent of this provision to require an announcement in bowling alleys, cocktail
lounges, restaurants, or places of worship. [101:A.12.7.7.3; 101:A.13.7.7.3]

A.20.2.4.2.1
The requirements are, of necessity, general in scope, as it is recognized that they apply to all
types of educational occupancies as well as conditions of occupancies, such as truant schools;
schools for the mentally handicapped, vision impaired, hearing impaired, and speech impaired;
and public schools. It is fully recognized that no one code can meet all the conditions of the
various buildings involved, and it will be necessary for site administrators to issue supplements
to these requirements, but all supplements should be consistent with these requirements.
[101:A.14.7.2.1; 101:A.15.7.2.1]

A.20.2.4.3.1
Particular attention should be given to keeping all doors unlocked; keeping doors that serve to
protect the safety of paths of egress closed and under no conditions blocked open, such as doors
on stairway enclosures; keeping outside stairs and fire escape stairs free from all obstructions and
clear of snow and ice; and allowing no accumulation of snow or ice or materials of any kind
outside exit doors that might prevent the opening of the door or interfere with rapid escape from
the building. [101:A.14.7.3.1; 101:A.15.7.3.1]
Any condition likely to interfere with safe egress should be corrected immediately, if possible, or
otherwise should be reported at once to the appropriate authorities. [101:A.14.7.3.1; 101:A.15.7.3.1]

A.20.3.1.3
The definition of day-care occupancy is intended to exclude day-care uses that are part of some
other occupancy. In such cases, the requirements of the predominant occupancy apply. Examples
of excluded facilities include the following:

1. Rooms located within places of worship used as nurseries or for supervision of children
   or religious education while services are being held in the building.
2. Rooms used for temporary child care during short-term recreational activities of the child's relative or guardian, such as within a health club or park district.

3. Rooms used for temporary child care during short-term activities such as court hearings, medical appointments, libraries, or other similar circumstances.

A.20.3.2.2
The purpose of this requirement is to prevent arrangements whereby a client can be trapped in a space or area. It is intended that this provision be broadly interpreted by the AHJ to include equipment such as refrigerators and freezers. [101:A.16.2.2.2.4; 101:A.17.2.2.2.4]

A.20.3.4.1.2
Day-care homes do not provide for the full-time maintenance of a client. Day-care occupancies that provide a primary place of residence are addressed in other day-care occupancy chapters. (See Chapters 24 through 33 of NFPA 101.) [101:A.17.6.1.1.2]

A.20.3.4.2.1
The requirements are, of necessity, general in scope, because it is recognized that they apply to all types of day-care occupancies as well as conditions of occupancies, such as truant day-care occupancies; occupancies for the mentally handicapped, vision impaired, hearing impaired, and speech impaired; adult day-care; care of infants; and day-care occupancies. It is fully recognized that no one code can meet all the conditions of the various buildings involved, and it will be necessary for site administrators, through the written fire emergency response plan, to issue supplements to these requirements; however, all supplements should be consistent with these requirements. Additionally, it is recommended that fire safety be a part of the educational programs of the occupancy for clients. [101:A.16.7.1; 101:A.17.7.1]

Fire emergency response plans need to be written and made available to all employees, including temporary or substitute staff, so that all employees know what is expected of them during a fire emergency. The elements needed in the written plan should be identified in coordination with the AHJ. [101:A.16.7.1; 101:A.17.7.1]

The facility fire emergency response plan might be a module of a facility disaster plan that covers other emergencies. [101:A.16.7.1; 101:A.17.7.1]

The proper safeguarding of clients during a fire emergency requires prompt and effective response by the facility employees in accordance with the fire emergency response plan. Duties covered under the plan should be assigned by position rather than by employee name. Such assignment ensures that, in the absence of an employee, the duties of the position will be performed by a substitute or temporary employee assigned to the position. Temporary or substitute employees should be instructed in advance regarding their duties under the plan for the position to which they are assigned. [101:A.16.7.1; 101:A.17.7.1]

Written fire emergency response plans should include, but should not be limited to, information for employees regarding methods and devices available for alerting occupants of a fire emergency. Employees should know how the fire department is to be alerted. Even where automatic systems are expected to alert the fire department, the written plan should provide for
backup alerting procedures by staff. Other responses of employees to a fire emergency should include the following:

1. Removal of clients in immediate danger to areas of safety, as set forth in the plan
2. Methods of using building features to confine the fire and its by-products to the room or area of origin
3. Control of actions and behaviors of clients during removal or evacuation activities and at predetermined safe assembly areas

The written plan should state clearly the facility policy regarding the actions staff are to take or not to extinguish a fire. It should also incorporate the emergency egress and relocation drill procedures set forth in 20.3.4.2.2. For additional guidance on emergency plans, see NFPA 1600. This standard establishes a common set of criteria for disaster management, emergency management, and business continuity programs.

A.20.3.4.2.2.1
The requirements are, of necessity, general in scope, because it is recognized that they apply to all types of day-care occupancies as well as conditions of occupancies, such as truant day-care occupancies; day-care occupancies for the mentally handicapped, vision impaired, hearing impaired, and speech impaired. It is fully recognized that no one code can meet all the conditions of the various buildings involved, and it will be necessary for site administrators to issue supplements to these requirements, but all supplements should be consistent with these requirements.

A.20.3.4.2.3.2
Particular attention should be given to keeping all doors unlocked; keeping doors that serve to protect the safety of paths of egress closed and under no conditions blocked open, such as doors on stairway enclosures; keeping outside stairs and fire escape stairs free from all obstructions and clear of snow and ice; and allowing no accumulation of snow or ice or materials of any kind outside exit doors that might prevent the opening of the door or interfere with rapid escape from the building.

A.20.4.2
Health care occupants have, in large part, varied degrees of physical disability, and their removal to the outside, or even their disturbance caused by moving, is inexpedient or impractical in many cases, except as a last resort. Similarly, recognizing that there might be an operating necessity for the restraint of the mentally ill, often by use of barred windows and locked doors, fire exit drills are usually extremely disturbing, detrimental, and frequently impracticable.
In most cases, fire exit drills, as ordinarily practiced in other occupancies, cannot be conducted in health care occupancies. Fundamentally, superior construction, early discovery and extinguishment of incipient fires, and prompt notification need to be relied on to reduce the occasion for evacuation of buildings of this class to a minimum. [101:A.18.7; 101:A.19.7]

A.20.4.2.1.5
Many health care occupancies conduct fire drills without disturbing patients by choosing the location of the simulated emergency in advance and by closing the doors to patients' rooms or wards in the vicinity prior to initiation of the drill. The purpose of a fire drill is to test and evaluate the efficiency, knowledge, and response of institutional personnel in implementing the facility fire emergency plan. Its purpose is not to disturb or excite patients. Fire drills should be scheduled on a random basis to ensure that personnel in health care facilities are drilled not less than once in each 3-month period. [101:A.18.7.1.4; 101:A.19.7.1.4] Drills should consider the ability to move patients to an adjacent smoke compartment. Relocation can be practiced using simulated patients or empty wheelchairs. [101:A.18.7.1.4; 101:A.19.7.1.4]

A.20.4.2.2.1
Each facility has specific characteristics that vary sufficiently from other facilities to prevent the specification of a universal emergency procedure. The recommendations that follow, however, contain many of the elements that should be considered and adapted, as appropriate, to the individual facility. [101:A.18.7.2.1; 101:A.19.7.2.1]

Upon discovery of fire, personnel should immediately take the following action:

1. If any person is involved in the fire, the discoverer should go to the aid of that person, calling aloud an established code phrase, which provides for both the immediate aid of any endangered person and the transmission of an alarm.
2. Any person in the area, upon hearing the code called aloud, should activate the building fire alarm using the nearest manual fire alarm box.
3. If a person is not involved in the fire, the discoverer should activate the building fire alarm using the nearest manual fire alarm box.
4. Personnel, upon hearing the alarm signal, should immediately execute their duties as outlined in the facility fire safety plan.
5. The telephone operator should determine the location of the fire as indicated by the audible signal.
6. In a building equipped with an uncoded alarm system, a person on the floor of fire origin should be responsible for promptly notifying the facility telephone operator of the fire location.
7. If the telephone operator receives a telephone alarm reporting a fire from a floor, the operator should regard that alarm in the same fashion as an alarm received over the fire alarm system and should immediately notify the fire department and alert all facility personnel of the place of fire and its origin.
8. If the building fire alarm system is out of order, any person discovering a fire should immediately notify the telephone operator by telephone, and the operator should then transmit this information to the fire department and alert the building occupants.
A.20.4.2.3.3
The purpose of this requirement is to provide a means for building designers, occupants, and operators to clearly designate approved egress corridors that can be identified even though physical or other obvious barriers might not be present to indicate their location. Floor plans used to satisfy this requirement might incorporate more than one function and more than one smoke compartment of the building, provided egress corridors are clearly identified where no fixed barriers are present. Such plans should be accessible to the AHJ but should not be required to be posted. [101:A.18.7.3.3; 101:A.19.7.3.3]

A.20.4.2.4
The most rigid discipline with regard to prohibition of smoking might not be nearly as effective in reducing incipient fires from surreptitious smoking as the open recognition of smoking, with provision of suitable facilities for smoking. Proper education and training of the staff and attendants in the ordinary fire hazards and their abatement is unquestionably essential. The problem is a broad one, varying with different types and arrangements of buildings; the effectiveness of rules of procedure, which need to be flexible, depends in large part on the management. [101:A.18.7.4; 101:A.19.7.4]

A.20.4.2.5.1
In addition to the provisions of 12.6.2, which deal with ignition resistance, additional requirements with respect to the location of cubicle curtains relative to sprinkler placement are included in NFPA 13. [101:A.18.7.5.1; 101:A.19.7.5.1]

A.20.4.2.5.6(2)
The user should verify that the products meet the referenced test methods of NFPA 701, and not the small-scale test procedure that was previously eliminated from NFPA 701. [101:A.18.7.5.6(2); 101:A.19.7.5.6(2)]

A.20.4.2.5.6(4)
The percentage of decorations should be measured against the area of any wall or ceiling, not the aggregate total of walls, ceilings, and doors. The door is considered part of the wall. The decorations must be located such that they do not interfere with the operation of any door, sprinkler, smoke detector, or any other life safety equipment. Other art might include hanging objects or three-dimensional items. [101:A.18.7.5.6(4); 101:A.19.7.5.6(4)]

A.20.5.2.4.1
Smoking regulations should include the following:

1. Smoking should be prohibited in any room, compartment, or area where flammable or combustible liquids, combustible gases, or oxygen is used or stored and in any other hazardous location, and the following also should apply:
   1. Such areas should be posted with signs that read NO SMOKING or the international symbol for no smoking.
2. In residential board and care facilities where smoking is totally prohibited and signs so indicating are placed at all major entrances, secondary signs with language that prohibits smoking are not required.

2. Smoking by residents classified as not responsible with regard to their ability to safely use and dispose of smoking materials should be prohibited.

3. Where a resident, as specified in A.20.5.2.4.1(2), is under direct supervision by staff or by a person approved by the administration, smoking might be permitted.

4. Smoking materials should not be provided to residents or maintained by residents without the approval of the administration.

5. Areas where smoking is permitted should be clearly identified.

6. Ashtrays of noncombustible material and safe design should be provided and required to be used in all areas where smoking is permitted.

7. Self-closing cover devices into which ashtrays can be emptied should be made available to all areas where smoking is permitted and should be required to be used.

[A.32.7.4.1; A.33.7.4.1]

A.20.5.2.5
The requirements applicable to draperies/curtains, upholstered furniture, and mattresses apply only to new draperies/curtains, new upholstered furniture, and new mattresses. The word *new* means unused, normally via procurement from the marketplace, either by purchase or donation, of items not previously used. Many board and care facilities allow residents to bring into the board and care home upholstered furniture items from the resident's previous residence. Such an item is not new and, thus, is not regulated. On the other hand, some of the larger board and care homes purchase contract furniture, as is done in hotels. Such new, unused furniture, whether purchased or received as a donation, is regulated by the requirements of 20.5.2.5.2. By federal law, mattresses manufactured and sold within the United States must pass testing per 16 CFR 1632 (FF4-72), Standard for the Flammability of Mattresses and Mattress Pads. [A.32.7.5; A.33.7.5]

A.20.5.2.5.2
New upholstered furniture within board and care homes should be tested for rates of heat release in accordance with 12.6.3.2.1. [A.32.7.5.2; A.33.7.5.2]

A.20.5.2.5.2.3
New mattresses within board and care homes should be tested for rates of heat release in accordance with 12.6.3.2.2. [A.32.7.5.3; A.33.7.5.3]

A.20.6.2
Ambulatory health care occupants have, in large part, varied degrees of physical disability, and their removal to the outside, or even their disturbance caused by moving, is inexpedient or impractical in many cases, except as a last resort. Similarly, recognizing that there might be an operating necessity for the restraint of the mentally ill, often by use of barred windows and locked doors, fire exit drills are usually extremely disturbing, detrimental, and frequently impracticable. [A.20.7; A.21.7]
In most cases, fire exit drills, as ordinarily practiced in other occupancies, cannot be conducted in ambulatory health care occupancies. Fundamentally, superior construction, early discovery and extinguishment of incipient fires, and prompt notification need to be relied on to reduce the occasion for evacuation of buildings of this class to a minimum. [101:A.20.7; 101:A.21.7]

A.20.6.2.1.5
Many ambulatory health care occupancies conduct fire drills without disturbing patients by choosing the location of the simulated emergency in advance and by closing the doors in the vicinity prior to the initiation of the drill. The purpose of a fire drill is to test and evaluate the efficiency, knowledge, and response of personnel in implementing the facility fire emergency plan. Its purpose is not to disturb or excite patients. Fire drills should be scheduled on a random basis to ensure that personnel in ambulatory health care facilities are drilled not less than once in each 3-month period. [101:A.20.7.1.4; 101:A.21.7.1.4]

Drills should consider the ability to move patients to an adjacent smoke compartment. Relocation can be practiced using simulated patients or empty wheelchairs. [101:A.20.7.1.4; 101:A.21.7.1.4]

A.20.6.2.2.1
Each facility has specific characteristics that vary sufficiently from other facilities to prevent the specification of a universal emergency procedure. The recommendations that follow, however, contain many of the elements that should be considered and adapted, as appropriate, to the individual facility. [101:A.20.7.2.1; 101:A.21.7.2.1]

Upon discovery of fire, personnel should immediately take the following action:

1. If any person is involved in the fire, the discoverer should go to the aid of that person, calling aloud an established code phrase, which provides for both the immediate aid of any endangered person and the transmission of an alarm.
2. Any person in the area, upon hearing the code called aloud, should activate the building fire alarm using the nearest manual fire alarm box.
3. If a person is not involved in the fire, the discoverer should activate the building fire alarm using the nearest manual fire alarm box.
4. Personnel, upon hearing the alarm signal, should immediately execute their duties as outlined in the facility fire safety plan.
5. The telephone operator should determine the location of the fire as indicated by the audible signal.
6. In a building equipped with an uncoded alarm system, a person on the floor of fire origin should be responsible for promptly notifying the facility telephone operator of the fire location.
7. If the telephone operator receives a telephone alarm reporting a fire from a floor, the operator should regard that alarm in the same fashion as an alarm received over the fire alarm system and should immediately notify the fire department and alert all facility personnel of the place of fire and its origin.
8. If the building fire alarm system is out of order, any person discovering a fire should immediately notify the telephone operator by telephone, and the operator should then transmit this information to the fire department and alert the building occupants.
The most rigid discipline with regard to prohibition of smoking might not be nearly as effective in reducing incipient fires from surreptitious smoking as the open recognition of smoking, with provision of suitable facilities for smoking. Proper education and training of the staff and attendants in the ordinary fire hazards and their abatement is unquestionably essential. The problem is a broad one, varying with different types and arrangements of buildings; the effectiveness of rules of procedure, which need to be flexible, depends in large part on the management.

In addition to the provisions of 12.6.2, which deal with ignition resistance, additional requirements with respect to the location of cubicle curtains relative to sprinkler placement are included in NFPA 13.

The percentage of decorations should be measured against the area of any wall or ceiling, not the aggregate total of walls, ceilings, and doors. The door is considered part of the wall. The decorations must be located such that they do not interfere with the operation of any door, sprinkler, smoke detector, or any other life safety equipment. Other art might include hanging objects or three-dimensional items.

It is the intent that this provision permits recycling of bottles, cans, paper and similar clean items that do not contain grease, oil, flammable liquids, or significant plastic materials using larger containers or several adjacent containers and not require locating such containers in a room protected as a hazardous area. Containers for medical records awaiting shredding are often larger than 32 gal (121 L). These containers are not to be included in the calculations and limitations of 20.6.2.5.1. There is no limit on the number of these containers, as FM Approval Standard 6921, Containers for Combustible Waste, ensures that the fire will not spread outside of the container. FM approval standards are written for use with FM Approvals. The tests can be conducted by any approved laboratory. The portions of the standard referring to FM Approvals are not included in this reference.

This requirement is permitted to be met by electronic or oral monitoring systems, visual monitoring, call signals, or other means.

Periodic, coordinated training should be conducted and should involve detention and correctional facility personnel and personnel of the fire department legally committed to serving the facility.
Personal property provides combustible contents for fire development. Therefore, adequate controls are needed to limit the quantity and combustibility of the fuels available to burn to reduce the probability of room flashover. The provisions of 20.7.2.4 will not, by themselves, prevent room flashover if personal property controls are not provided. [101]: A.22.7.2; 101: A.23.7.2

A.20.7.2.4 The type, quantity, and arrangement of furniture and other combustibles are important factors in determining how fast the fire will develop. Furnishings, including upholstered items and wood items, such as wardrobes, desks, and bookshelves, might provide sufficient fuel to result in room flashover, which is the full fire involvement of all combustibles within a room once sufficient heat has been built up within the room. [101]: A.22.7.4; 101: A.23.7.4

A.20.7.2.4.3 Mattresses used in detention and correctional facilities should be evaluated with regard to the fire hazards of the environment. The potential for vandalism and excessive wear and tear also should be taken into account when evaluating the fire performance of the mattress. ASTM F1870, Standard Guide for Selection of Fire Test Methods for the Assessment of Upholstered Furnishings in Detention and Correctional Facilities provides guidance for this purpose. [101]: A.23.7.4.3

A.20.8.2.1.1 Employers are obligated to determine the degree to which employees are to participate in emergency activities. Regulations of the U.S. Department of Labor (OSHA) govern these activities and provide options for employers, from total evacuation to aggressive structural fire fighting by employee brigades. (For additional information, see 29 CFR 1910, E and L, “OSHA Regulations for Emergency Procedures and Fire Brigades.”) [101]: A.28.7.1.1; 101: A.29.7.1.1

A.20.8.2.1.2 Emergencies should be assumed to have arisen at various locations in the occupancy in order to train employees in logical procedures. [101]: A.28.7.1.2; 101: A.29.7.1.2

A.20.8.2.4.1 Floor diagrams should reflect the actual floor arrangement and should be oriented with the actual direction to the exits. [101]: A.28.7.4.1; 101: A.29.7.4.1

A.20.8.2.4.2 Factors for developing the fire safety information include such items as construction type, suppression systems, alarm and detection systems, building layout, and building HVAC systems. [101]: A.28.7.4.2; 101: A.29.7.4.2

A.21.1.4 For further information on aircraft hangars, see NFPA 409. [101]: A.40.6

A.21.1.5 For further information on aircraft hangars, see NFPA 409. [101]: A.42.6
A.25.1.4.2
NFPA 58 permits the use of portable butane-fueled appliances in restaurants and in attended commercial food catering operations where fueled by a _not in excess maximum_ of two 10 oz (0.28 kg) LP-Gas capacity, nonrefillable butane containers having a water capacity not in excess of 1.08 lb (0.4 kg) per container. Containers are required to be directly connected to the appliance, and manifolding of containers is not permitted. Storage of cylinders is also limited to 24 containers, with an additional 24 permitted where protected by a 2-hour fire resistance–rated barrier. **(See 4.1.3 of NFPA 101 and Annex C of NFPA 101 for referenced documents on hazardous materials.)** [101:A.8.7.3.2]

A.25.5.3.3.1
The requirements of 25.5.3.3.1 can be considered as a Class 4, Type 60 system per NFPA 110. [101:A.11.9.3.3.1]
Second Revision No. 51-NFPA 1-2016 [ Global Comment ]


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Submitter Information Verification

Submitter Full Name: Kristin Bigda
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Committee Statement

Committee Statement: Extract update.
Response Message:
A.12.2.1 Building construction types are defined in NFPA 220, Standard on Types of Building Construction. The following material is extracted verbatim from NFPA 220 and is included here as a convenience for users of this Code. Any requests for Formal Interpretations (FIs) or Tentative Interim Amendments (TIAs) on the following material should be directed to the Technical Committee on Building Construction. See Table A.12.2.1 for fire resistance ratings for each building construction type.

Type I and Type II Construction. Type I (442 or 332) and Type II (222, 111, or 000) construction shall be those types in which the fire walls, structural elements, walls, arches, floors, and roofs are of approved noncombustible or limited-combustible materials. [220:4.3.1]

Type III Construction. Type III (211 or 200) construction shall be that type in which exterior walls and structural elements that are portions of exterior walls are of approved noncombustible or limited-combustible materials, and in which fire walls, interior structural elements, walls, arches, floors, and roofs, are entirely or partially of wood of smaller dimensions than required for Type IV construction or are of approved noncombustible, limited-combustible, or other approved combustible materials. [220:4.4.1]

Type IV Construction. Type IV (2HH) construction shall be that type in which fire walls, exterior walls, and interior bearing walls and structural elements that are portions of such walls are of approved noncombustible or limited-combustible materials, except as allowed for exterior walls in 4.5.6.7 of NFPA 220. Other interior structural elements, arches, floors, and roofs shall be of solid or laminated wood or cross-laminated timber without concealed spaces or with concealed spaces conforming to 4.5.6.7 of NFPA 220 and shall comply with the allowable dimensions of 4.5.5 of NFPA 220. [220:4.5.1]

Table A.12.2.1 Fire Resistance Ratings for Type I through Type V Construction (hr) [220: Table 4.1.1]
Second Revision No. 54-NFPA 1-2016 [ Global Comment ]


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Committee Statement

Committee Statement: Extract update.
Response Message:
3.3.155* Incident Commander (IC). The individual responsible for all incident activities, including the development of strategies and tactics and the ordering and the release of resources. [472, 2013]

A.3.3.155 Incident Commander (IC). This position is equivalent to the on-scene incident commander as defined in OSHA 1910.120(8), Hazardous Waste Operations and Emergency Response. The IC has overall authority and responsibility for conducting incident operations and is responsible for the management of all incident operations at the incident site. [472: A.3.3.3740]
Second Revision No. 55-NFPA 1-2016 [ Global Comment ]


Supplemental Information

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Committee Statement

Committee Statement: Extract update.
Response Message:
3.3.275 Wildland/Urban Interface. The presence of structures in locations in which the AHJ determines that topographical features, vegetation fuel types, local weather conditions, and prevailing winds result in the potential for ignition of the structures within the area from flames and firebrands of a wildland fire. An area where wildland fuels abut structures, with a clear line of demarcation between residential, business, and public structures and wildland fuels. [1144, 2013]

A.3.3.275 Wildland/Urban Interface. The term wildland/urban interface can distort the perception of the primary issue. It can direct attention to “where” structures are located (e.g., at the edge of communities near the wildland) rather than if they are highly ignitable. And if so, the focus on “where” can result in a concern about things that will not make a big difference in reducing structure loss (i.e., how fire fighters and equipment get there, what type of fire equipment is needed, and the location of fire hydrants and water sources). How wide the roads are and where the fire hydrants are located become of little value if there are more structures at risk than equipment to protect them, or if it is too dangerous to safely be there with fire-fighting forces. The essence of this issue is not where structures and domestic landscapes adjoin wildland, but the location, density, and availability of ignitable structures. Which structures are at the greatest risk, ignition-resistant homes bordering the wildland or a dense subdivision with wood shingle roofs several miles away from wildland fuels? The wildland/urban interface is not geographic location, but rather a set of conditions that can exist in many communities. [1144, A.3.3.26]

17.1.2* The structure assessment shall, as-at a minimum, include the following:
(1) Identification and documentation of the wildland fire hazards in the ignition zone(s) for each structure within wildland fire hazard areas, according to the elements and conditions in 17.1.4
(2) Determination of mitigation measures for vegetation, other combustibles, and the structure, including the periodic maintenance associated with such measures
(3) Establishment of priorities relative to mitigating the risks from wildland fire
(4) Evaluation of the site for conflagration hazards associated with the property to provide information for fire operations strategies should the site or surrounding properties become involved with fire.

[1144:4.1.2]

A.17.1.2 Figure A.17.1.2 and Table A.17.1.2 are examples of two different approaches to hazard assessment. [1144: A.4.1.2]
Figure A.17.1.2 is an example of an assessment guide with assessment information based on observation of the areas around the structure. This form, intended to be given to the resident, can be very useful by indicating the most serious hazards and the mitigation recommendation(s) that can be taken to reduce the ignition hazard. In this example, samples of the kind of information noted in an assessment are given as observations and suggestions for mitigation. [1144: A.4.1.2]

This example of an assessment guide is designed to help determine how vulnerable the structure will be during a wildland fire and to convey to the resident those items that should be corrected (mitigated) so that their home will have a better chance to survive a wildland fire. This form is offered as an example of the kind of tool that might be useful during a site visit as a guide for assessing the structure ignition zone. Remember, the following assessment items are for prevention/mitigation measures to be done well in advance of wildland fire season. [1144: A.4.1.2]

Figure A.17.1.2 is a form used to document observations, collect data, provide a hazard assessment, and give mitigation recommendations for the resident. From the mitigation recommendations, a mitigation plan and schedule is developed in accordance with 17.1.10. For more information on the use of this assessment form, refer to the course *Assessing Wildfire Hazards in the Home Ignition Zone*, available from the national Firewise Communities Program (www.firewise.org). [1144: A.4.1.2]

Table A.17.1.2 is a modified rating form based on the previous edition of NFPA 1144, *Standard for Reducing Structure Ignition Hazards from Wildland Fire*. Infrastructure elements of water supply, signage, and other fire suppression resources have been deleted, since the presence or absence of such resources does not modify the existing hazards of the structure. The table is presented only as an example of a rating system and should be modified to meet the environmental conditions of the area under consideration. For more information on creating an assessment system, consult *Wildland/Urban Interface Fire Hazards: A New Look at Understanding Assessment Methodologies Pamphlet*, produced by the national Firewise Communities Program (www.firewise.org). [1144: A.4.1.2]

A numeric rating form that will yield a hazard rating number can have a variety of uses, for example, determining relative hazards among several properties and mapping overall hazard ratings on a map. However, residents and homeowners often accept the rating number as finite and undertake mitigation measures that will merely reduce the rating rather than actually reduce the ignition potential of the structure. [1144: A.4.1.2]
17.1.4* Structure Assessment Elements and Conditions. As a minimum, the structure assessment shall cover elements and conditions indicated in 17.1.5 through 17.1.9. [1144:4.2]

A.17.1.4 It is critical to keep in mind that the ignition of the structure might occur from one or more of the following sources:
(1) Big flames (crown fire or intense surface fire). One objective of observation of the conditions and elements and subsequent mitigation recommendations is to keep crown fire and high intensity surface fire at a distance of 100–200 ft (30–60 m) or more from home and other potential hazards (flammables, combustibles, buildings, etc.).
(2) Small flames (surface fire). Another objective is to keep small flames at a distance of 30 ft (9 m) or more from home(s) and flammable combustible attachments (decks).
(3) Firebrands (embers). A final and essential objective is to eliminate beds of fine fuel and entry points for firebrands on and near home(s). [1144: A.4.2]

17.1.8* From Foundation to the Immediate Landscaped Area.
The structure assessment shall document the conditions of 17.1.8.1 through 17.1.8.5 to observe construction and vegetation, as they place the structure in the most risk from ignition by a wildland fire. [1144:4.2.4]

A.17.1.8 The structure ignition zone includes the spatially arranged traditional landscaping zones, but can exceed the extent of the property line. Figure A.17.1.8 illustrates the relationship of the structure and immediate landscaped area to the larger structure ignition zone. Within the immediate landscaped area [from the structure to approximately 30 ft (9 m)], often referred to as the defensible space, special consideration should be given that any combustible materials (e.g., plants, lawn furniture, litter, construction materials) should be removed or reduced to prevent their ignition, which in turn could ignite in the 0 ft to 5 ft (0 m to 1.5 m) zone immediately adjacent to the structure and reduced in the zone from 5 ft to 30 ft (1.5 m to 9 m) to minimize the chance for ignition of the structure. The total structure ignition zone includes any spatially arranged landscaping area and can
exceed the extent of the property line. The level of risk of ignition within the total area of the ignition zone depends on the type of construction and is further influenced by slope, soils, and other site-specific conditions. [1144: A.4.2.4]

The AHJ should require the development of a landscape plan for the property. Such plans should address four zones around the property as follows:

1. The most immediate landscaped area is the closest to the house and includes the area encircling the structure for at least 30 ft (9 m) on all sides. The landscaped vegetation within 30 ft (9 m) of structures should be irrigated as needed, cleared of dead vegetation, and/or planted with succulents and other plants (where appropriate) that are low in flammability combustibility potential. Plantings should be limited to carefully spaced, low-growing, low-flammability combustibility species, grasses, and lawns. Shrubs planted next to the structure should be of low flammability combustibility, no more than 18 in. (45 cm) in height, and not planted against the home. The planting bed should be noncombustible (e.g., stone, gravel, bare ground) or irrigated if combustible materials (e.g., bark mulch) are used. All highly combustible plants, such as junipers and ornamental conifers, should be removed or trimmed and maintained to be ignition-resistant. Vegetation deposits (dry leaf and pine litter) that can support surface fire and flames should be removed regularly. Areas of vegetation (natural areas, undeveloped areas, landscaped areas, fields, etc.) that exist near the structure should be evaluated for the possibility of causing ignition of the structure.

2. Progressing outward from the structure, the types and densities of vegetation should change to reduce the continuity of vegetation fuels. For example, plantings can be done in islands. Trees can be introduced into this zone with careful consideration of their flammability combustibility and continued maintenance to separate crowns and avoid ladder fuels. Tree placement should be planned so that the edge of the canopy of the tree when fully mature is no closer than 10 ft (3 m) to the edge of the structure.

3. Progressing even farther from the structure, more medium-sized plants and well-spaced trees can be planted in well-spaced groupings to reduce exposure to wildland fire and help maintain privacy. The volume of vegetation (i.e., fuel) should be kept as low as possible or practical.

4. The most distant area [100–200 ft to 200 ft (30–60 m to 60 m)] from the structure determines the extent of the structure ignition zone. Plants in this furthest area should be carefully pruned and thinned, and highly flammable combustible vegetation removed. Particular attention should be paid to the types and densities of the vegetation in this area. For example, some vegetation and trees generate more firebrands than others and require additional thinning, removal, or replacement.
17.1.8.1* The structure assessment shall document all vegetative fuels and other combustible materials adjacent to and within 30 ft (9 m) of the structure for their potential to contribute to the intensity and spread of wildland fire. [1144:4.2.4.1]

A.17.1.8.1 Vegetative fuels include live vegetation, mulch and landscaping materials, slash piles, composting piles, and firewood storage. [1144: A.4.2.4.1]

Flammable Combustible vegetation close enough to windows to provide intense radiant heat or flame contact should be pruned, moved, or substituted with smaller, lower flammability combustibility plants. Figure A.17.1.8.1(a) illustrates the use of low flammability combustibility plants separated by a gravel area next to the foundation. [1144: A.4.2.4.1]

17.1.8.3* The structure assessment shall document all projections attached to the primary structure. [1144:4.2.4.3]

A.17.1.8.3 Attachments include, but are not limited to, permanent and temporary construction such as decks, fences, awnings, lean-to buildings; and flammable combustible walkways, fencing, or decking attached to the home. [1144: A.4.2.4.3]

17.1.9.2* The structure assessment shall document the species and location of trees and the separation of tree crowns within the area between the outer edge of the immediate landscaped area and the extent of the structure ignition zone. [1144:4.2.5.2]

A.17.1.9.2 The location (placement) of trees and the separation between them is important to prevent ignition of the structure from radiant heat and to reduce the concentration of leaf fall and needle drop near the structure. Adequate separation and control of ignition potential are factors that affect fire intensity and are dependent on the size, density, and species of trees and vegetation. [1144:A.4.2.5.2]

Consider using islands of trees that offer separation of trees from the structure and other combustibles. Figure A.17.1.9.2(a) illustrates the use of such planting islands that preserve key trees for aesthetics while providing shade and exposure separation from structures. Figure A.17.1.9.2(b) shows that small planting islands within an expanse of maintained lawn provides both separation and low
flammability -combustibility protection from ignition close the structure. [1144: A.4.2.5.2]

17.1.10.7 The map shall include, but not be limited to, the following data elements:
(1) Lot designations
(2) Structure locations on each lot
(3) Locations of wildland fire evacuation centers or safety zones
(4) Hazard severity for each lot
(5) Overlapping ignition zones
(6) Location of fire hydrants, cisterns, or other water sources for fire fighting

[1144:4.3.7]

17.3.5.2.1.1* Ground fuels, including native vegetation and plants used for landscaping within the defined landscaping zones, shall be treated or removed. [1144:6.2.1]

A.17.3.5.2.1.1

17.3.5.2.1.9 Mobile and Manufactured Homes.
17.3.5.2.1.9.1 Permanently located mobile and manufactured homes with an open space beneath shall have a skirt of noncombustible material or material that has a minimum fire-resistant rating of 20 minutes, materials, exterior fire-retardant-treated wood, or other ignition-resistant material. [1144:5.10.1]

17.3.5.2.1.11.4 Propane tanks and other flammable or combustible liquids storage shall conform to NFPA 58, *Liquefied Petroleum Gas Code*, and the wildland fire hazard mitigation plan required in 17.1.10. [1144:5.12.4]
Second Revision No. 56-NFPA 1-2016 [ Global Comment ]


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Submittal Date: Wed Oct 12 12:24:26 EDT 2016

Committee Statement

Committee Statement: Extract update.
Response Message:
1.7.12.3 The construction documents for each phase shall be complete in themselves, so that review and inspection can properly be made. Preliminary plans of the total building shall be submitted with the construction documents, and with sufficient detail, so that proper evaluation can be made. Areas and items not included in the phase to be permitted shall be shown as not included. [5000:1.7.6.3.3.3]

3.3.3 Addition. An increase in building area, aggregate floor area, building height or number of stories of a structure. [5000, 20152018]

3.3.22 Basement. Any story of a building wholly or partly below grade plane that is not considered the first story above grade plane. [5000, 20152018]

3.3.29.6* High-Rise Building. A building where the floor of an occupiable story is greater than 75 ft (23 m) above the lowest level of fire department vehicle access. [5000, 20152018]

3.3.48 Cleanroom. A room in which the concentration of airborne particles is controlled to specified limits, including areas below the raised floor and above the ceiling grid if these areas are part of the air path and within the rated construction. [5000, 20152018]

3.3.86 Dispensing. The pouring or transferring of a material from a container tank, or similar vessel whereby vapors, dusts, fumes, mists, or gases could be liberated to the atmosphere. [5000, 20152018]

3.3.92 Dwelling Unit. One or more rooms arranged for complete, independent housekeeping purposes, with space for eating, living, and sleeping; facilities for cooking; and provisions for sanitation. [5000, 20152018]

3.3.107* Explosive Material. A chemical compound, mixture, or device, the primary or common purpose of which is to function by explosion. [5000, 20152018]

3.3.130* Floor Area.  
3.3.130.1* Gross Floor Area. The floor area within the inside perimeter of the outside walls of the building under consideration with no deduction for hallways, stairs, closets, thickness of interior walls, columns, elevator and building services shafts, or other features, but excluding floor openings associated with atriums and communicating spaces. [5000, 20152018]

3.3.130.2 Net Floor Area. The floor area within the inside perimeter of the outside walls, or the outside walls and fire walls of the building, or outside and/or inside walls that bound an occupancy or incidental use area requiring the occupant load to be calculated using net floor area under consideration with deductions for hallways, stairs, closets, thickness of interior walls, columns, or other features. [5000, 20152018]

3.3.142* Hazard of Contents.  
3.3.142.1 High Hazard. High hazard contents shall include materials defined as hazardous materials in 3.3.173.4, whether stored, used, or handled. [5000:6.3.2.4.1.1]

3.3.142.1.1 High Hazard Level 1 Contents. High hazard Level 1 contents shall include materials that present a detonation hazard including, but not limited to, the following: (1)
Explosives; (2) Unclassified detonable organic peroxides; (3) Class 4 oxidizers; (4) Detonable pyrophoric materials; (5) Class 3 detonable and Class 4 unstable (reactive) materials. [5000:6.3.2.4.2]

3.3.142.1.2 High Hazard Level 2 Contents. High hazard Level 2 contents shall include materials that present a deflagration hazard or a hazard from accelerated burning including, but not limited to, the following: (1) Class I, Class II, or Class III-A flammable or combustible liquids that are used or stored in normally open containers or systems, or in closed containers or systems at gauge pressures of more than 15 psi (103 kPa); (2) Combustible dusts stored, used, or generated in a manner creating a severe fire or explosion hazard; (3) Flammable gases and flammable cryogenic liquids; (4) Class I organic peroxides; (5) Class 3 solid or liquid oxidizers that are used or stored in normally open containers or systems, or in closed containers or systems at gauge pressures of more than 15 psi (103 kPa); (6) Nondetonable pyrophoric materials; (7) Class 3 nondetonable unstable (reactive) materials; (8) Class 3 water-reactive materials [5000:6.3.2.4.3]

3.3.142.1.3 High Hazard Level 3 Contents. High hazard Level 3 contents shall include materials that readily support combustion or present a physical hazard including, but not limited to, the following: (1) Level 2 and Level 3 aerosols; (2) Class I, Class II, or Class III-A flammable or combustible liquids that are used or stored in normally closed containers or systems at gauge pressures of less than 15 psi (103 kPa); (3) Flammable solids, other than dusts classified as high hazard Level 2, stored, used, or generated in a manner creating a high fire hazard; (4) Class II and Class III organic peroxides; (5) Class 2 solid or liquid oxidizers; (6) Class 3 solid or liquid oxidizers that are used or stored in normally closed containers or systems at gauge pressures of less than 15 psi (103 kPa); (7) Oxidizing gases and oxidizing cryogenic liquids; (8) Class 2 unstable (reactive) materials; (9) Class 2 water-reactive materials [5000:6.3.2.4.4]

3.3.142.1.4 High Hazard Level 4 Contents. High hazard Level 4 contents shall include materials that are acute health hazards including, but not limited to, the following: (1) Corrosives; (2) Highly toxic materials; (3) Toxic materials [5000:6.3.2.4.5]

3.3.142.1.5 High Hazard Level 5 Contents. High hazard Level 5 contents include hazardous production materials (HPM) used in the fabrication of semiconductors or semiconductor research and development. [5000:6.3.2.4.6]

3.3.142.2* Low Hazard Contents. Low hazard contents shall be classified as those of such low combustibility that no self-propagating fire therein can occur. [5000:6.3.2.2]

3.3.142.3* Ordinary Hazard Contents. Ordinary hazard contents shall be classified as those that are likely to burn with moderate rapidity or to give off a considerable volume of smoke. [5000:6.3.2.3]

3.3.162.1* Ceiling Limit. The maximum concentration of an airborne contaminant to which one can be exposed. [5000, 20152018]

3.3.163 Limited-Combustible (Material). See 4.5.10. [5000, 20152018]

3.3.164 Liquid. A material that has a melting point that is equal to or less than 68°F (20°C) and a boiling point that is greater than 68°F (20°C) and 14.7 psia (101.3 kPa). When not otherwise identified, the term liquid shall mean both flammable and combustible liquids. [5000, 20152018]
3.3.173.5 Hazardous Production Material (HPM). A solid, liquid, or gas associated with semiconductor manufacturing that has a degree-of-hazard rating of 3 or 4 in health, flammability, instability, or water reactivity in accordance with NFPA 704 and that is used directly in research, laboratory, or production processes that have as their end product materials that are not hazardous. [5000, 20152018]

3.3.173.10 Limited-Combustible Material. See 4.5.10. [5000, 20152018]

3.3.173.11 Noncombustible Material. See 4.5.9. [5000, 20152018]

3.3.213 Quality Assurance. The procedures conducted by the registered design professionals (RDPs) responsible for design and the registered design professionals responsible for inspection that provide evidence and documentation to the RDPs, the owner, and the AHJ that the work is being constructed in accordance with the approved construction documents. [5000, 20152018]

3.3.214 Quality Assurance Program. A predefined set of observations, special inspections, tests, and other procedures that provide an independent record to the owner, AHJ, and RDP responsible for design that the construction is in general conformance with the approved construction documents. [5000, 20152018]

3.3.219 Registered Design Professional (RDP). An individual who is registered or licensed to practice his/her respective design profession as defined by the statutory requirements of the professional registration laws of the state or jurisdiction in which the project is to be constructed. [5000, 20152018]

3.3.231* Smoke Barrier. A continuous membrane, or a membrane with discontinuities created by protected openings, where such membrane is designed and constructed to restrict the movement of smoke. [5000, 20152018]

3.3.237 Solid Material. A material that has a melting point, decomposes, or sublimes at a temperature greater than 68°F (20°C). [5000, 20152018]

3.3.248 Story. The portion of a building located between the upper surface of a floor and the upper surface of the floor or roof next above. [5000, 20152018]

3.3.251 Structural Element. The columns and girders, beams, trusses, joists, braced frames, moment-resistant frames, and vertical and lateral resisting elements, and other framing members that are designed to carry any portion of the dead or live load and lateral forces, that are essential to the stability of the building or structure. [5000, 20152018]

3.4.2.1 Sensitivity Analysis. An analysis performed to determine the degree to which a predicted output will vary given a specified change in an input parameter, usually in relation to models. [5000, 20152018]

3.4.5* Design Specification. A building characteristic and other conditions that are under the control of the design team. [5000, 20152018]

3.4.10* Fuel Load. The total quantity of combustible contents of a building, space, or fire area. [5000, 20152018]
4.5.9 Noncombustible Material.

4.5.9.1 A material that complies with any one of the following shall be considered a noncombustible material:

1. *The material, in the form in which it is used and under the conditions anticipated, will not ignite, burn, support combustion, or release flammable vapors when subjected to fire or heat.
2. The material is reported as passing ASTM E136, Standard Test Method for Behavior of Materials in a Vertical Tube Furnace at 750 Degrees C.
3. The material is reported as complying with the pass/fail criteria of ASTM E136 when tested in accordance with the test method and procedure in ASTM E2652, Standard Test Method for Behavior of Materials in a Tube Furnace with a Cone-shaped Airflow Stabilizer, at 750 Degrees C. [5000:7.1.4.1.1]

4.5.9.2 Where the term limited-combustible is used in this Code, it shall also include the term noncombustible. [5000:7.1.4.1.2]

4.5.10 Limited-Combustible Material.

A material shall be considered a limited-combustible material where both of the following conditions of 4.5.10.1, and 4.5.10.2, and the conditions of either 4.5.10.3 or 4.5.10.4, are met. [5000:7.1.4.2]

4.5.10.1 The material does not comply with the requirements for a noncombustible material in accordance with 4.5.9. [5000:7.1.4.2(1)]

4.5.10.2 The material, in the form in which it is used, exhibits a potential heat value not exceeding 3500 Btu/lb (8141 kJ/kg) where tested in accordance with NFPA 259, Standard Test Method for Potential Heat of Building Materials. [5000:7.1.4.2(2)]

4.5.10.3 The material has a structural base of a noncombustible material with a surfacing not exceeding a thickness of 1/8 in. (3.2 mm) where the surfacing exhibits a flame spread index not greater than 50 when tested in accordance with ASTM E84, Standard Test Method for Surface Burning Characteristics of Building Materials, or ANSI/UL 723, Standard for Test for Surface Burning Characteristics of Building Materials. [5000:7.1.4.2.1]

4.5.10.4 The material is composed of materials which, in the form and thickness used, neither exhibit a flame spread index greater than 25 nor evidence of continued progressive combustion when tested in accordance with ASTM E84 or ANSI/UL 723, and are of such composition that all surfaces that would be exposed by cutting through the material on any plane would neither exhibit a flame spread index greater than 25 nor evidence of continued progressive combustion when tested in accordance with ASTM E84 or ANSI/UL 723. [5000:7.1.4.2.2]
An alternate approach for a material to be considered a limited combustible material is where the material is tested in accordance with ASTM E2965, *Standard Test for Determination of Low Levels of Heat Release Rate for Materials and Products Using an Oxygen Combustion Calorimeter*, at an incident heat flux of 75 kW/m² for a 20-minute exposure, the peak heat release rate does not exceed 150 kW/m² for longer than 10 seconds, and the total heat released does not exceed 8 MJ/m².

Where the term *limited-combustible* is used in this Code, it shall also include the term *noncombustible*.


13.3.2.23.4.2 Hose Connections.

13.3.2.23.4.2.1 There shall be a hose outlet connected to a system sized to deliver 250 gal/min (946 L/min) at the most hydraulically remote outlet.

13.3.2.23.4.2.2 The outlet shall be supplied from the mall concourse zone sprinkler system and shall be hydraulically calculated.

13.3.2.23.4.2.3 Hose outlets shall be provided at each of the following locations:

1. Within the mall concourse at the entrance to each exit passage or corridor
2. At each floor level landing within enclosed stairways opening directly onto the mall concourse
3. At exterior public entrances to the mall concourse

13.3.2.27.4 Mini-Storage Building.

An automatic sprinkler system shall be installed throughout all mini-storage buildings greater than 2500 ft² (232 m²) and where any of the individual storage units are separated by less than a 1-hour fire resistance–rated barrier.

13.3.2.27.5 Bulk Storage of Tires.
Buildings and structures where the volume for the storage of tires exceeds 20,000 ft³ (566 m³) shall be equipped throughout with an approved automatic fire sprinkler system. [5000:30.3.5.2]

13.3.2.28 Woodworking Operations.
An approved automatic fire sprinkler system shall be installed in buildings containing woodworking operations exceeding 2500 ft² (232 m²) that use equipment, machinery, or appliances; that generate finely divided combustible waste; or that use finely divided combustible materials. [5000:29.3.5.1.2]

13.3.2.30 New Industrial Occupancies.
New industrial occupancies, other than low-hazard industrial occupancies, shall be protected by an approved automatic sprinkler system in accordance with NFPA 13 in any of the following locations:

1. Throughout all industrial occupancies three or more stories in height
2. Throughout all industrial occupancies exceeding 12,000 ft² (1115 m²) in fire area
3. Where the total area of all floors, including mezzanines, exceeds 24,000 ft² (2230 m²)

[5000:29.3.5.1.1]

25.1.5 Fire Hazards.
25.1.5.1 The finished ground level enclosed by the structure, and the surrounding finished ground level not less than 10 ft (3050 mm) outside of the structure, shall be cleared of all flammable or combustible material and vegetation. [5000:32.3.5.1.1]

25.1.6 Extinguishment Requirements.
25.1.6.1 Enclosed stadiums, arenas, and similar structures shall be protected throughout by an approved, electrically supervised automatic sprinkler system in accordance with Section 13.3, unless otherwise permitted by the following:

1. Where the ceiling or roof, whichever is lower, of the playing/activity area is more than 55 ft (16.7 m) above the floor, sprinklers shall not be required above the playing/activity area where permitted by the AHJ.
2. Sprinklers shall not be required above seating areas that view the playing/activity area. [5000:32.3.5.2]

25.1.6.2 An enclosed area shall be protected by an approved sprinkler system in accordance with Section 13.3, unless such an area is one of the following:

1. Enclosed stadiums, arenas, and similar structures
2. Press boxes of less than 1000 ft² (93 m²)
3. Storage facilities of less than 1000 ft² (93 m²), if enclosed with minimum 1-hour fire resistance–rated construction
4. Enclosed areas underneath grandstands or bleachers that comply with 16.4.9.5 of NFPA 5000

[5000:32.3.5.3]
25.1.6.3
Portable fire extinguishers shall be installed in assembly occupancies in accordance with Section 13.6, unless otherwise permitted by one of the following:

1. The requirement of 25.1.6.3 shall not apply to seating areas.
2. The requirement of 25.1.6.3 shall not apply to floor areas used for contests, performances, or entertainment.
3. The requirement of 25.1.6.3 shall not apply to outside assembly occupancy areas.
4. Portable extinguishers shall be permitted to be located in secure locations accessible to staff.

60.1.1
Applicability.
Occupancies containing high hazard contents shall comply with this chapter in addition to other applicable requirements of this Code. [5000:34.1.1.1]

60.1.2
Subjects Not Regulated.
Buildings, and portions thereof, containing high hazard contents limited to any of the following shall not be required to comply with this chapter:

1. Flammable and combustible liquids associated with application of flammable finishes and complying with Chapter 43.
2. Flammable and combustible liquids associated with wholesale and retail sales and storage in mercantile occupancies and complying with Chapter 66.
3. Class IIIA and Class IIIIB combustible liquid solvents in closed systems employing listed cleaning equipment complying with Chapter 24.
4. Refrigerants and refrigerant oil contained within closed-cycle refrigeration systems complying with Chapter 53 and the building code.
5. Flammable and combustible liquid beverages in liquor stores and distributors without bulk storage.
6. High hazard contents stored or used in farm buildings or similar occupancies for on-premises agricultural use.
7. Corrosive materials in stationary batteries utilized for facility emergency power, uninterrupted power supply, or similar purposes, provided that the batteries are provided with safety venting caps and ventilation is provided in accordance with Chapter 52.
8. Corrosive materials displayed in original packaging in mercantile occupancies intended for personal or household use or as building materials.
9. Aerosol products in storage or mercantile occupancies and complying with Chapter 61.
10. Flammable and combustible liquids storage tank buildings meeting the requirements of Chapter 24 of NFPA 30.
11. Flammable and combustible liquids storage tank vaults meeting the requirements of Chapter 25 of NFPA 30.
12. Flammable and combustible liquids process buildings meeting the requirements of Chapter 17 of NFPA 30.
13. Installation of fuel gas distribution systems and associated equipment in accordance with Section 11.4 and Chapter 69.

[5000:34.1.1.2]
66.9.7.2
Control areas shall be separated from each other by fire barriers in accordance with Table 66.9.7.2. [5000: Table 34.2.5.1.1] [400: Table 5.2.2.1]

Table 66.9.7.2 Design and Number of Control Areas [5000: Table 34.2.5.1.1] [400: Table 5.2.2.1]

A.3.3.29.6 High-Rise Building.
It is the intent of this definition that, in determining the level from which the highest occupiable floor is to be measured, the enforcing agency should exercise reasonable judgment, including consideration of overall accessibility to the building by fire department personnel and vehicular equipment. Where a building is situated on a sloping terrain and there is building access on more than one level, the enforcing agency might select the level that provides the most logical and adequate fire department access. [5000:A.3.3.68.10]

A.3.3.108 Explosive Material.
The term explosive material includes, but is not limited to, dynamite, black powder, pellet powder, initiating explosives, detonators, safety fuses, squibs, detonating cord, igniter cord, igniters, and Display Fireworks 1.3G (Class B, Special). The term explosive includes any material determined to be within the scope of Title 18, United States Code, Chapter 40, and also includes any material classified as an explosive, other than Consumer Fireworks 1.4G (Class C, Common), by the Hazardous Materials Regulations of the U.S. Department of Transportation (DOT) in 49 CFR. [5000:A.3.3.407.3]

The former classification system used by the DOT included the terms high explosive and low explosive, as further defined in 3.4.06.3.2 of NFPA 5000. These terms remain in use by the U.S. Bureau of Alcohol, Tobacco, and Firearms, and Explosives. Explosive materials classified as hazard Class 1 are further defined under the current system applied by DOT. Compatibility group letters are used in concert with division numbers to specify further limitations on each division noted. For example, the letter G (as in 1.4G) identifies substances or articles that contain a pyrotechnic substance and similar materials. UN/DOT Class 1 Explosives are defined as follows:

1. Division 1.1 explosives are explosives that are a mass explosion hazard, which is a hazard that instantaneously affects almost the entire load.
2. Division 1.2 explosives are explosives that are a projection hazard but not a mass explosion hazard.
3. Division 1.3 explosives are explosives that are a fire hazard and either a minor blast hazard or a minor projection hazard, or both, but not a mass explosion hazard.
4. Division 1.4 explosives are explosives that pose a minor explosion hazard and meet both of the following criteria:
   1. The explosive effects are largely confined to the package, and no projection of fragments of appreciable size or range is to be expected.
   2. An external fire cannot cause virtually instantaneous explosion of almost the entire contents of the package.
5. Division 1.5 explosives are very insensitive explosives that are comprised of substances that are a mass explosion hazard, but are so insensitive that there is very little probability of initiation or of transition from burning to detonation under normal conditions of transport.
6. Division 1.6 explosives are extremely insensitive articles that are not a mass explosion hazard, that are comprised of articles that contain only extremely insensitive detonating

substances, and that demonstrate a negligible probability of accidental initiation or propagation.

A.3.3.132.1 Gross Floor Area.
Where the term floor area is used, it should be understood to be gross floor area, unless otherwise specified.

A.3.3.144 Hazard of Contents.
Hazardous materials are materials that present physical or health hazards and are regulated by the Code. The categories of materials classified as physical hazards, health hazards, or both have been established in concert with those categories identified by OSHA in 29 CFR that are used by preparers of Material Safety Data Sheets (MSDS). In some cases, the hazard categories are further subdivided into classes that have long been established by NFPA standards. For example, while OSHA recognizes flammable liquids as a broad class, including those that are combustible, such liquids are further categorized by building and fire codes with respect to degree of hazard under the system of classification used by NFPA to include Class I, Class II, and Class III liquids. They are further subdivided within these classes to Class IA, Class IB and so forth. A similar approach is used for materials in other categories where there are subcategories of hazard established by existing NFPA standards, including oxidizers, unstable reactives, organic peroxides, water reactives, and others.

Under the classification system used by OSHA, a hazardous material can have one or more physical or health hazards in categories not currently regulated by the Code; for example, irritants, sensitizers, radioactive materials, etiological agents, and others. This is not to say that these materials are not hazardous materials, but rather that the Code does not provide specific regulation for the hazard category represented.

The Code defines contents as either high hazard, low hazard, or ordinary hazard. The category of high hazard, which includes hazardous materials, is subdivided into groups in which the hazards of the groups are comparable, that is, high hazard Level 1-5. (See also A.34.1.1 of NFPA 5000.)

A.3.3.164.1 Ceiling Limit.
The ceiling limits utilized are to be those published in 29 CFR 1910.1000.

A.3.3.185.15 Industrial Occupancy.
For laboratories within the scope of NFPA 45, the occupancies are defined in NFPA 45, Section 3.3, as follows:

1. Noninstructional labs are considered industrial.
2. Labs within the scope of NFPA 99 are considered health care.
3. Instructional labs for grades 12 and below are considered educational.
4. Labs for grades above grade 12 and Class D labs are business occupancies.

A.3.3.185.31.1 Mini-Storage Building.
Mini-storage buildings are typically designed to accommodate relatively small transient tenants who are often private individuals or persons who own small businesses and need additional
storage space that is generally very small in area to accommodate their short-term storage needs. This definition is not intended to apply to large warehouse buildings designed to be rented or leased to relatively large multiple tenants who are generally storing their wares in conjunction with their businesses. Garage units that are primarily intended for vehicular storage as part of a multifamily development are not intended to be classified as mini-storage buildings. [5000:A.3.3.68.13]

A.3.4.5 Design Specification.
Design specifications include both hardware and human factors, such as the conditions produced by maintenance and training. For purposes of performance-based design, the design specifications of interest are those that affect the ability of the building to meet the stated goals and objectives. [5000:A.3.3.607.1]

A.3.4.10 Fuel Load.
Fuel load includes interior finish and trim. [5000:A.3.3.385.3]

A.4.5.9.1(1)
Examples of such materials include steel, concrete, masonry, and glass. [5000:A.7.1.4.1.1(1)]
Second Revision No. 57-NFPA 1-2016 [Global Comment]


Supplemental Information

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<th>Description</th>
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Submitter Information Verification

Submitter Full Name: Kristin Bigda
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Submittal Date: Wed Oct 12 12:25:08 EDT 2016

Committee Statement

Committee Statement: Extract update.
Response Message:

Public Comment No. 50-NFPA 1-2016 [Section No. 30.2.5 [Excluding any Sub-Sections]]
Public Comment No. 60-NFPA 1-2016 [Section No. 30.2.3]
Public Comment No. 62-NFPA 1-2016 [Section No. 30.2.8 [Excluding any Sub-Sections]]
30.1.2 Occupancy Classification.
The occupancy classification of a motor fuel dispensing facility that is located inside a building or structure shall be a special purpose industrial occupancy as defined in NFPA 101 or as determined in accordance with the adopted building code. [30A:7.3.1]

30.1.3 Means of Egress.
In a motor fuel dispensing facility that is located inside a building or structure, the required number, location, and construction of means of egress shall meet all applicable requirements for special purpose industrial occupancies, as set forth in NFPA 101, or as determined in accordance with the adopted building code. [30A:7.3.3]

30.2.2 Occupancy Classification.
The occupancy classification of a repair garage shall be a special purpose industrial occupancy as defined in NFPA 101, or as determined in accordance with the adopted building code. [30A:7.4.1]

30.2.3 General Construction Requirements.
In major repair garages, where CNG-fueled vehicles, hydrogen-fueled vehicles, LNG-fueled vehicles, or LP-Gas-fueled vehicles are repaired, all applicable requirements of NFPA 2, NFPA 52 or NFPA 58, whichever is applicable, shall be met. [30A:7.4.2]

30.2.4 Means of Egress.
In a repair garage, the required number, location, and construction of means of egress shall meet all applicable requirements for special purpose industrial occupancies, as set forth in NFPA 101, or as determined in accordance with the adopted building code. [30A:7.4.3]

30.2.5 Drainage.
In areas of repair garages used for repair or servicing of vehicles, floor assemblies shall be constructed of noncombustible materials or, if combustible materials are used in the assembly, they shall be surfaced with approved, nonabsorbent, noncombustible material, except as indicated in 30.2.5.1. [30A:7.4.4]

Exception:
30.2.5.1 Slip-resistant, nonabsorbent, interior floor finishes having a critical radiant flux not more than 9.87 Btu/in² (0.45 W/cm²), as determined by NFPA 253, shall be permitted. [30A:7.4.4.1]

30.2.5.2 Floors shall be liquidtight to prevent the leakage or seepage of liquids and shall be sloped to facilitate the movement of water, fuel, or other liquids to floor drains. [30A:7.4.4.12]
In areas of repair garages where vehicles are serviced, any floor drains shall be properly trapped and shall discharge through an oil/water separator to the sewer or to an outside vented sump. [30A:7.4.4.23]

30.2.6 Pits, Belowgrade Work Areas, and Subfloor Work Areas.

30.2.6.1 Pits, belowgrade work areas, and subfloor work areas used for lubrication, inspection, and minor automotive maintenance work shall comply with the provisions of this chapter, in addition to other applicable requirements of NFPA 30A. [30A:7.4.5.1]

30.2.6.3 In pits, belowgrade work areas, and subfloor work areas, the required number, location, and construction of means of egress shall meet the requirements for special purpose industrial occupancies in Chapter 40 of NFPA 101 or in accordance with the adopted building code. [30A:7.4.5.3]

30.2.7 Fixed Fire Protection.

Automatic sprinkler protection installed in accordance with the requirements of Section 13.3 shall be provided in throughout all buildings containing major repair garages, as herein defined, when any one of the following conditions exist:

1. The building housing the major repair garage is two or more stories in height, including basements, and any one the aggregate area of the floors major repair garage exceeds 10,000 ft² (930 m²).
2. The major repair garage is one story and exceeds 12,000 ft² (1115 m²).
3. The major repair garage is servicing vehicles parked in the basement of the building. [30A:7.4.6]

30.2.8 Gas Detection System.

Repair garages used for repair of vehicle engine fuel systems fueled by non-odorized gases, such as hydrogen and non-odorized LNG/CNG, shall be provided with an approved flammable gas detection system. Gas detection systems in repair garages for hydrogen vehicles shall be in accordance with NFPA 2. [30A:7.4.7]

30.2.8.4 System Integrity

The circuits of the detection system required by 30.2.8 shall be monitored for integrity in accordance with NFPA 72. [30A:7.4.7.4]
Exhaust duct openings shall be located so that they effectively remove vapor accumulations at floor level from all parts of the floor area. Where lighter-than-air gaseous fuel vehicles are repaired, exhaust duct openings shall be located so that they effectively remove vapor accumulations at the ceiling level. [30A:7.5.4]

A.30.2.9.4
Lighter-than-air fuels include fuels such as hydrogen and natural gas, but not LPG. [30A:A.7.5.4]

30.2.10.6*
Where major repairs are conducted on CNG-fueled vehicles or LNG lighterc-than-air-fueled vehicles, open flame heaters or heating equipment with exposed surfaces having a temperature in excess of 750°F (399°C) shall not be permitted in areas subject to ignitable concentrations of gas. [30A:7.6.6]

42.2.1.3*
Sections 42.2 through 42.8 shall not apply to those motor fuel dispensing facilities where only liquefied petroleum gas (LP-Gas), liquefied natural gas (LNG), or compressed natural gas (CNG), or hydrogen is dispensed as motor fuel. [30A:1.1.3]

42.3.3.2* Aboveground Storage Tanks.

Except as modified by the provisions of this subsection, Chapter 4 of NFPA 30A, aboveground storage tanks shall meet all applicable requirements of Chapters 21 and 22 of NFPA 30. [30A:4.3.2]

A.42.3.3.2
PEI RP200, Recommended Practices for Installation of Aboveground Storage Systems for Motor Vehicle Fueling, also provides information on this subject. Proper installation, inspection, and maintenance of aboveground storage systems for motor vehicle fueling, including associated devices and components. The U.S. Environmental Protection Agency's regulation for Spill Prevention Control and Countermeasure (SPCC) Plans found in 40 CFR 112, provides additional requirements. [30A:A.4.3.2]

42.3.3.6.7
Storage tank appurtenances shall be installed and calibrated in accordance with the manufacturer's instructions, published industry practices, or equivalent methods approved by the AHJ. [30A:4.3.6.7]

A.42.3.3.8
Appropriate corrosion control standards include the following:
1. STI RP 892-91, Recommended Practice for Corrosion Protection of Underground Piping Networks Associated with Liquid Storage and Dispensing Systems
2. NACE SP0169 STI RP-01-69, Recommended Practice for Control of External Corrosion of Underground or Submerged Metallic Piping Systems
3. STI RP 1632, Cathodic Protection of Underground Petroleum Storage Tanks and Piping Systems

[30A:A.4.3.8]

42.5.3.9

Where liquid is supplied to the dispensing device under pressure, a listed, rigidly anchored, double-poppet type emergency shutoff valve incorporating a fusible link or other thermally actuated device, designed to close automatically in the event of severe impact or fire exposure, shall be installed in the supply line at the base of each individual island-type dispenser or at the inlet of each overhead dispensing device. The emergency shutoff valve shall be installed in accordance with the manufacturer's instructions. The emergency shutoff valve shall not incorporate a slip-joint feature.

Exception: As provided for in 42.5.3.10. [30A:6.3.9]

42.5.4.2

Each pump shall have installed on the discharge side a listed leak detection device that will provide an audible or visible indication, restricts or shuts off the flow of product if the piping or a dispenser is leaking. Each leak-detecting device shall be checked and tested at least annually according to the manufacturers' specifications to ensure proper installation and operation.

Exception: A leak detection device shall not be required if all piping is visible. [30A:6.4.2]

42.5.7 Emergency Electrical Disconnects.

Fuel dispensing systems shall be provided with one or more clearly identified emergency shutoff devices or electrical disconnects. Such devices or disconnects shall be installed in approved locations but not less than 20 ft (6 m) or more than 100 ft (30 m) from the fuel dispensing devices that they serve. Emergency shutoff devices or electrical disconnects shall disconnect power to all dispensing devices; to all remote pumps serving the dispensing devices; to all associated power, control, and signal circuits; and to all other electrical equipment in the hazardous (classified) locations surrounding the fuel dispensing devices and shall mechanically or electrically isolate other fluid transfer systems serving the fuel dispensing area. When more than one emergency shutoff device or electrical disconnect is provided, all devices shall be interconnected. Resetting from an emergency shutoff condition shall require manual intervention and the manner of resetting shall be approved by the AHJ.

Exception: Intrinsically safe electrical equipment need not meet this requirement. [30A:6.7]

42.5.7.1
At attended motor fuel dispensing facilities, the devices or disconnects shall be readily accessible to the attendant and labeled with an approved sign stating “EMERGENCY FUEL SHUTOFF” or equivalent language. [30A:6.7.1]

42.5.7.2
At unattended motor fuel dispensing facilities, the devices or disconnects shall be readily accessible to patrons and at least one additional device or disconnect shall be readily accessible to each group of dispensing devices on an individual island. The device(s) or disconnect(s) shall be labeled with an approved sign stating “EMERGENCY FUEL SHUTOFF” or equivalent language [30A:6.7.2]

42.7.2.2.1
Delivery operations shall meet all applicable requirements of NFPA 385 and the requirements of 42.7.2.2.2 through 42.7.2.2.46. [30A:9.2.2.1]

42.7.2.2.2
No separation shall be required between the delivery vehicle and the fill connection of an underground storage tank. [30A:9.2.2.2]

42.7.2.2.3
The delivery vehicle shall be separated from any aboveground tank in accordance with Table 42.7.2.2.3

Table 9.2.2.3 Minimum Separation Distances Between Delivery Vehicles and Aboveground Tanks

<table>
<thead>
<tr>
<th>Aboveground Tank Type</th>
<th>Separation Distance Between Delivery Vehicle and Aboveground Tank (ft)</th>
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<tbody>
<tr>
<td>Protected aboveground tanks</td>
<td>0</td>
</tr>
<tr>
<td>Tanks in abovegrade vaults (measured from vault wall)</td>
<td>0</td>
</tr>
<tr>
<td>Tanks filled by gravity</td>
<td>0</td>
</tr>
<tr>
<td>Fire-resistant tanks</td>
<td>15</td>
</tr>
<tr>
<td>Other tanks meeting the requirements of NFPA 30 storing Class II or Class III liquids</td>
<td>15</td>
</tr>
<tr>
<td>Other tanks meeting the requirements of NFPA 30 storing Class I liquids</td>
<td>25</td>
</tr>
</tbody>
</table>

[30A:9.2.2.3]

by at least 25 ft (7.6 m).

Exception No. 1: No minimum separation distance shall be required for tanks that are filled by gravity.

Exception No. 2: The required minimum separation distance shall be permitted to be reduced to 15 ft (4.6 m) where the fuel being delivered is not a Class I liquid. [30A:9.2.2.2]
42.7.2.2.3.1
Separation distances shall be imposed by the use of curbing, guard posts, or other approved methods. [30A:9.2.2.3.1]

42.7.2.2.3.1*
Means shall be provided to prevent an accidental release originating from the delivery vehicle from flowing under the aboveground tank. [30A:9.2.2.3.2]

A.9.2.2.3.2
If the tank is situated in a dike, the dike wall meets this requirement. For secondary containment-type tanks, drainage, curbing, or other approved means can be used.

42.7.2.2.3–4
The delivery vehicle shall be located so that all parts of the vehicle are on the premises when delivery is made. Exception: This requirement shall not apply to existing fuel dispensing facilities and fuel dispensing facilities inside buildings. [30A:9.2.2.34]

42.7.2.2.4–5
Tank filling shall not begin until the delivery operator has determined that the tank has sufficient available capacity (i.e., ullage). [30A:9.2.2.45]

42.7.2.2.5–6
Tanks shall be filled through a liquidtight connection. [30A:9.2.2.5]

42.7.2.2.56.1
Where an aboveground tank is filled by means of fixed piping, either a check valve and shutoff valve with a quick-connect coupling or a check valve with a dry-break coupling shall be installed in the piping at a point where connection and disconnection is made between the tank and the delivery vehicle. This device shall be protected from tampering and physical damage. [30A:9.2.2.5.1]

42.7.2.2.56.2
Underground tanks and tanks in belowgrade vaults shall be filled through a liquidtight connection within a spill container. [30A:9.2.2.5.2]

42.7.2.5* Display of Materials.
The storage or placement for display or sale of products shall be prohibited within 20 ft of any fuel dispenser. [30A:9.2.2.5.5]

A.42.7.2.5
Many fuel stations display items such as wood, bagged ground cover, cartons of consumable products, and other combustibles that create vision obstructions, excessive fire load, and other hazards in and around dispensing islands and pumps. [30A:A.9.2.5.5]

42.7.2.9 Maintenance of Aboveground Storage Tank Appurtenances.
Storage tank appurtenances shall be maintained and operated in accordance with manufacturer’s instructions, published industry practices, or equivalent methods approved by the AHJ. [30A:9.2.9]

42.7.4.2
There shall be at least one attendant on duty while the self-service facility is open for business. The attendant’s primary function shall be to supervise, observe, and control the dispensing of Class I liquids while said liquids are being dispensed motor fuels. [30A:9.4.2]

42.7.6 Refueling from Tank Vehicles.

The dispensing of Class I and Class II liquids in the open from a tank vehicle to a motor vehicle located at commercial, industrial, governmental, or manufacturing establishments and intended for fueling vehicles used in connection with their businesses located at commercial, industrial, governmental, or manufacturing establishments and intended for fueling vehicles used in connection with their businesses shall be permitted only if all of the requirements of 42.7.6.1 through 42.7.6.7 have been met. [30A:9.6]

42.7.6.8
A means for bonding the tank vehicle to the motor vehicle shall be provided. Such bonding means shall be employed during fueling operations. [30A:9.6.8]

42.7.6.9
A spill kit designed for motor vehicle fuels shall be carried on the tank vehicle and employed in case of a fuel spill. [30A:9.6.9]

42.8.2.3 *
Dispensing devices for CNG, LNG, hydrogen, and LP-Gas shall be listed or approved. [30A:12.2.3]

A 42.8.2.3
Not all fuels have equipment that is currently listed. As technology develops, this provision will allow the authorities having jurisdiction (AHJ) the latitude to approve systems and equipment that cannot be currently listed. [30A:A,12.2.3]
42.8.2.4*
Listed or approved hose assemblies shall be used to dispense fuel. Hose length at automotive motor fuel dispensing facilities shall not exceed 18 ft (5.5 m). [30A:12.2.4]

A.42.8.2.4
See A.12.2.3. [30A:A.12.2.4]

A.42.8.3.4
The selection of the 20 ft (6 m) separation distance between storage containers of different gaseous fuels is based on long-standing requirements in NFPA 2, NFPA 52, NFPA 2, and NFPA 58. The separation distance between containers storing gaseous fuels and liquid motor fuel dispensers is based on the maximum 18-foot length of dispenser hose attached to the liquid fuel dispenser and the potential for a liquid pool fire to affect the gaseous fuel storage containers. [30A:A.12.3.4]
Add the following definitions to Chapter 3:

3.XX Marijuana extraction facility. A building used for the solvent-based extraction process of marijuana.

3.XX Marijuana extraction equipment. Equipment or appliances used for the extraction of botanical material such as essential oils, from marijuana.

3.XX Extraction room (marijuana). The room or space in which the solvent–based extractions occur.

3.XX Observation. For the purposes of marijuana extraction equipment field verification, a practice or condition not technically noncompliant with other regulations or requirements, but could lead to noncompliance if left unaddressed.

3.XX Desolventizing. The act of removing a solvent from a material.

3.XX Miscella. A mixture, in any proportion, of the extracted oil or fat and the extracting solvent.

3.XX Transfilling. The process of transferring a gas, either in compressed or liquid form from one cylinder or container to another cylinder or container.

A.3.XX Transfilling usually occurs from a bulk container to a smaller container such as filling a small compressed gas cylinder.

3.XX Chemical fume hood: A ventilated enclosure designed to contain and exhaust fumes, gases, vapors, mists, and particulate matter generated within the hood interior. [45: 2015]

Supplemental Information

<table>
<thead>
<tr>
<th>File Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chapter_38_definitions_For_Submittal.docx</td>
<td></td>
</tr>
</tbody>
</table>

Submitter Information Verification

Submitter Full Name: Kristin Bigda
Organization: National Fire Protection Assoc
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Mon Oct 17 13:07:50 EDT 2016

Committee Statement

Committee Statement: This revisions adds new definitions to Chapter 3 as a result of the new Chapter 38 on marijuana growing, processing, and extraction facilities. The added definitions will assist users in the application of the new Chapter.

Response Message:
Permits shall be required in accordance with Table 1.12.8(a) through Table 1.12.8(d).

### Table 1.12.8(a) Permit Requirements

<table>
<thead>
<tr>
<th>Operations and Materials</th>
<th>Permit Required</th>
<th>Cross Reference Section Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aerosol products</td>
<td>To store or handle an aggregate quantity of Level 2 or Level 3 aerosol products in excess of 500 lb (226.8 kg)</td>
<td>61.1.2</td>
</tr>
<tr>
<td>Aircraft fuel servicing</td>
<td>To provide aircraft fuel servicing</td>
<td>42.10.1.2</td>
</tr>
<tr>
<td>Aircraft hangars</td>
<td>For servicing or repairing aircraft</td>
<td>21.1.1</td>
</tr>
<tr>
<td>Aircraft refueling vehicles</td>
<td>To operate aircraft refueling vehicles</td>
<td>42.10.1.2</td>
</tr>
<tr>
<td>Airport terminal buildings</td>
<td>For construction and alteration</td>
<td>21.2.2.1</td>
</tr>
<tr>
<td>Ammonium nitrate</td>
<td>For storage</td>
<td>Chapter 74</td>
</tr>
<tr>
<td>Amusement parks</td>
<td>For construction, alteration, or operation of amusement park fire protection safety features</td>
<td>10.15.1</td>
</tr>
<tr>
<td>Asbestos removal</td>
<td>For the removal of asbestos</td>
<td>16.8.2</td>
</tr>
<tr>
<td>Automatic fire suppression systems</td>
<td>For installation, modification, or removal from service of any automatic fire suppression system*</td>
<td>13.1.1.1; 50.4.2</td>
</tr>
<tr>
<td>Automobile wrecking yards</td>
<td>To operate automobile wrecking yards</td>
<td>22.2</td>
</tr>
<tr>
<td>Automotive fuel servicing</td>
<td>To provide automotive fuel servicing</td>
<td>42.2.2.1; 42.11.2.2.4; 42.11.3.1</td>
</tr>
<tr>
<td>Battery systems</td>
<td>To install or operate stationary lead-acid battery systems</td>
<td>52.2</td>
</tr>
<tr>
<td>Candles, open flames, and portable cooking</td>
<td>To use in connection with assembly areas, dining areas of restaurants, or drinking establishments</td>
<td>17.3.2; 20.1.1.1</td>
</tr>
<tr>
<td>Carnivals and fairs</td>
<td>To conduct a carnival or fair</td>
<td>10.15.1</td>
</tr>
<tr>
<td>Cellulose nitrate film</td>
<td>To store, handle, use, or display</td>
<td>20.15.7.2</td>
</tr>
<tr>
<td>Cellulose nitrate plastic</td>
<td>To store or handle more than 25 lb (11.3 kg)</td>
<td>43.1.1.4</td>
</tr>
<tr>
<td>Change of occupancy</td>
<td>For the change of occupancy classification of an existing building</td>
<td>1.7.11.5</td>
</tr>
<tr>
<td>Cleanrooms</td>
<td>For construction, alteration, or operation</td>
<td>23.3</td>
</tr>
<tr>
<td>Combustible fibers</td>
<td>For storage or handling of combustible fibers greater than 100 ft³ (2.8 m³)</td>
<td>45.1.3</td>
</tr>
<tr>
<td>Combustible material storage</td>
<td>To store more than 2500 ft³ (70.8 m³) gross volume</td>
<td>10.19.2; 19.1.1.1; 31.2</td>
</tr>
<tr>
<td>Commercial rubbish-handling operation</td>
<td>To operate</td>
<td>19.1.1</td>
</tr>
<tr>
<td>Compressed gases</td>
<td>1. To store, use, or handle compressed gases in excess of the amounts listed in Table 1.12.8(b) 2. When the compressed gases in use or storage exceed the amounts listed in Table 1.12.8(b), a permit is required to install, repair damage to, abandon, remove, place temporarily out of service, close, or substantially modify a compressed gas system 3. For additional permit requirements for compressed gases facility closures, see 63.1.2</td>
<td>63.1.2</td>
</tr>
<tr>
<td>Operations and Materials</td>
<td>Permit Required</td>
<td>Cross Reference Section Number</td>
</tr>
<tr>
<td>--------------------------</td>
<td>----------------</td>
<td>-------------------------------</td>
</tr>
<tr>
<td>Construction</td>
<td>For the construction of a building or structure</td>
<td>1.7.11.8</td>
</tr>
<tr>
<td>Covered mall buildings</td>
<td>Annual requirement for facilities that utilize mall area for exhibits or displays with 4 conditions</td>
<td>20.1.5.5.1</td>
</tr>
<tr>
<td>Crop maze</td>
<td>To operate a crop maze</td>
<td>10.14.11.1</td>
</tr>
</tbody>
</table>
| Cryogens                 | To produce, store, or handle cryogens in excess of amounts listed in Table 1.12.8(c)  
*Exception: Where federal or state regulations apply or for fuel systems of a vehicle* | 63.1.2                       |
| Cutting and welding operation | For operations within a jurisdiction | 41.1.5; 41.3.2.2; 41.3.2.2.2 |
| Display fireworks (1.3G) | For possession, transportation, storage, manufacture, sale, handling, and discharge of display fireworks within the jurisdiction | 65.2.3; 65.5.2               |
| Drycleaning plants       | To engage in business of drycleaning or to change to a more hazardous cleaning solvent | 24.2                         |
| Dust-producing operations | To operate a grain elevator, flour mill, starch mill, feed mill, or plant pulverizing aluminum, coal, cocoa, magnesium, spices, sugar, or other similar combustible material | 40.2                         |
| Energy storage systems, including battery stationary storage systems and capacitor energy storage systems | To install and operate energy storage systems exceeding Table 52.2.1 and Table 52.3.1 | 52.1.2                       |
| Exhibit and trade shows  | For operation of all exhibits and trade shows held within a jurisdiction | 20.1.5.5.1                   |
| Explosives               | 1. Manufacture, sell, dispose, purchase, storage, use, possess, or transport of explosives within the jurisdiction  
2. For additional permit requirements for blasting operations, see 65.9.2 | 65.9.2                       |
| Fire alarm and detection systems and related equipment | For installation, modification, or removal from service of any fire alarm and detection systems and related equipment* | 13.1.1.1                     |
| Fire apparatus access roads | For the construction of a fire apparatus access road | 18.1.2                       |
| Fire hydrants and water-control valves | To use a fire hydrant or operate a water-control valve intended for fire suppression purposes | 13.1.1.1                     |
| Fire pumps and related equipment | For installation of, modification to, or removal from service of any fire pumps, jockey pumps, controllers, and generators* | 13.1.1.1                     |
| Flame effects            | Use of flame effects before an audience | 65.4.2                       |
| Flammable and combustible liquids | 1. To use or operate, repair, or modify a pipeline for the on-site transportation of flammable or combustible liquids  
2. To store, handle, or use Class I liquids in excess of 5 gal (18.9 L) in a building or in excess of 10 gal (37.9 L) outside of a building  
*Exception to item (2): A permit is not required for the following:  
(a) The storage or use of Class I liquids in the fuel tank of | 66.1.5                       |
<table>
<thead>
<tr>
<th>Operations and Materials</th>
<th>Permit Required</th>
</tr>
</thead>
<tbody>
<tr>
<td>a motor vehicle, aircraft, motorboat, mobile power plant, or mobile heating plant unless such storage in the opinion of the chief would cause an unsafe condition</td>
<td></td>
</tr>
<tr>
<td>(b) The storage or use of paints, oils, varnishes, or similar flammable mixtures when such liquids are stored for maintenance, painting, or similar purposes for a period of not more than 30 days</td>
<td></td>
</tr>
<tr>
<td>3. To store, handle, or use Class II or Class III-A liquids in excess of 25 gal (94.6 L) in a building or in excess of 60 gal (227.1 L) outside a building</td>
<td></td>
</tr>
<tr>
<td>Exception to item (3): Fuel oil used in connection with oil-burning equipment</td>
<td></td>
</tr>
<tr>
<td>4. To remove Class I or Class II liquids from an underground storage tank used for fueling motor vehicles by any means other than the approved, stationary on-site pumps normally used for dispensing purposes</td>
<td></td>
</tr>
<tr>
<td>5. To install, construct, alter, or operate tank vehicles, equipment, tanks, plants, terminals, wells, fuel-dispensing stations, refineries, distilleries, and similar facilities where flammable and combustible liquids are produced, processed, transported, stored, dispensed, or used</td>
<td></td>
</tr>
<tr>
<td>6. To install, alter, clean, repair, line with a protective coating, remove, abandon, place temporarily out of service, or otherwise dispose of a flammable or combustible liquid tank</td>
<td></td>
</tr>
<tr>
<td>7. To change the type of contents stored in a flammable or combustible liquid tank to a material other than those for which the tank was designed and constructed</td>
<td></td>
</tr>
<tr>
<td>Fruit ripening</td>
<td>To operate a fruit-ripening process</td>
</tr>
<tr>
<td>General storage</td>
<td>To store materials indoors or outdoors, representing a broad range of combustibles, including plastics, rubber tires, and roll paper</td>
</tr>
<tr>
<td>Grandstands, bleachers, and folding and telescopic seating</td>
<td>For construction, location, erection, or placement of grandstands, bleachers, and folding and telescopic seating</td>
</tr>
</tbody>
</table>
| Hazardous materials | 1. To store, transport on site, dispense, use, or handle hazardous materials in excess of the amounts listed in Table 1.12.8(d)  
2. To install, repair, abandon, remove, place temporarily out of service, close, or substantially modify a storage facility or other area regulated by Chapter 60 when the hazardous materials in use or storage exceed the amounts listed in Table 1.12.8(d) | Chapter 60 |  
<p>| High-piled combustible storage | To use any building or portion thereof as a high-piled storage area exceeding 500 ft² (46.45 m²) | 20.15.8.2 |<br />
| High-powered rocketry | For the manufacture, sale, and use of high-powered rocketry | 65.8.2; 65.7.2 |<br />
| Hot work operations | To conduct hot work | 17.3.2; 41.1.5; 41.3.4 |</p>
<table>
<thead>
<tr>
<th>Operations and Materials</th>
<th>Permit Required</th>
<th>Cross Reference Section Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Industrial ovens and furnaces</td>
<td>For operation of industrial ovens and furnaces covered by Chapter 51</td>
<td>51.1.2</td>
</tr>
<tr>
<td>Laboratories</td>
<td>For construction, alteration, or operation</td>
<td>26.3</td>
</tr>
<tr>
<td>Liquefied petroleum gases</td>
<td>1. To store, use, handle, or dispense LP-Gas of 125 gal (0.5 m³) (water capacity) aggregate capacity or greater 2. To install or modify LP-Gas systems</td>
<td>42.11.2.2.4 69.1.2</td>
</tr>
<tr>
<td>Liquid- or gas-fueled vehicles</td>
<td>To display, compete, or demonstrate liquid- or gas-fueled vehicles or equipment in assembly buildings</td>
<td>20.1.5.5.1</td>
</tr>
<tr>
<td>Lumberyards and woodworking plants</td>
<td>For storage of lumber exceeding 100,000 board ft</td>
<td>31.2</td>
</tr>
<tr>
<td>Marijuana growing, processing, or extraction facilities</td>
<td>For the construction, alteration, or operation of a marijuana growing, processing, or extraction facility</td>
<td>38.2</td>
</tr>
<tr>
<td>Marine craft fuel servicing</td>
<td>To provide marine craft fuel servicing</td>
<td>42.9.1.4</td>
</tr>
<tr>
<td>Means of egress</td>
<td>For the modification of a means of egress system in an existing building</td>
<td>1.7.11.6</td>
</tr>
<tr>
<td>Membrane structures, tents, and canopies — permanent</td>
<td>For construction, location, erection, or placement</td>
<td>25.1.2</td>
</tr>
<tr>
<td>Membrane structures, tents, and canopies — temporary</td>
<td>To erect or operate an air-supported temporary membrane structure or tent having an area in excess of 200 ft² (18.6 m²) or a canopy in excess of 400 ft² (37.2 m²) Exception: Temporary membrane structures, tents, or canopy structures used exclusively for camping.</td>
<td>25.1.2</td>
</tr>
<tr>
<td>Mobile cooking operations</td>
<td>To conduct mobile cooking operations</td>
<td>50.7</td>
</tr>
<tr>
<td>Motion picture and television production studio soundstages and approved production facilities</td>
<td>To design, construct, operate, and maintain soundstages and approved production facilities used in motion picture and television industry productions</td>
<td>32.2</td>
</tr>
<tr>
<td>Oil- and gas-fueled heating appliances</td>
<td>To install oil- and gas-fired heating appliances</td>
<td>11.5.1.8</td>
</tr>
<tr>
<td>Open burning</td>
<td>1. To conduct open burning 2. For additional permit requirements for open burning, see 10.11.1</td>
<td>10.11.1</td>
</tr>
<tr>
<td>Open fires</td>
<td>1. For kindling or maintaining an open fire 2. For additional permit requirements for open fires, see 10.11.4†</td>
<td>10.11.1</td>
</tr>
<tr>
<td>Organic coatings</td>
<td>For operation and maintenance of a facility that manufactures organic coatings</td>
<td>43.1.1.4</td>
</tr>
<tr>
<td>Organic peroxide formulations</td>
<td>To store, transport on site, use, or handle materials in excess of amounts listed in Tables 1.12.8(c) and (d)</td>
<td>Chapter 75</td>
</tr>
<tr>
<td>Outside storage of tires</td>
<td>To store more than 500 tires outside</td>
<td>33.1.2</td>
</tr>
<tr>
<td>Oxidizers</td>
<td>To store, transport on site, use, or handle materials in excess of amounts listed in Tables 1.12.8(c) and (d)</td>
<td>Chapter 70</td>
</tr>
<tr>
<td>Parade floats</td>
<td>To use a parade float for public performance, presentation, spectacle, entertainment, or parade</td>
<td>10.17.1</td>
</tr>
<tr>
<td>Places of assembly</td>
<td>To operate a place of assembly</td>
<td>10.15.1; 20.1.1.1</td>
</tr>
<tr>
<td>Operations and Materials</td>
<td>Permit Required</td>
<td>Cross Reference Section Number</td>
</tr>
<tr>
<td>--------------------------</td>
<td>----------------</td>
<td>---------------------------------</td>
</tr>
<tr>
<td>Pyrotechnic articles</td>
<td>For the manufacture, storage, sale, or use of pyrotechnic articles within the jurisdiction</td>
<td>65.2.3; 65.3.3; 65.5.2</td>
</tr>
<tr>
<td>Pyrotechnics before a proximate audience</td>
<td>For the display and use of pyrotechnic materials before a proximate audience</td>
<td>65.3.3</td>
</tr>
<tr>
<td>Pyroxylin plastics</td>
<td>For storage, handling, assembly, or manufacture of pyroxylin plastics</td>
<td>43.1.1.4</td>
</tr>
<tr>
<td>Private fire hydrants</td>
<td>For installation, modification, or removal from service of any private fire hydrants</td>
<td>13.1.1.1</td>
</tr>
<tr>
<td>Refrigeration equipment</td>
<td>To install or operate a mechanical refrigeration unit or system regulated by this Code</td>
<td>53.1.3</td>
</tr>
<tr>
<td>Repair garages and service stations</td>
<td>For operation of service stations and repair garages</td>
<td>30.1.1.3; 30.2.1.1</td>
</tr>
<tr>
<td>Rocketry manufacturing</td>
<td>For the manufacture of model rocket motors</td>
<td>65.7.2</td>
</tr>
<tr>
<td>Rooftop heliports</td>
<td>For construction, modification, or operation of a rooftop heliport</td>
<td>21.3.2.1</td>
</tr>
<tr>
<td>Solvent extraction</td>
<td>For storage, use, and handling</td>
<td>44.3</td>
</tr>
<tr>
<td>Spraying or dipping of flammable finish</td>
<td>For installation or modification of any spray room, spray booth, or preparation work station, or to conduct a spraying or dipping operation utilizing flammable or combustible liquids or powder coating</td>
<td>43.1.1.4</td>
</tr>
<tr>
<td>Standpipe systems</td>
<td>For installation, modification, or removal from service of any standpipe system *</td>
<td>13.1.1.1</td>
</tr>
<tr>
<td>Special outdoor events</td>
<td>For the location and operation of special outdoor events</td>
<td>10.15.1</td>
</tr>
<tr>
<td>Tar kettles</td>
<td>To place a tar kettle, a permit must be obtained prior to the placement of a tar kettle</td>
<td>16.7.1.2; 17.3.2</td>
</tr>
<tr>
<td>Tire storage</td>
<td>To use an open area or portion thereof to store tires in excess of 500 tires</td>
<td>33.1.2; 34.1.2</td>
</tr>
<tr>
<td>Torch-applied roofing operation</td>
<td>For the use of a torch for application of roofing materials</td>
<td>16.6.1</td>
</tr>
<tr>
<td>Water supply system for fire flow</td>
<td>For the construction of a water supply system for fire flow</td>
<td>18.1.2</td>
</tr>
<tr>
<td>Wildland fire–prone areas</td>
<td>For use of hazardous areas within fire-prone areas</td>
<td>17.3.2</td>
</tr>
<tr>
<td>Wood products</td>
<td>To store wood chips, hogged material, wood by-products, lumber, or plywood in excess of 200 ft³ (5.7 m³)</td>
<td>31.2</td>
</tr>
</tbody>
</table>

*Maintenance performed in accordance with this Code is not considered a modification and does not require a permit.

†Cooking and recreational fires are exempt and do not require a permit.

Table 1.12.8(b) Permit Amounts for Compressed Gases

<table>
<thead>
<tr>
<th>Type of Gas</th>
<th>Amount</th>
<th>ft³</th>
<th>m³</th>
</tr>
</thead>
<tbody>
<tr>
<td>Corrosive</td>
<td></td>
<td>200</td>
<td>0.57</td>
</tr>
<tr>
<td>Flammable</td>
<td></td>
<td>200</td>
<td>0.57</td>
</tr>
<tr>
<td>Highly toxic</td>
<td></td>
<td>Any amount</td>
<td></td>
</tr>
<tr>
<td>Inert and simple asphyxiant</td>
<td></td>
<td>6000</td>
<td>169.9</td>
</tr>
</tbody>
</table>
### Table 1.12.8(c) Permit Amounts for Cryogens

<table>
<thead>
<tr>
<th>Type of Cryogen</th>
<th>Inside Building</th>
<th>Outside Building</th>
</tr>
</thead>
<tbody>
<tr>
<td>Corrosive</td>
<td>Over 1</td>
<td>Over 1</td>
</tr>
<tr>
<td>Flammable</td>
<td>Over 1</td>
<td>60</td>
</tr>
<tr>
<td>Toxic/highly toxic</td>
<td>Over 1</td>
<td>Over 1</td>
</tr>
<tr>
<td>Nonflammable</td>
<td>60</td>
<td>500</td>
</tr>
<tr>
<td>Oxidizer (includes oxygen)</td>
<td>10</td>
<td>50</td>
</tr>
</tbody>
</table>

Note: See Chapter 63.

### Table 1.12.8(d) Permit Amounts for Hazardous Materials

<table>
<thead>
<tr>
<th>Type of Material</th>
<th>Amount</th>
<th>U.S. Unit</th>
<th>Metric Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cellulose nitrate</td>
<td>25 lb</td>
<td>11.3 kg</td>
<td></td>
</tr>
<tr>
<td>Combustible fiber</td>
<td>100 ft$^3$</td>
<td>2.8 m$^3$</td>
<td></td>
</tr>
<tr>
<td>Combustible liquids</td>
<td>See Table 1.12.8(a)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Corrosive gases</td>
<td>See Table 1.12.8(b)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Corrosive liquids</td>
<td>55 gal</td>
<td>208 L</td>
<td></td>
</tr>
<tr>
<td>Corrosive solids</td>
<td>500 lb</td>
<td>227 kg</td>
<td></td>
</tr>
<tr>
<td>Cryogens</td>
<td>See Table 1.12.8(c)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Display fireworks (1.3G)</td>
<td>Any amount</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Explosives</td>
<td>Any amount</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Flammable gases</td>
<td>See Table 1.12.8(b)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Flammable liquids</td>
<td>See Table 1.12.8(b)</td>
<td></td>
<td></td>
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<tr>
<td>Flammable solids</td>
<td>100 lb</td>
<td>45.4 kg</td>
<td></td>
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<tr>
<td>Highly toxic gases</td>
<td>See Table 1.12.8(b)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Highly toxic liquids</td>
<td>Any amount</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Highly toxic solids</td>
<td>Any amount</td>
<td></td>
<td></td>
</tr>
<tr>
<td>LP-Gas</td>
<td>See Table 1.12.8(b)</td>
<td></td>
<td></td>
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<tr>
<td>Nitrate film (cellulose)</td>
<td>Any amount</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Organic peroxides:</td>
<td>See Table 1.12.8(a)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Class I</td>
<td>Any amount</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Class II</td>
<td>Any amount</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Class III</td>
<td>10 lb</td>
<td>4.5 kg</td>
<td></td>
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<td>Class IV</td>
<td>20 lb</td>
<td>9 kg</td>
<td></td>
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<tr>
<td>Class V</td>
<td>Not required</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Unclassified detonable</td>
<td>Any amount</td>
<td></td>
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<td>Amount</td>
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<td>---------------------------------------------</td>
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</tr>
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<td></td>
<td>U.S. Unit</td>
<td>Metric Unit</td>
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<tr>
<td>Oxidizing gases</td>
<td>See Table 1.12.8(b)</td>
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<tr>
<td>Oxidizing liquids:</td>
<td>Any amount</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Class 4</td>
<td>1 gal</td>
<td>3.8 L</td>
<td></td>
</tr>
<tr>
<td>Class 3</td>
<td>10 gal</td>
<td>38 L</td>
<td></td>
</tr>
<tr>
<td>Class 2</td>
<td>55 gal</td>
<td>208 L</td>
<td></td>
</tr>
<tr>
<td>Oxidizing solids:</td>
<td>See Table 1.12.8(a)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Class 4</td>
<td>Any amount</td>
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<tr>
<td>Class 3</td>
<td>10 lb</td>
<td>4.5 kg</td>
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</tr>
<tr>
<td>Class 2</td>
<td>100 lb</td>
<td>45 kg</td>
<td></td>
</tr>
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<td>Class 1</td>
<td>500 lb</td>
<td>227 kg</td>
<td></td>
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<tr>
<td>Pyrophoric gases</td>
<td>See Table 1.12.8(b)</td>
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<tr>
<td>Pyrophoric liquids</td>
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<td>Pyrophoric solids</td>
<td>Any amount</td>
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<tr>
<td>Toxic gases</td>
<td>See Table 1.12.8(b)</td>
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<td></td>
</tr>
<tr>
<td>Toxic liquids</td>
<td>10 gal</td>
<td>38 L</td>
<td></td>
</tr>
<tr>
<td>Toxic solids</td>
<td>100 lb</td>
<td>45 kg</td>
<td></td>
</tr>
<tr>
<td>Unstable (reactive) gases</td>
<td>See Table 1.12.8(b)</td>
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<td></td>
</tr>
<tr>
<td>Unstable (reactive) liquids:</td>
<td>Any amount</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Class 4</td>
<td>Any amount</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Class 3</td>
<td>Any amount</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Class 2</td>
<td>5 gal</td>
<td>19 L</td>
<td></td>
</tr>
<tr>
<td>Class 1</td>
<td>10 gal</td>
<td>38 L</td>
<td></td>
</tr>
<tr>
<td>Unstable (reactive) solids:</td>
<td>Any amount</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Class 4</td>
<td>Any amount</td>
<td></td>
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</tr>
<tr>
<td>Class 3</td>
<td>Any amount</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Class 2</td>
<td>50 lb</td>
<td>22.7 kg</td>
<td></td>
</tr>
<tr>
<td>Class 1</td>
<td>100 lb</td>
<td>45 kg</td>
<td></td>
</tr>
<tr>
<td>Water reactive liquids:</td>
<td>Any amount</td>
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</tr>
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<td>Class 3</td>
<td>Any amount</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Class 2</td>
<td>5 gal</td>
<td>19 L</td>
<td></td>
</tr>
<tr>
<td>Class 1</td>
<td>10 gal</td>
<td>38 L</td>
<td></td>
</tr>
<tr>
<td>Water reactive solids:</td>
<td>Any amount</td>
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<td>Class 3</td>
<td>Any amount</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Class 2</td>
<td>50 lb</td>
<td>22.7 kg</td>
<td></td>
</tr>
<tr>
<td>Class 1</td>
<td>100 lb</td>
<td>45 kg</td>
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Note: See Chapter 60 for additional requirements and exceptions.

**Supplemental Information**

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<th>File Name</th>
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<td>Table_1.12_additions.docx</td>
<td>For staff use.</td>
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</table>

**Submitter Information Verification**
Submitter Full Name: Kristin Bigda
Organization: National Fire Protection Assoc

Committee Statement

Committee Statement: This revision is adding two new permitting requirements to Table 1.12.8(a). The permitting requirements coordinate with new provisions for energy storage systems in Chapter 52 and marijuana processing and extraction facilities in new Chapter 38.

Response Message:

Public Comment No. 86-NFPA 1-2016 [Section No. 1.12.8]
Public Comment No. 99-NFPA 1-2016 [Section No. 1.12.8]
3.XX Marijuana extraction facility. A building used for the solvent-based extraction process of marijuana.

3.XX Marijuana extraction equipment. Equipment or appliances used for the extraction of botanical material such as essential oils, from marijuana.

3.XX Extraction room (marijuana). The room or space in which the solvent–based extractions occur.

3.XX Observation. For the purposes of marijuana extraction equipment field verification, a practice or condition not technically noncompliant with other regulations or requirements, but could lead to noncompliance if left unaddressed.

3.XX Desolventizing. The act of removing a solvent from a material.

3.XX Miscella. A mixture, in any proportion, of the extracted oil or fat and the extracting solvent.

3.XX Transfilling. The process of transferring a gas, either in compressed or liquid form from one cylinder or container to another cylinder or container.

A.3.XX Transfilling usually occurs from a bulk container to a smaller container such as filling a small compressed gas cylinder.

3.XX Chemical fume hood: A ventilated enclosure designed to contain and exhaust fumes, gases, vapors, mists, and particulate matter generated within the hood interior. [45: 2015]
When required by the AHJ, revised construction documents or shop drawings shall be prepared and submitted for review and approval to illustrate corrections or modifications necessitated by field conditions or other revisions to approved plans, construction documents.

Submitter Information Verification

Submitter Full Name: Kristin Bigda
Organization: National Fire Protection Assoc
Street Address:
City:
State:
Zip:
Submittal Date: Thu Oct 13 08:01:13 EDT 2016

Committee Statement

Committee Statement:
This FR brings in the term "plans". This code uses "construction documents" and "shop drawings". Bringing in "plans" doesn't catch anything that construction documents and shop drawings can.

Response Message:
Public Comment No. 77-NFPA 1-2016 [Section No. 1.14.5]
1.16.4.3
Where the AHJ has not adopted a separate penalty schedule, or if state laws or rules do not specify a penalty, violations of this Code shall be subject to a $250,00 penalty per day for each violation.

Submitter Information Verification
Submitter Full Name: Kristin Bigda
Organization: [Not Specified]
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Mon Oct 03 16:48:49 EDT 2016

Committee Statement
Committee Statement: $250 for each violation is too general and subjective for a section that has no specifics. The $250 may be too much or too less to serve as a benchmark. Requiring a $100 penalty per day for each violation provides a reasonable penalty amount and necessary guidance for how to apply the penalty (per day, per violation.)

Response Message:
Public Comment No. 76-NFPA 1-2016 [Section No. 1.16.4.3]
2.2 NFPA Publications.
National Fire Protection Association, 1 Batterymarch Park, Quincy, MA 02169-7471.


<table>
<thead>
<tr>
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<tbody>
<tr>
<td>Standard Number</td>
<td>Standard Title</td>
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<tr>
<td>-----------------</td>
<td>---------------------------------------------------</td>
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<tr>
<td>NFPA 1142</td>
<td>Standard on Water Supplies for Suburban and Rural Fire Fighting</td>
</tr>
<tr>
<td>NFPA 1144</td>
<td>Standard for Reducing Structure Ignition Hazards from Wildland Fire</td>
</tr>
<tr>
<td>NFPA 1192</td>
<td>Standard on Recreational Vehicles</td>
</tr>
<tr>
<td>NFPA 1221</td>
<td>Standard for the Installation, Maintenance, and Use of Emergency Services Communications Systems</td>
</tr>
<tr>
<td>NFPA 1901</td>
<td>Standard for Automotive Fire Apparatus</td>
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<tr>
<td>NFPA 2113</td>
<td>Standard on Selection, Care, Use, and Maintenance of Flame-Resistant Garments for Protection of Industrial Personnel Against Short-Duration Thermal Exposures</td>
</tr>
</tbody>
</table>

**NFPA 5000®, Building Construction and Safety Code®, 2018 edition.**

### Submitter Information Verification

**Submitter Full Name:** Kristin Bigda  
**Organization:** National Fire Protection Assoc

### Committee Statement

**Committee Statement:** Reference update.

**Response Message:**

---

National Fire Protection Association Report

http://submittals.nfpa.org/TerraViewWeb/ContentFetcher?commentPara...
2.3.1 ANSI Publications.
American National Standards Institute, Inc., 25 West 43rd Street, 4th floor, New York, NY 10036.

Submitter Information Verification

Submitter Full Name: Kristin Bigda
Organization: [Not Specified]
Street Address:
City:
State:
Zip:
Submittal Date: Sat Oct 01 23:07:04 EDT 2016

Committee Statement

Committee Statement: Reference update. B56.1 is relocated from section with ASME references.
Response Message:
2.3.2  APA Publication.

American Pyrotechnics Association, P.O. Box 30438, Bethesda, MD 20824.


Submitter Information Verification

Submitter Full Name: Kristin Bigda
Organization: [ Not Specified ]
Street Address:
City:
State:
Zip:
Submittal Date: Sat Oct 01 23:10:21 EDT 2016

Committee Statement

Committee Statement: Reference update.
Response Message:
2.3.3  API Publications.

American Petroleum Institute, 1220 L Street, NW, Washington, DC 20005-4070.


Submitter Information Verification

Submitter Full Name: Kristin Bigda
Organization: [ Not Specified ]
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Sat Oct 01 23:14:56 EDT 2016

Committee Statement

Committee Statement: Reference update.
Response Message:
2.3.5 ASME Publications.

- American Society of Mechanical Engineers, Two Park Avenue, New York, NY 10016-5990.

Submitter Information Verification

Submitter Full Name: Kristin Bigda
Organization: [ Not Specified ]
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Sun Oct 02 07:54:12 EDT 2016

Committee Statement

Committee Statement: Reference update. Reference to ASME B56.1 was moved to Section for ANSI references as the ASME designation has been dropped.
Response Message: 

2.3.6 ASTM Publications.
ASTM D6823, Commercial Burner Fuels from Used Lube Oils, 2008.
reapproved 2013.

ASTM E2174, Standard Practice for On-Site Inspection of Installed Fire Stops, 2010a e1 2014b.


Submitter Information Verification

Submitter Full Name: Kristin Bigda
Organization: [ Not Specified ]
Street Address:
City:
State:
Zip:
Submittal Date: Sun Oct 02 09:53:07 EDT 2016

Committee Statement

Committee Statement: Reference update.
Response Message:

Public Comment No. 51-NFPA 1-2016 [Section No. 2.3.6]
Second Revision No. 5-NFPA 1-2016 [ Section No. 2.3.9 ]

2.3.9 FM Publications.

FM Global, 1301 Atwood Avenue, P.O. Box 7500, Johnston, RI 02919.


Approval Standard for Plastic Plugs for Steel Drums, Class Number 6083, October 2006.


Submitter Information Verification

Submitter Full Name: Kristin Bigda
Organization: [ Not Specified ]
Street Address:
City:
State:
Zip:
Submittal Date: Sun Oct 02 08:22:34 EDT 2016

Committee Statement

Committee Statement: Reference update.
Response Message:
Underwriters Laboratories Inc., 333 Pfingsten Road, Northbrook, IL 60062-2096.


UL 1564, Standard for Industrial Battery Chargers, 2015.
UL 2245, Standard for Below-Grade Vaults for Flammable Liquid Storage Tanks, 2006.

Submitter Information Verification

Submitter Full Name: Kristin Bigda
Organization: [ Not Specified ]
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Sun Oct 02 08:59:49 EDT 2016

Committee Statement
Committee Statement: Reference update.
Response Message:

Public Comment No. 81-NFPA 1-2016 [Section No. 2.3.17]
2.3.18  ULC Publications.
Underwriters' Laboratories of Canada, 7 Underwriters Road, Toronto, Ontario M1R 3B4, Canada.

Submitter Information Verification

Submitter Full Name: Kristin Bigda
Organization: [ Not Specified ]
Street Address:
City:
State:
Zip:
Submittal Date: Sun Oct 02 08:48:59 EDT 2016

Committee Statement

Committee Statement: Reference update.
Response Message:
Second Revision No. 6-NFPA 1-2016 [ Section No. 2.3.19 ]

2.3.19 UN Publications.

Submitter Information Verification

Submitter Full Name: Kristin Bigda
Organization: [ Not Specified ]
Street Address:
City:
State:
Zip:
Submittal Date: Sun Oct 02 08:41:18 EDT 2016

Committee Statement

Committee Statement: Reference update.
Response Message:
Second Revision No. 7-NFPA 1-2016 [Section No. 2.3.20]

2.3.20 U.S. Government Publications.
Interstate Commerce Commission (ICC), Rules for Construction of Unfired Pressure Vessels, U.S. Department of Transportation, Washington, DC.
Title 21, Code of Federal Regulations, Part 210, “Processing, Packing, or Holding Drugs; General.”
Title 21, Code of Federal Regulations, Part 211, “Current Good Manufacturing Practice for Finished Pharmaceuticals.”

Submitter Information Verification

Submitter Full Name: Kristin Bigda
Organization: [Not Specified]
Street Address:
City:
State:
Zip:
Submittal Date: Sun Oct 02 08:44:02 EDT 2016

Committee Statement

Committee Statement: Reference update.
Response Message:
2.4 References for Extracts in Mandatory Sections.


### Submitter Information Verification

**Submitter Full Name:** Kristin Bigda  
**Organization:** National Fire Protection Assoc  
**Street Address:**  
**City:**  
**State:**  
**Zip:**  
**Submittal Date:** Thu Oct 13 08:28:04 EDT 2016

### Committee Statement

**Committee:**  
**Statement:** Adding reference to NFPA 1142 per the addition of new definitions of 'rural' and 'suburban.'

**Response Message:**
Second Revision No. 68-NFPA 1-2016 [ New Section after 3.3.224 ]

3.3.232 Rural

Those areas that are not unsettled wilderness or uninhabitable territory but are sparsely populated with densities below 500 persons per square mile. [1142, 2017]

Submitter Information Verification

Submitter Full Name: Kristin Bigda
Organization: National Fire Protection Assoc
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Thu Oct 13 08:21:29 EDT 2016

Committee Statement

Committee Statement: Providing direction to the AHJ as to what is a "rural" environment and what is a "suburban" environment is important as specific exceptions are provided in Chapter 18 for structures that fall within those definitions. Without clear criteria, the AHJ is left with no guidance as to when those exceptions should apply.

Response Message:

Public Comment No. 17-NFPA 1-2016 [New Section after 3.3.281]
3.3.265* Suburb or Suburban

Those moderately inhabited areas with population densities of at least 500 persons per square mile but less than 1000 persons per square mile. [1142, 2017]

Supplemental Information

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Submitter Information Verification

Submitter Full Name: Kristin Bigda
Organization: National Fire Protection Assoc
Street Address:
City:
State:
Zip:
Submittal Date: Thu Oct 13 08:23:14 EDT 2016

Committee Statement

Committee Statement: Providing direction to the AHJ as to what is a "rural" environment and what is a "suburban" environment is important as specific exceptions are provided in Chapter 18 for structures that fall within those definitions. Without clear criteria, the AHJ is left with no guidance as to when those exceptions should apply.

Response Message:

Public Comment No. 18-NFPA 1-2016 [Section No. A.18.4.3.1.1]
A.3.3.265 Suburb or Suburban. Suburban areas can include populous towns or large villages or be located outside the official limits of a densely settled city of 2500 to 50,000 people per census block, or those areas that interface with the outer rim of an urban cluster (UC). Suburban communities usually exist within commuting distance of urban areas but exhibit their own jurisdictional autonomy. [1142, 2017]
Second Revision No. 13-NFPA 1-2016 [ Section No. 7.2 ]

7.2 Risk Analysis for Mass Notification Systems.

7.2.1 General.

Notification systems A risk analysis shall be provided in accordance with NFPA 72 and the provisions of 7.2.2 through 7.2.4.

7.2.2 Considerations.

The risk analysis required by 10.5.4.1 shall additionally address all of the following considerations:

(1) Fire and non-fire emergencies
(2) The specific nature and anticipated risks of each facility
(3) Characteristics of associated buildings, areas, spaces, campuses, equipment, and operations

7.2.3 Emergency Communications System.

An emergency communications system in accordance with NFPA 72 shall be provided where the need for such is identified by the risk analysis commensurate with the likelihood, vulnerability, magnitude, and potential consequences of emergencies.

7.2.4 Emergency Action Response Plan.

The completed emergency action plan in accordance with NFPA 72 shall be used for the design of the mass notification and emergency communication systems.

Submitter Information Verification

Submitter Full Name: Kristin Bigda
Organization: [ Not Specified ]
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Mon Oct 03 17:34:21 EDT 2016

Committee Statement

Committee Statement: This revision updates the terminology to correctly reference a risk analysis versus a notification system. Notification requirements should be detailed in Emergency Communications Systems. NFPA 72 uses the term Emergency Response Plan and should remain consistent among standards. Section 7.2.2 should remain as proposed at the First Draft.

Response Message:

Public Comment No. 9-NFPA 1-2016 [Section No. 7.2.1]
Public Comment No. 11-NFPA 1-2016 [Section No. 7.2.4]
Public Comment No. 10-NFPA 1-2016 [Section No. 7.2.2]
### Second Revision No. 14-NFPA 1-2016 [ Section No. 10.10.10 ]

<table>
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<th>10.10.10* Discontinuance.</th>
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<tbody>
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<td>The AHJ shall be authorized to require any fire or smoke to be immediately discontinued if the fire is determined to constitute a hazardous condition.</td>
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#### Supplemental Information

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#### Submitter Information Verification

- **Submitter Full Name:** Kristin Bigda
- **Organization:** [ Not Specified ]
- **Street Address:**
- **City:**
- **State:**
- **Zip:**
- **Submittal Date:** Mon Oct 03 17:46:30 EDT 2016

#### Committee Statement

- **Committee Statement:** Bon fires in densely populated urban areas can create nuisance issues to neighboring properties where smoke from the bon fires is wind driven into other homes and businesses. The AHJ should have the authority to have the fire discontinued until more appropriate and safe conditions are available.

  Annex: PI 123 raised an issue regarding the creation of a "nuisance." The change provides additional clarity as to what constitutes a potential hazardous condition under this section as well as also confirming that these determinations will need to be made on a case-by-case basis.

- **Response Message:**

  Public Comment No. 21-NFPA 1-2016 [New Section after A.10.10.9.1]

  Public Comment No. 22-NFPA 1-2016 [Section No. 10.10.10]
A.10.10.10
A hazardous condition is intended to include any fire that generates smoke or products of combustion that could obstruct visibility in traffic, create health issues, damage property, or contribute to conditions that create property, safety, or health hazards. As numerous variables can go into this determination, the authority having jurisdiction will need to evaluate each situation on a case-by-case basis.
11.1.4.1
Relocatable power taps shall be of the polarized or grounded type with overcurrent protection and shall be listed to UL 1363, Standard for Relocatable Power Taps, or UL 1363A, Outline of Investigation for Special Purpose Relocatable Power Taps, where applicable.

Submitter Information Verification

Submitter Full Name: Kristin Bigda
Organization: [ Not Specified ]
Street Address:
City:
State:
Zip:
Submittal Date: Mon Oct 03 18:20:59 EDT 2016

Committee Statement

Committee Statement: The current code language requires relocatable power taps to be listed, but does not specify what standard is to be used. Referencing specific standards for listing will clarify which relocatable power taps are suitable for specific occupancies and uses.

In addition to the current code requirements for relocatable power taps to be polarized or grounded type with overcurrent protection, which is covered in Sections 13 and 14 of ANSI/UL 1363, requiring the relocatable power taps to be listed in accordance with ANSI/UL 1363 will also address all other applicable safety requirements for relocatable power taps used in occupancies other than healthcare occupancies.

The addition of UL 1363A in this code section will address the specific requirements for relocatable power taps used in General Patient Care Areas or Critical Patient Care Areas as defined by Article 517 of the National Electrical Code for Health Care Facilities. UL 1363A, Outline of Investigation for Special Purpose Relocatable Power Taps. UL 1363A requires compliance with UL 1363, with additional requirements specific to the use, such as the use of hospital-grade receptacle outlets and plugs, and verification of electrical and mechanical integrity when used with medical equipment.

Response Message:
Public Comment No. 80-NFPA 1-2016 [Section No. 11.1.4.1]
11.9.3 The New emergency command center rooms shall be a minimum of 200 ft\(^2\) (19 m\(^2\)) with a minimum dimension of 10 ft (3050 mm).

11.9.3.1 Existing emergency command center rooms shall be maintained with the minimum square footage and dimensions previously approved by the AHJ.

Submitter Information Verification

Submitter Full Name: Kristin Bigda
Organization: [ Not Specified ]
Street Address: [ Not Specified ]
City: [ Not Specified ]
State: [ Not Specified ]
Zip: [ Not Specified ]
Submittal Date: Mon Oct 03 18:28:53 EDT 2016

Committee Statement

Committee Statement: As identified during the first draft balloting, the revised dimensions for 11.9.3 would require existing emergency command centers that were previously approved at smaller square footage or dimensions to be expanded to meet the minimums of 11.9.3. This would be an onerous code requirement to place on existing facilities and in many cases, technically infeasible. This comment revises 11.9.3 so that the language applies only to new emergency command centers. A new 11.9.3.1 is added to address existing emergency command centers and to ensure that the square footage and dimensions of such centers are not reduced unless approved by the AHJ.

Response Message:

Public Comment No. 59-NFPA 1-2016 [Section No. 11.9.3]

Where fire alarm systems are integrated with other building systems and equipment, the integrated systems shall be tested in accordance with NFPA 4.

Submitter Information Verification

Submitter Full Name: Kristin Bigda
Organization: [Not Specified]
Street Address:
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Submittal Date: Mon Oct 03 18:35:49 EDT 2016

Committee Statement

Committee Statement: The subject is addressed by newly extracted NFPA 101 text in section 13.1.3 and the applicable occupancy provisions in chapter 20. Current section 13.1.13 is not needed.
Response Message:

Public Comment No. 79-NFPA 1-2016 [Section No. 13.1.13]
18.2.3.5.1 Dimensions.

18.2.3.5.1.1* Fire department access roads shall have an unobstructed width of not less than 20 ft (6.1 m).

18.2.3.5.1.1.1* Where approved by the AHJ, the width of fire department access roads shall be permitted to be less than the minimum specified in 18.2.3.5.1.1.

18.2.3.5.1.2 Fire department access roads shall have an unobstructed vertical clearance of not less than 13 ft 6 in. (4.1 m).

18.2.3.5.1.2.1 Vertical clearance shall be permitted to be reduced where approved by the AHJ, provided such reduction does not impair access by fire apparatus, and approved signs are installed and maintained indicating the established vertical clearance when approved.

18.2.3.5.1.2.2 Vertical clearances or widths shall be increased when vertical clearances or widths are not adequate to accommodate fire apparatus.

Submitter Information Verification

Submitter Full Name: Kristin Bigda
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Street Address:
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Submittal Date: Mon Oct 03 18:40:37 EDT 2016

Committee Statement

Committee Statement: The first draft included provisions for width in the same line as vertical clearances. This was not correct formatting as width is addressed in 18.2.3.5.1.1 and not the vertical clearance section. This comment moves the width requirements to under 18.2.3.5.1.1 and renumbers the sections as 18.2.3.5.1.1.1 and 18.2.3.5.1.1.2 are modifiers to 18.2.3.5.1.1. The same renumbering has been proposed for the 18.2.3.5.1.2 section so 18.2.3.5.1.2.1 and 18.2.3.5.1.2.2 modify the main paragraph.

The committee did not accept proposed language for "apparatus anticipated obstructions" as this can be unenforceable language.

Response Message: Public Comment No. 53-NFPA 1-2016 [Section No. 18.2.3.5.1]
18.2.3.5.3 Turning Radius.

18.2.3.5.3.1 The turning radius of a fire department access road shall be as approved by the AHJ.

18.2.3.5.3.2 Turns in fire department access roads shall maintain the minimum road width.

18.2.3.5.3.3 Fire department access roads connecting to roadways shall be provided with curb cuts extending at least 2 ft (0.61 m) beyond each edge of the fire department access road.

18.2.3.5.4 Dead Ends.

Dead-end fire department access roads in excess of 150 ft (46 m) in length shall be provided with approved provisions for the fire apparatus to turn around.

18.2.3.5.5 Bridges.

18.2.3.5.5.1 When a bridge is required to be used as part of a fire department access road, it shall be constructed and maintained in accordance with nationally recognized standards.

18.2.3.5.5.2 The bridge shall be designed for a live load sufficient to carry the imposed loads of fire apparatus.

18.2.3.5.5.3 Vehicle load limits shall be posted at both entrances to bridges where required by the AHJ.

18.2.3.5.6 Grade.

18.2.3.5.6.1 The gradient for a fire department access road shall not exceed the maximum approved design limitations of the fire apparatus of the fire department and shall be subject to approval by the AHJ.

18.2.3.5.6.2* The angle of approach and departure for any means of fire department access road shall not exceed 1 ft drop in 20 ft (0.3 m drop in 6 m) or the design limitations of the fire apparatus of the fire department, and shall be subject to approval by the AHJ.

18.2.3.5.6.3 Fire department access roads connecting to roadways shall be provided with curb cuts extending at least 2 ft (0.61 m) beyond each edge of the fire department access road.

Submitter Information Verification

Submitter Full Name: Kristin Bigda
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Street Address:
City:
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Submittal Date: Mon Oct 03 18:48:05 EDT 2016
### Committee Statement

**Committee Statement:**

This comment relocates 18.2.3.5.6.3 to a new 18.2.3.5.3.3. The topic of a curb is more closely related to the section for "Turning Radius" than its existing placement in the "grade" section. Therefore, it is more appropriate for it to be under 18.2.3.5.3 than 18.2.3.5.6.

This revisions also deletes section 18.2.3.5.6.1. As written in the first draft, it is unsure what the intent of this section is relative to 18.2.3.5.6.2 nor does it provide any added value above 18.2.3.5.6.2.

The inclusion of "means of" does not appear to convey a coherent requirement. Deleting this language simplifies the intent and provides a clearer expectation.

### Response Message:

- Public Comment No. 54-NFPA 1-2016 [Sections 18.2.3.5.3, 18.2.3.5.4, 18.2.3.5.5, 18.2.3.5.6]
- Public Comment No. 55-NFPA 1-2016 [Section No. 18.2.3.5.6.1]
- Public Comment No. 56-NFPA 1-2016 [Section No. 18.2.3.5.6.2]
18.2.4.2.6.1

Electric gate operators and systems, where provided, shall be installed, maintained, listed, and labeled in accordance with UL 325, Door, Drapery, Gate, Louver, and Window Operators and Systems.

Submitter Information Verification

Submitter Full Name: Kristin Bigda
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Street Address: 
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Submittal Date: Mon Oct 03 18:58:54 EDT 2016

Committee Statement

Committee Statement: Inclusion of the word 'systems' would match the scope of UL 325 and the intent that this section cover the entire gate system and not just the operators. The revisions also adds "installed and maintained" as those are key components of UL 325 compliance.

Response Message:

Public Comment No. 57-NFPA 1-2016 [Section No. 18.2.4.2.6.1]
18.2.4.2.6.2
Gates intended for automatic operation shall be designed, constructed, and installed to comply with ASTM F2200, Standard Specification for Automated Vehicular Gate Construction.

Submitter Information Verification

Submitter Full Name: Kristin Bigda
Organization: [ Not Specified ]
Street Address:
City:
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Submittal Date: Mon Oct 03 19:11:03 EDT 2016

Committee Statement

Committee Statement: Maintenance of the gate system, in the same condition as it was installed, is imperative to ensure the long term safe operation of the gate. Otherwise, gate components could fail or be disabled and there would be no mechanism for the AHJ to address repairs or safety.

Response Message:

Public Comment No. 58-NFPA 1-2016 [Section No. 18.2.4.2.6.2]
Second Revision No. 60-NFPA 1-2016 [ Chapter 31 [Title Only] ]

Forest Products and Biomass Feedstocks

Submitter Information Verification

Submitter Full Name: Kristin Bigda
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City: 
State: 
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Submittal Date: Wed Oct 12 13:44:50 EDT 2016

Committee Statement

Committee Statement: The modification of the Chapter name is to provide for material covered by a new section to be added to the chapter dealing with biomass feedstock utilized at biomass to ethanol industrial facilities.

Response Message:
Second Revision No. 61-NFPA 1-2016 [ Section No. 31.1 ]

31.1* General.
The storage, manufacturing, and processing of timber, lumber, plywood, veneers, biomass feedstock, and by-products shall be in accordance with this chapter and NFPA 664.

Submitter Information Verification

Submitter Full Name: Kristin Bigda
Organization: National Fire Protection Assoc
Street Address:
City:
State:
Zip:

Committee Statement

Committee Statement: This revision is part of a group of changes to provide requirements addressing the exterior storage of biomass feedstock utilized for biomass to ethanol manufacturing facilities. A new section 31.3.10 is being added via a separate revision.

Response Message:
The requirements of this chapter shall apply to the outside storage of the following:

1. Lumber and wood panel products at retail and wholesale lumber storage yards
2. Lumber and wood panel products at other than retail and wholesale storage yards
3. Ties, poles, piles, posts, and other similar forest products at pressure-treating plant yards
4. Outside storage of wood chips, hogged material, and wood by-products
5. Logs
6. Outside storage of biomass feedstocks

Submitter Information Verification

Submitter Full Name: Kristin Bigda
Organization: National Fire Protection Assoc
Street Address:
City:
State:
Zip:
Submittal Date: Wed Oct 12 13:59:03 EDT 2016

Committee Statement

Committee Statement: The purpose of this revision is to add storage requirements for biomass feedstock that is utilized for the manufacturing of ethanol. The stocks could include bales of corn stover, switch grass and/or hay. The general requirements for the storage of agricultural products are not appropriate for this activity.

This revision is part of a group of changes to provide requirements addressing the exterior storage of biomass feedstock utilized for biomass to ethanol manufacturing facilities. A new section 31.3.10 is being added via a separate revision.
31.3.10 Outside Storage of Biomass Feedstock.

31.3.10.1 The fire hazard potential inherent in biomass feedstock storage operations with large quantities of combustible materials shall be controlled by a positive fire prevention program under the direct supervision of upper level management that shall include the following:

(1) Selection, design, and arrangement of storage yard areas and materials-handling equipment based upon proven fire prevention and protection principles

(2) Means for early fire detection, transmission of alarm, and fire extinguishment

(3) Establishment of control over the various factors that lead to spontaneous heating, including provisions for monitoring the internal condition of the pile

(4) Fire department access roads to separate large stacks and provide access for effective fire-fighting operations

(5) Separation of yard storage from yard buildings and other exposing properties

(6) Effective fire prevention maintenance program, including regular yard inspections by trained personnel

31.3.10.2 Bale stacks shall not exceed 25 ft (7620 mm) in height, 50 ft (15,240 mm) in width and 150 ft (45,720 mm) in length.

31.3.10.2.1 Bale stacks shall not exceed 25 ft (7.6 m) in height, 150 ft (45 m) in width, and 250 ft (76.2 m) in length.

31.3.10.3 The storage site shall be reasonably level, on solid ground.

31.3.10.4 Access to the plant and yard from public highways shall be provided by all-weather roadways capable of supporting fire department apparatus.

31.3.10.5 All sides of each storage site shall be accessible by means of fire department access roads.

31.3.10.6 Where more than one pile exists, they shall be subdivided by fire department access roads having not less than 30 ft (9 m) of clear space at the base of the piles.

31.3.10.7 Power-operated, shovel-type or scoop-type vehicles, dozers, bale movers, or similar equipment shall be available for use in moving stored material for fire fighting.

31.3.10.8 Training of the plant emergency organization also shall include procedures and precautions to be observed by yard crews employing power equipment in fighting internal fires.

31.3.10.9 Portable fire extinguishers for Class A fires shall be provided in accordance with Section 13.6 on all vehicles operating in the storage yard in addition to the normal Class B units for the vehicle.
31.3.10.10  
Lightning protection shall be provided for the outside storage yard in accordance with NFPA 780.

31.3.10.11  
Outside storage yards shall be secured against unauthorized access in an approved manner.

31.3.10.12  
Water supplies shall be provided in accordance with this Code.

Submitter Information Verification

Submitter Full Name: Kristin Bigda  
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State:  
Zip:  
Submittal Date: Wed Oct 12 14:09:32 EDT 2016

Committee Statement

Committee Statement: The purpose of this revision is to provide for the safe storage of biomass feedstock at biomass to ethanol manufacturing facilities. Existing general requirements for the storage of agricultural products are not sufficient for these types of operations. Some of the language proposed is from other comparable sections of NFPA 1. The storage arrangement dimensions is based upon current operations after shorter separation distances were found to be insufficient to retard fire spread. The requirements for securing the site in an approved manner and for the provision of lightning protection is in recognition of the two main causes of fires in this type of storage, arson and lightning strikes.

Response Message:  
Public Comment No. 3-NFPA 1-2016 [Global Input]
34.10.3* Outdoor Storage.

34.10.3.1

The storage of pallets at wood and wood composite pallets or listed pallets equivalent to wood at pallet manufacturing and pallet recycling facility sites shall comply with 34.10.4.

34.10.3.2

Idle pallets stored outside shall be stored in accordance with Table 34.10.3.2(a) and Table 34.10.3.2(b).

Table 34.10.3.2(a) Required Clearance Between Outside Idle Pallet Storage and Other Yard Storage

<table>
<thead>
<tr>
<th>Pile Size</th>
<th>Minimum Distance</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>ft</td>
</tr>
<tr>
<td>Under 50 pallets</td>
<td>20</td>
</tr>
<tr>
<td>50–200 pallets</td>
<td>30</td>
</tr>
<tr>
<td>Over 200 pallets</td>
<td>50</td>
</tr>
</tbody>
</table>

Table 34.10.3.2(b) Required Clearance Between Outside Idle Pallet Storage and Building

<table>
<thead>
<tr>
<th>Wall Construction</th>
<th>Minimum Distance of Wall from Storage</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Under 50 Pallets</td>
</tr>
<tr>
<td></td>
<td>ft</td>
</tr>
<tr>
<td>Masonry with no openings</td>
<td>0</td>
</tr>
<tr>
<td>Masonry with wired glass in openings, outside sprinklers, and 1-hour doors</td>
<td>0</td>
</tr>
<tr>
<td>Masonry with wired or plain glass, outside sprinklers, and 3/4-hour doors</td>
<td>10</td>
</tr>
<tr>
<td>Wood or metal with outside sprinklers</td>
<td>10</td>
</tr>
<tr>
<td>Wood, metal, or other</td>
<td>20</td>
</tr>
</tbody>
</table>

34.10.3.3

Idle pallet stacks shall not exceed 15 ft (4.6 m) in height nor shall cover an area of greater than 400 ft² (37 m²). Pallet stacks shall be arranged to form stable piles. A distance of not less than 8 ft (2.4 m) shall separate stacks. Piles shall be no closer than 8 ft (2.4 m) to any property line.

34.10.4 Outside Storage at Pallet Manufacturing and Pallet Recycling Facilities.

34.10.4.1*

The outside storage of pallets wood and wood composite pallets or listed pallets equivalent to wood on the same site as a pallet manufacturing or pallet recycling facility shall comply with 34.10.4.
34.10.4.2
Each site shall maintain a current site plan that includes a general description of the property, the boundaries of the lot, the size and location of all buildings, and that. The site plan shall be submitted to the authority having jurisdiction for review and approval and shall include all of the following:

1. Lot lines
2. Utilities
3. Type, size, location, and type of construction and presence of sprinkler protection for other of the buildings on the site property
4. Presence of fire protection systems
5. Water supply sources for fire-fighting purposes
6. Locations of flammable liquid hazardous material storage areas
7. Location of pallet storage
8. Equipment protected with a dust collection system
9. Fire department access routes
10. Designated smoking areas
11. Locations of fire alarm control panels

34.10.4.3
The owner or designated representative shall prepare an approved fire prevention plan for review and approval by the authority having jurisdiction, that includes all of the following:

1. Frequency of walk-through inspections to verify compliance with the approved fire prevention plan
2. Hot work permit process in accordance with Chapter 41
3. Preventive maintenance program for equipment associated with the pallet activities
4. Inspection, testing, and maintenance of fire protection systems in accordance with Chapter 13
5. Frequency of walk-through inspections to verify pallet stack height, area, and setbacks are in compliance with 34.10.4

34.10.4.4
The owner or designated representative shall prepare and train employees in an approved emergency evacuation plan in accordance with Section 10.8.

34.10.4.5
The owner or designated representative shall prepare a security management plan based on a security risk assessment and shall make the plan and assessment available to the AHJ upon request.

34.10.4.6
Unless permitted by 34.10.4.11, stacks of pallets shall not be stored within 0.75 times the stack height or 8 ft (2.4 m), whichever is greater, of any property line.

34.10.4.7
Unless permitted by 34.10.4.11, stacks of pallets shall not be stored within 0.75 times the stack height of any important building on site.

34.10.4.8
Pallet stacks shall not exceed 20 ft (6 m) in height.
34.10.4.9*

The size of pallet arrays shall comply with one of the following:

1. Where the access to the pallet array is less than 20 ft (6 m) in width but at least 8 ft (2.4 m) in width, the nearest edge of any individual pallet stack shall be no more than 30 ft (9 m) from the access.

2. Where the access to the pallet array is by a fire department access route complying with Section 18.2, the nearest edge of any individual pallet stack shall be no more than 50 ft (15 m) from the access.

3. The individual pallet stack depth from access within pallet arrays at existing facilities that exceed 34.10.4.9(1) or 34.10.4.9(2) shall be as approved by the AHJ.

34.10.4.10*

Fire flow requirements for the site shall be determined by the AHJ.

34.10.4.11

Portable fire extinguishers shall be provided within 75 ft (23 m) of any pallet stack, selected, installed, and maintained in accordance with Section 13.6.

34.10.4.12

The AHJ shall be permitted to allow pallet stacks closer to a property line or structure on site where additional fire protection is provided, including, but not limited to, the following:

1. The storage yard areas and materials-handling equipment selection, design, and arrangement are based upon an approved risk assessment.

2. Automatic fire detection transmits an alarm signal to a supervising station in accordance with NFPA 72.

3. Fire department access roads are provided around all storage areas.

Supplemental Information

File Name: SR-71_A.34.10.4.9.docx

Submitter Information Verification

Submitter Full Name: Kristin Bigda
Organization: National Fire Protection Assoc
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Submittal Date: Thu Oct 13 10:39:04 EDT 2016

Committee Statement

Committee Statement: This Second Revision incorporates several changes as proposed by the many public comments submitted on Section 34.10.3 and 34.10.4. 1. Limits the application of the provisions to wood and wood composite pallets or listed pallets equivalent to wood. The section is not intended to apply pallets that are not wood or not a listed equivalent. 2. Expands the site plan provisions to include hazardous material storage and not just flammable liquid storage. The provisions now explicitly state that the pallet storage locations are to be identified on the site plan. 3. Provides a minimum clearance to the property line of 8 ft (2.4 m). 4. Editorial clarifications, updated terminology and corrected references.
Regarding new 34.10.4.9: The proposed language controls the depth of a pallet array based upon effective fire stream discharge. Where the discharge may be from hand lines or surface master stream devices, the depth of the individual pallet stack within the pallet array is restricted by requiring that no pallet be more than 30 ft from the access provided to the pallet arrays. Where the discharge may be by engine mounted or aerial master stream devices, the depth of the pallet array is restricted such that no pallet is more than 50 ft from the fire department access route complying with 18.2 (20 ft in width).

Response Message:

Public Comment No. 65-NFPA 1-2016 [Section No. 34.10.4]
Public Comment No. 83-NFPA 1-2016 [Sections 34.10.3, 34.10.4]
Public Comment No. 82-NFPA 1-2016 [Section No. 34.10.4.8]
Public Comment No. 67-NFPA 1-2016 [Section No. 34.10.4.1]
Public Comment No. 23-NFPA 1-2016 [Section No. 34.10.4]
Public Comment No. 24-NFPA 1-2016 [Section No. 34.10.4.8]
Public Comment No. 26-NFPA 1-2016 [Section No. 34.10.4.3]
Public Comment No. 27-NFPA 1-2016 [Section No. 34.10.4.3]
Public Comment No. 25-NFPA 1-2016 [Section No. 34.10.3.1]
A.34.10.4.9
The access to the individual pallet stacks within a pallet array is based upon water stream reach. The 30 ft (9 m) depth in 34.10.4.9(1) using an 8 ft (2.4 m) wide aisle is based upon hand hose line stream reach. The 50 ft (15 m) depth in 34.10.4.9(2) is based upon master stream reach whether from a deck gun mounted upon an engine or from an aerial device.

The arrangement can be in any configuration as long the measurement to the individual pallet stack within the pallet array meets 34.10.4.9(1) or 34.10.4.9(2). The configuration can be with 8 ft or 50 ft (2.4 m or 15 m) aisle on one side, an 8 ft or 50 ft (2.4 m or 15 m) aisles on both sides, or a combination of aisle widths.
Chapter 38  Reserved  Marijuana Growing, Processing, or Extraction Facilities

38.1  Application.

38.1.1  Chapter 38 shall apply to the growing and processing of marijuana within new and existing buildings.

38.1.2  The use, storage, transfilling, and handling of hazardous materials shall comply with this chapter, and other applicable provisions of this Code.

38.1.3  Chapter 38 shall not apply to the retail sale of marijuana where growing and processing does not occur.

38.1.4  Where a material, its use, or associated process poses multiple hazards, all hazards shall be addressed in accordance with applicable requirements of this Code.

38.1.5  The occupancy of buildings or portions of buildings where the growing or processing of marijuana occurs shall be in accordance with Chapter 6 and the applicable building code.

38.2  Permits.

Permits, where required, shall comply with Section 1.12.

38.3  Fire Protection Systems.

Fire protection systems shall be provided in accordance with Chapter 13.

38.4  Means of Egress.

Means of egress shall be in accordance with Chapter 14.

38.5  Growing or Production of Marijuana.

38.5.1  Ventilation for Light Fixtures.

Light fixture ductwork shall be installed in accordance with the manufacturer and NFPA 90A.

38.5.2  Odor Control.

The use of ozone generators used for odor control shall comply with Chapter 54.

38.5.3  Interior Finish, Contents, and Furnishings.

38.5.3.1  Interior finish, including the use of any plastic, mylar, or other thin film sheeting to enclose rooms or cover any walls or ceilings shall be in accordance with Sections 12.5 and 12.6.

38.5.3.2  Hanging of plastic from ceiling or from suspended overhead structures to create wall dividers shall not be permitted.

38.5.4  Fumigation.

38.5.4.1  General.

Any marijuana growing facility that is fumigated shall comply with 38.5.4.

38.5.4.2  Sources of Ignition.

Sources of ignition shall be shut off during the fumigation activity and remain shut off until the required ventilation is completed.
38.5.4.3 Notification.

38.5.4.3.1 The AHJ and fire department shall be notified in writing not less than 48 hours before the building, structure, or space is to be closed in connection with the utilization of any toxic or flammable fumigant.

38.5.4.3.2 Notification, as required by 38.5.4.3.1, shall include the following:

1. The location of the enclosed space to be fumigated or fogged
2. The occupancy
3. The fumigants or insecticides to be utilized
4. The person or persons responsible for the operation
5. The date and time at which the operation will begin

38.5.4.3.3 Written notice of any fumigation or insecticidal fogging operation shall be given to all affected occupants of the building, structure, or space in which such operations are to be conducted with sufficient advance notice to allow the occupants to evacuate the building, structure, or space.

38.5.4.3.4 Written notice, as required by 38.5.4.3.3, shall inform the occupants as to the purposes, anticipated duration, and hazards associated with the fumigation or insecticidal fogging operation.

38.5.4.4 Signage.

38.5.4.4.1 Approved warning signs indicating the danger, type of chemical involved, and necessary precautions shall be posted on all doors and entrances to the premises, including interior rooms and areas.

38.5.4.4.2 Signage shall be located at the exterior main entry and at the entries to those areas being fumigated indicating the duration of the fumigation.

38.5.4.5 Watch Personnel.

38.5.4.5.1 During the period fumigation is in progress a watchperson shall remain on duty at the entrance or entrances to the enclosed fumigated space until after the fumigation is completed and the building, structure, or space is properly ventilated and safe for occupancy.

38.5.4.5.2 Sufficient watchpersons shall be provided to prevent any person from entering the enclosed space under fumigation unobserved.

38.5.4.6 Occupancy During Fumigation.

Occupants of the building, structure, or space to be fumigated, except the personnel conducting the fumigation, shall be evacuated from such building, structure, or space prior to commencing fumigation operations.

38.5.4.7 Sealing of Building Structure, or Space.

Paper, and other similar materials, used to wrap or cover a building, structure, or space in excess of that required for the sealing of cracks, casements, and similar openings shall meet the flame propagation performance criteria of Test Method 1 or Test Method 2 of NFPA 701.

38.5.4.8 Maintenance of Openings.

All openings to the building, structure, or space to be fumigated or fogged shall be kept securely closed during such operation.
38.5.4.9 Venting and Cleanup.
At the end of the exposure period the following procedures shall be followed:

1. Fumigators shall safely and properly ventilate the premises and contents.
2. Fumigant containers, residues, debris, and other materials used for such fumigation shall be properly disposed.
3. Obstructions shall be cleared from gas-fired appliance vents.

38.5.5 Pesticide Application.
38.5.5.1 A warning sign shall be provided to indicate that pesticides have been applied.
38.5.5.2 A record of pesticide application shall be provided and shall include the following:

1. The pesticide product or chemical used
2. The date and time the pesticide was applied
3. When the room or area is safe to reoccupy

38.6 Processing or Extraction.
38.6.1 General.
38.6.1.1 Extraction Room.
38.6.1.1.1 Extraction rooms in a marijuana extraction facility shall be constructed in accordance with the building code and this Code.

38.6.1.1.2 For other than CO$_2$ and nonhazardous extraction process, the marijuana extraction equipment and process shall be located in a room of noncombustible construction dedicated to the extraction process and the room shall not be used for any other purpose.

38.6.1.3 Marijuana extraction shall not be located in any building containing assembly, educational, day care, health care, ambulatory health care, residential board and care, residential, or detention and correctional facilities.

38.6.1.4 Means of Egress.
For extraction rooms using hazardous materials, each room shall be provided with at least one exit access door complying with the following:

1. The door shall swing in the direction of egress travel.
2. The door shall be provided with a self-closing or automatic closing device.
3. The door shall be equipped with panic or fire exit hardware.

38.6.1.2 Staffing.
38.6.1.2.1 For other than approved, unattended processes, the extraction process shall be continuously staffed.
38.6.1.2.2*
Staff monitoring the extraction process shall be trained in the following:

1. The extraction process
2. The transfer of solvents, where applicable
3. All emergency procedures

38.6.1.2.3
All staff training records shall be maintained on-site and made available to the AHJ upon request.

38.6.1.3  Operator Training.

38.6.1.3.1
In addition to the provisions of 38.6.1.2, the operator of the marijuana extraction equipment shall also receive training in safe operation of the equipment.

38.6.1.3.2*
Documentation of training required by 38.6.1.3.1 shall be maintained on-site and made available to the AHJ upon request.

38.6.1.4  Signage.

38.6.1.4.1
All applicable safety data sheets (SDS) shall be posted in the extraction room.

38.6.1.4.2
The NFPA 704 hazard rating diamond sign and no smoking signs shall be posted on the exterior of the extraction room door.

38.6.1.4.3
Applicable hazard warning signage shall be posted throughout the facility as applicable for emergency equipment.

38.6.1.5  Systems, Equipment, and Processes.

38.6.1.5.1  General.

38.6.1.5.1.1
Systems, equipment, and processes shall be in accordance with 38.6.1.5.1 through 38.6.1.5.6.3.

38.6.1.5.1.2
Systems, equipment, and processes shall include, but are not limited to, vessels, chambers, containers, cylinders, tanks, piping, tubing, valves, fittings, and pumps.

38.6.1.5.1.3
In addition to the requirements in 38.6.1.5, systems, equipment, and processes shall also comply with 60.5.1.6, other applicable provisions of this Code, the building code, and NFPA 90A.

38.6.1.5.1.4
Systems or equipment used for the extraction of marijuana/cannabis oils and products from plant material shall be performed using equipment that has been listed or approved.

38.6.1.5.2  Equipment.

38.6.1.5.2.1
Where an explosion condition exists, heating equipment such as vacuum ovens, heating mantels, heat guns, or other equipment shall not be used to heat flammable or combustible liquids or oils containing liquefied petroleum gasses.
Refrigerators, freezers, and other cooling equipment used to store or cool flammable liquids shall be listed for the storage of flammable/combustible liquids or be listed for Class I, Division 1 locations, as described in Article 501 of NFPA 70.

LPG tanks shall comply with 69.2.1.

Approval for Systems and Equipment with No Listing.

Where the system used for extraction of marijuana oils and products from plant material is not listed, the system shall have a designer of record.

The designer of record shall be a registered design professional.

Documentation for Equipment with No Listing.

For systems and equipment not listed for the specific use, a technical report in accordance with Section 1.15 documenting the design or peer review of the equipment shall be prepared and submitted to the AHJ for review and approval.

Change of Extraction Medium.

Where the medium of extraction or solvent is changed from the material indicated in the technical report or as required by the manufacturer, the technical report shall be revised at the cost of the facility owner and submitted for review and approval by the AHJ prior to the use of the equipment with the new medium or solvent.

If the original designer of record is not available, then the new designer of record shall comply with 38.6.1.5.3.

Equipment Field Verification.

Prior to operation of the extraction equipment, the designer of record for the equipment shall inspect the site of the extraction process once equipment has been installed for compliance with the technical report and the building analysis.

The designer of record performing the field verification shall provide a report of findings and observations of the site inspection to the AHJ for review and approval prior to the approval of the extraction process.

The field inspection report authored by designer of record shall include the serial number of the equipment used in the process and shall confirm the equipment installed is the same model and type of equipment identified in the technical report.

Liquified Petroleum Gas (LPG) Extraction.

Marijuana extraction facilities using liquefied petroleum gas solvents shall comply with 38.6.1 and 38.6.2.

Exhaust.

An approved exhaust system shall be provided for LPG extractions.
38.6.2.2
The exhaust systems shall be installed and maintained in accordance with NFPA 91 or the mechanical code.

38.6.2.3
All LPG extraction operations, including processes for off-gassing spent plant material and oil retrieval, shall be conducted within a chemical fume hood or enclosure in compliance with NFPA 91 or the mechanical code.

38.6.2.3 Electrical.

38.6.2.3.1
All conductive equipment and conductive objects within the exhaust room shall be bonded and grounded with a resistance of less than $1.0 \times 10^{-6}$ ohms in accordance with NFPA 70.

38.6.2.3.2
The area within a hood or enclosure used for LPG extractions shall be classified as a Class I, Division 1 hazardous location in accordance with NFPA 70.

38.6.2.3.3
Areas adjacent to Class I, Division 1 locations shall be classified in accordance with NFPA 70.

38.6.2.3.4
All electrical components within the extraction room shall be interlocked with the hazardous exhaust system such that room lighting and other extraction room electrical equipment will only operate when the exhaust system is in operation.

38.6.2.3.5
An automatic emergency power system shall be provided for the following items, when installed:

1. Extraction room lighting
2. Extraction room ventilation system
3. Solvent gas detection system

38.6.2.4 Extraction Room Gas Detection System.

38.6.2.4.1
An approved continuous gas detection system shall be provided.

38.6.2.4.2
The gas detection system shall alert the extraction operator in an approved manner at a gas detection threshold no greater than 25 percent of the gas LEL/LFL.

38.6.2.4.3
Gas detection systems shall be provided with constant noninterlocked power.

38.6.2.5 Protection.

38.6.2.5.1
An automatic suppression system shall be provided within hoods or enclosures, including ductwork, in accordance with the following:

1. An automatic water sprinkler system that meets all applicable requirements of NFPA 13
2. A carbon dioxide extinguishing system that meets all applicable requirements of NFPA 12
3. A dry chemical extinguishing system that meets all applicable requirements of NFPA 17
4. A gaseous agent extinguishing system that meets all applicable requirements of NFPA 2001

38.6.2.6 Storage.

LPG containers not in use shall not be stored within extraction rooms.
38.6.2.7  Facility Piping Systems.
LPG liquid piping systems shall be in compliance with NFPA 58.

38.6.3  Flammable and Combustible Liquid Extraction.

38.6.3.1  General.
Marijuana extraction facilities using flammable and combustible liquid solvents shall comply with 38.6.1 and 38.6.3.

38.6.3.2  Exhaust.
38.6.3.2.1  Extraction and post oil processing operations, including dispensing of flammable liquids between containers, shall be performed in one of the following locations:

(1) A chemical fume hood in accordance with Chapter 7 of NFPA 45.
(2) An approved exhaust system installed in accordance with NFPA 91 or the mechanical code.

38.6.3.2.2  Unheated processes at atmospheric pressure using less than 16 oz (473 ml) of flammable liquids shall not be required to comply with 38.6.3.2.1.

38.6.3.3  Classified electrical systems shall be in accordance with NFPA 70.

38.6.3.4  All electrical components within the chemical fume hood or exhausted enclosure shall be interlocked such that the exhaust system shall be in operation for lighting and components to be used.

38.6.4  Carbon Dioxide Extraction.

38.6.4.1  General.
Marijuana extraction facilities using carbon dioxide solvents shall comply with 38.6.1 and 38.6.4.

38.6.4.2  Storage and Handling.
All CO₂ compressed gas cylinders shall be secured to a fixed object to prevent falling.

38.6.4.3  CO₂ Gas Detection.
38.6.4.3.1  An approved, listed CO₂ detector shall be installed in the CO₂ extraction room.

38.6.4.3.2  Auto calibrating and self-zeroing devices or detectors shall be prohibited.

38.6.4.3.3  The detector shall be set to alarm at 5000 ppm of CO₂.

38.6.4.4  CO₂ Discharges.
The extraction equipment pressure relief devices and blow-off valves shall be piped to the exterior of the building.
Transfilling.

Filling LPG extraction equipment supply containers shall be in compliance with 69.3.5, 69.4.2, and NFPA 58.

Supplemental Information

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Submitter Information Verification

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Committee Statement

Committee Statement: New Chapter 38 is a result of year long task group work to develop a new Chapter which provides safety requirements for marijuana growing, processing, and extraction facilities. The Committee provided language for a new chapter as a Committee Input during the First Draft stage. After the First Draft meeting a task group was formed consisting of both Technical Committee members and industry experts who volunteered their time over the year to further develop and refine the chapter.

This new chapter is a direct result of requests from the industry for guidance in the Fire Code on the requirements necessary to protect marijuana growing, processing, and extraction facilities. There are several hazards that make these facilities unique (use of hazardous materials as solvents, fumigation, special systems and equipment, staff training, transfilling LPG) and this Chapter focuses on those hazards while pointing users to other sections in the Code for provisions that can be applied generically (fire protection systems, means of egress, occupancy classification, hazardous materials.)

The Chapter is broken down into seven subsections:

38.1 Application
38.2 Permits
38.3 Fire Protection Systems
38.4 Means of Egress
38.5 Growing or Production of Marijuana
38.6 Processing or Extraction
38.7 Transfilling

Section 38.5 includes provisions for the growing and production of marijuana which includes: ventilation, light fixtures, interior finish and contents, fumigation and pesticide application.

Section 38.6 addresses provisions for processing or extraction of marijuana which include: systems, equipment and processes, documentation of systems and equipment, and equipment field
verification applicable to all extraction processes as well as solvent specific provisions which are divided into three sections for Liquefied Petroleum Gas, Flammable and Combustible Liquids, and CO2.

Response
Message:
Public Comment No. 4-NFPA 1-2016 [Global Input]
Public Comment No. 64-NFPA 1-2016 [Chapter 46]
A.38.1
Processing of other agricultural products not addressed by this chapter should comply with other applicable sections of this Code.

A.38.1.1
For the purposes of this Code, the term marijuana includes all forms of cannabis, including hemp.

A.38.1.5
Occupancy classification should take into consideration the hazards associated with the process occurring in the facility and the quantities of high-hazard contents.

A.38.4
Due to security of growing and processing operations, access control, electromagnetic locks, and other locking arrangements are used. Chapter 14 addresses the installation of specialized locking devices.

A.38.5.4.1
Fumigation for marijuana growing, processing, or extraction facility includes the production or use of sulfur dioxide.

A.38.5.4.2
Fires, open flames, and similar sources of ignition should be eliminated from the space under fumigation or insecticidal fogging. Electricity in any part of the building, structure, or space where operation of switches or electrical devices, equipment, or systems could serve as a source of ignition should be shut off. In addition, electronic devices, including portable equipment and cellular phones, should be shut off and telephone lines should be disconnected from telephones.

A.38.6
Flammable or combustible liquids, flammable gases, liquefied petroleum gases, or nonflammable gases used in extraction processing of oils and fats are hereinafter referred to as “solvents.”

The extraction process includes extracting the oils and fats by use of a solvent, desolventizing the raw material and producing the miscella, distilling the solvent from the miscella, and recovering the solvent.

A.38.6.1.1.2
The dedicated room should not be used for any other purpose, including storage. Materials that might interfere with the operation of exhaust systems should be prohibited, such as acoustical ceiling tiles.

A.38.6.1.4
Examples of rooms using hazardous materials for extraction are those using flammable and combustible liquids and CO₂.

A.38.6.1.2.1
Nonhazardous processes might not warrant constant attendance by trained personnel.

A.38.6.1.2.2
Staff monitoring the extraction process do not need to meet the training requirements of 38.6.1.3.

A.38.6.1.2.2(2)
The transfer of solvent includes LPG liquid transfilling.
A.38.6.1.3.2

Examples of these programs include, but are not limited to, the following:

1. Training programs developed by extraction equipment manufacturers
2. Compressed Gas Association CGA P-1, *Safe Handling of Compressed Gases in Containers*, for operators of CO₂ equipment
3. Programs by governmental organizations

A.38.6.1.5.2.3

The provisions for container (i.e., tank) construction are applicable to the working tank or the supply tank that is connected to the extraction equipment.

A.38.6.1.5.4

The technical report documenting the design or peer review should be submitted for review and approval to the AHJ prior to the equipment being located or installed at the facility.

Where a technical report is required to be submitted for review and approval by the AHJ, the following should occur:

1. Prior to submittal of the technical report, the engineer should submit to the AHJ any educational background and professional experience specific to the review and approval of system, equipment, and processes with like hazards of those associated with the marijuana extraction system.
2. Once the proof of qualifications are found acceptable by the AHJ, the engineer of record should produce the technical report and the report should be signed and sealed in accordance with respective state requirements.

All of, but not limited to, the following items should be included in the technical report:

1. Manufacturer information.
2. Engineer of record information.
3. Date of review and report revision history.
4. Signature page, which should include the following:
   (a) Author of the report
   (b) Date of report
   (c) Seal, date, and signature of engineer of record performing the design or peer review
   (d) Date and signature of the engineer performing the engineering check of the report (which cannot be performed by the authoring engineer though it can be from the same firm as the authoring engineer)
5. Model number of the item evaluated. If the equipment is provided with a serial number, the serial number should be included for verification at time of site inspection.
6. Methodology of the design or peer review process used to determine minimum safety requirements. Methodology should consider the basis of design, and should include a code analysis and code path to demonstrate the reason as to why specific code or standards are applicable or not.
Equipment description. A list of all components and subassemblies of the system or equipment, indicating the materials, solvent compatibility, maximum temperature, and pressure limits.

A general flow schematic or general process flow diagram (PFD) of the process. All primary components of the process equipment should be identified and match the aforementioned list. Operating temperatures, pressures, and solvent state of matter should be identified in each primary step or component. A piping and instrumentation diagram (PID or PI&D) might be provided but is not required.

Analysis of the vessel(s) if pressurized beyond standard atmospheric pressure. Analysis should include purchased and fabricated components.

Structural analysis for the frame system supporting the equipment.

Process safety analysis of the extraction equipment, from the introduction of raw product to the end of the extraction process.

Comprehensive process hazard analysis considering failure modes and points of failure throughout the process. This portion of the review should include review of emergency procedure information provided by the manufacturer of the equipment or process and not that of the facility, building, or room.

Review of the assembly instructions, and operational and maintenance manuals provided by the manufacturer.

Findings and observations of the analysis.

List of references used in the analysis.

If the technical report or manufacturer’s literature indicate specific requirements for the location, room, space, or building where the extraction process is to occur, the engineer of record, as approved, should review the construction documents of such location, room, space, or building and provide a report of their findings and observations to the AHJ.

The findings and observations should include the following:

1. Process safety analysis of the entire process from raw material to finished product.
2. Comprehensive process hazard analysis considering failure modes and points throughout the process and a review of emergency procedures as related to the equipment or process and the facility.

A.38.6.2.4.2

The purpose of alerting the extraction operator is to provide notification that the operator is in a flammable environment because the LP gas used is not odorized. This could be in the form of a visual warning, local alarm, or other approved means. However, it is not intended for evacuation or to dispatch the fire department.

A.38.6.3.2.1

The intent of this section is to require an exhaust system utilization to capture velocities across the work area. Standard laboratory capture velocity is between 80 and 100 ft/min (24 and 30 m/min).

Most flammable liquid extractions and post oil processing are bench-top process that can be conducted in a chemical fume hood. Larger operations might need larger hoods or special full-room exhaust systems in compliance with NFPA 91 or the mechanical code. The exception is intended for small unheated processes where plant material might be soaked in flammable liquid and directly transferred to a food product.

A.38.6.4.4
Exhaust piping can be of the flexible type as long as the piping or hose is capable of handling the force of the exhaust. Relief devices include spring-loaded pressure relief valves or rupture disks.

A.38.7

The intent of this section is for filling the working container (i.e., tank) connected to the extraction equipment.
Chapter 40 Dust Explosion and Fire Prevention

40.1 General Application.

Equipment, processes, and operations that involve the manufacture, processing, blending, repackaging, or handling of combustible particulate solids or combustible dusts regardless of concentration or particle size shall be installed and maintained in accordance with this chapter and the following standards as applicable:

- NFPA 61, Standard for the Prevention of Fires and Dust Explosions in Agricultural and Food Processing Facilities
- NFPA 69, Standard on Explosion Prevention Systems
- NFPA 85, Boiler and Combustion Systems Hazards Code
- NFPA 120, Standard for Fire Prevention and Control in Coal Mines
- NFPA 484, Standard for Combustible Metals
- NFPA 652, Standard on the Fundamentals of Combustible Dust
- NFPA 654, Standard for the Prevention of Fire and Dust Explosions from the Manufacturing, Processing, and Handling of Combustible Particulate Solids
- NFPA 655, Standard for Prevention of Sulfur Fires and Explosions
- NFPA 664, Standard for the Prevention of Fires and Explosions in Wood Processing and Woodworking Facilities

40.1.1 All facilities and operations that manufacture, process, blend, convey, repackage, generate, or handle combustible dusts or combustible particulate solids shall be in compliance with NFPA 652 and, as applicable, NFPA 61, NFPA 69, NFPA 85, NFPA 120, NFPA 484, NFPA 654, NFPA 655, and NFPA 664.

40.2 Permits.

Permits, where required, shall comply with Section 1.12.

40.3 Retroactivity.

This chapter shall apply to new and existing facilities and processes. [652: 9.1]

40.3.1 Existing facilities shall perform a dust hazards analysis (DHA) in accordance with Chapter 7 of NFPA 652.

40.4* General.

The procedures and training in this chapter shall be delivered in a language that the participants can understand. [652: 9.2]

40.5 Operating Procedures and Practices.

40.5.1* The owner/operator shall establish written procedures for operating its facility and equipment to prevent or mitigate fires, deflagrations, and explosions from combustible particulate solids. [652: 9.3.1]

40.5.2* The owner/operator shall establish safe work practices to address hazards associated with maintenance and servicing operations. [652: 9.3.2]
40.5.2.1
The safe work practices shall apply to employees and contractors. [652: 9.3.2.1]

40.6  Inspection, Testing, and Maintenance.

40.6.1*
Equipment affecting the prevention, control, and mitigation of combustible dust fires, deflagrations, and explosions shall be inspected and tested in accordance with the applicable NFPA standard and the manufacturers' recommendations. [652: 9.4.1]

40.6.2
The inspection, testing, and maintenance program shall include the following:

(1) Fire and explosion protection and prevention equipment in accordance with the applicable NFPA standards
(2) Dust control equipment
(3) Housekeeping
(4) Potential ignition sources
(5)* Electrical, process, and mechanical equipment, including process interlocks
(6) Process changes
(7) Lubrication of bearings

[652: 9.4.2]

40.6.3
The owner/operator shall establish procedures and schedules for maintaining safe operating conditions for its facility and equipment in regard to the prevention, control, and mitigation of combustible dust fires and explosions. [652: 9.4.3]

40.6.4*
Where equipment deficiencies that affect the prevention, control, and mitigation of dust fires, deflagrations, and explosions are identified or become known, the owner/operator shall establish and implement a corrective action plan with an explicit deadline. [652: 9.4.4]

40.6.5*
Inspections and testing activities that affect the prevention, control, and mitigation of dust fires, deflagrations, and explosions shall be documented. [652: 9.4.5]

40.6.6
A thorough inspection of the operating area shall take place on an as-needed basis to help ensure that the equipment is in safe operating condition and that proper work practices are being followed. [652: 9.4.6]

40.7  Training and Hazard Awareness.

40.7.1*
Employees, contractors, temporary workers, and visitors shall be included in a training program according to the potential exposure to combustible dust hazards and the potential risks to which they might be exposed or could cause. [652: 9.5.1]

40.7.2*
General safety training and hazard awareness training for combustible dusts and solids shall be provided to all affected employees. [652: 9.5.2]

40.7.2.1*
Job-specific training shall ensure that employees are knowledgeable about fire and explosion hazards of combustible dusts and particulate solids in their work environment. [652: 9.5.2.1]

40.7.2.2
Employees shall be trained before taking responsibility for a task. [652: 9.5.2.2]
**40.7.2.3**
Where explosion protection systems are installed, training of affected personnel shall include the operations and potential hazards presented by such systems. [652: 9.5.2.3]

**40.7.3**
Refresher training shall be provided as required by the AHJ and as required by other relevant industry- or commodity-specific NFPA standards. [652: 9.5.3]

**40.7.4**
The training shall be documented. [652: 9.5.4]

**40.8** Contractors.

**40.8.1**
Owner/operators shall ensure the requirements of Section 40.8 are met. [652: 9.6.1]

**40.8.2**
Only qualified contractors shall be employed for work involving the installation, repair, or modification of buildings (interior and exterior), machinery, and fire and explosion protection equipment that could adversely affect the prevention, control, or mitigation of fires and explosions. [652: 9.6.2]

**40.8.3** Contractor Training.

**40.8.3.1**
Contractors operating owner/operator equipment shall be trained and qualified to operate the equipment and perform the work. [652: 9.6.3.1]

**40.8.3.2**
Contractor training shall be documented. [652: 9.6.3.2]

**40.8.3.3**
Contractors working on or near a given process shall be made aware of the potential hazards from and exposures to fires and explosions. [652: 9.6.3.3]

**40.8.3.4**
Contractors shall be trained and required to comply with the facility’s safe work practices and policies in accordance with 40.5.2. [652: 9.6.3.4]

**40.8.3.5**
Contractors shall be trained on the facility’s emergency response and evacuation plan, including, but not limited to, emergency reporting procedures, safe egress points, and evacuation area. [652: 9.6.3.5]

**40.9** Emergency Planning and Response.

**40.9.1**
A written emergency response plan shall be developed for preparing for and responding to work-related emergencies including, but not limited to, fire and explosion. [652: 9.7.1]

**40.9.2**
The emergency response plan shall be reviewed and validated at least annually. [652: 9.7.2]

**40.10** Incident Investigation.

**40.10.1**
The owner/operator shall have a system to ensure that incidents that result in a fire, deflagration, or explosion are reported and investigated in a timely manner. [652: 9.8.1]

**40.10.2**
The investigation shall be documented and include findings and recommendations. [652: 9.8.2]

**40.10.3**
A system shall be established to address and resolve the findings and recommendations. [652: 9.8.3]
40.10.4*
The investigation findings and recommendations shall be reviewed with affected personnel. [652: 9.8.4]

40.11 Management of Change.

40.11.1*
Written procedures shall be established and implemented to manage proposed changes to process materials, staffing, job tasks, technology, equipment, procedures, and facilities. [652: 9.9.1]

40.11.2
The procedures shall ensure that the following are addressed prior to any change:

(1)* The basis for the proposed change
(2)* Safety and health implications
(3) Whether the change is permanent or temporary, including the authorized duration of temporary changes
(4) Modifications to operating and maintenance procedures
(5) Employee training requirements
(6) Authorization requirements for the proposed change
(7) Results of characterization tests used to assess the hazard, if conducted

[652: 9.9.2]

40.11.3*
Implementation of the management of change procedure shall not be required for replacements-in-kind. [652: 9.9.3]

40.11.4
Design and procedures documentation shall be updated to incorporate the change. [652: 9.9.4]

40.12* Documentation Retention.

40.12.1
The owner/operator shall establish a program and implement a process to manage the retention of documentation, including, but not limited to, the following:

(1) Training records
(2) Equipment inspection, testing, and maintenance records
(3)* Incident investigation reports
(4) Dust hazards analyses
(5)* Process and technology information
(6)* Management of change documents
(7) Emergency response plan documents
(8)* Contractor records

[652: 9.10.1]

40.13 Management Systems Review.

40.13.1
The owner/operator shall evaluate the effectiveness of the management systems presented in this standard by conducting a periodic review of each management system. [652: 9.11.1]

40.13.2
The owner/operator shall be responsible for maintaining and evaluating the ongoing effectiveness of the management systems presented in this standard. [652: 9.11.2]
40.14* Employee Participation.

Owner/operators shall establish and implement a system to consult with and actively involve affected personnel and their representatives in the implementation of this standard. [652: 9.2]

40.3 Fugitive Dust Control and Housekeeping.

40.3.1 Fugitive Dust Control.

40.3.1.1 Continuous suction to minimize the escape of dust shall be provided for processes where combustible dust is liberated in normal operation. [654: 8.1.1]

40.3.1.2 The dust shall be conveyed to air-material separators. [654: 8.1.2]

40.3.2 Housekeeping.

All requirements of 40.3.2.1 through 40.3.2.3 shall be applied retroactively. [654: 8.2]

40.3.2.1 Cleaning Frequency.

40.3.2.1.1 Where the facility is intended to be operated with less than the dust accumulation defined by the owner/operator's chosen criterion in Section 6.1 of NFPA 654, the housekeeping frequency shall be established to ensure that the accumulated dust levels on walls, floors, and horizontal surfaces such as equipment, ducts, pipes, hoods, ledges, beams, and above suspended ceilings and other concealed surfaces, such as the interior of electrical enclosures, does not exceed the threshold dust mass/accumulation. [654: 8.2.1.1]

40.3.2.1.2 Where the facility is intended to be operated with less than the dust accumulation defined by the owner/operator's chosen criterion in Section 6.1 of NFPA 654, a planned inspection process shall be implemented to evaluate dust accumulation rates and the housekeeping frequency required to maintain dust accumulations below the threshold dust mass/accumulation. [654: 8.2.1.2]

40.3.2.1.3 Where the facility is intended to be operated with less than the dust accumulation defined by the owner/operator's chosen criterion in Section 6.1 of NFPA 654, the housekeeping procedure shall include specific requirements establishing time to clean local spills or short-term accumulation to allow the elimination of the spilled mass or accumulation from the calculations in Section 6.1 of NFPA 654. [654: 8.2.1.3]

40.3.2.1.4 Where the facility is intended to be operated with more than the dust accumulation defined by the owner/operator's chosen criterion in Section 6.1 of NFPA 654, a documented risk evaluation acceptable to the AHJ shall be permitted to be conducted to determine the level of housekeeping consistent with any dust explosion and dust flash fire protection measures provided in accordance with Section 6.4 and 11.2.2 of NFPA 654. [654: 8.2.1.4]

40.3.2.2 Cleaning Methods.

40.3.2.2.1 Surfaces shall be cleaned in a manner that minimizes the risk of generating a fire or explosion hazard. [654: 8.2.2.1]

40.3.2.2.2 Vacuuming shall be the preferred method of cleaning. [654: 8.2.2.2]

40.3.2.2.3 Where vacuuming is impractical, permitted cleaning methods shall include sweeping and water wash-down. [654: 8.2.2.3]
40.3.2.2.4

Blow-downs using compressed air or steam shall be permitted to be used for cleaning inaccessible surfaces or surfaces where other methods of cleaning result in greater personal safety risk. Where blow-down using compressed air is used, the following precautions shall be followed:

Vacuuming, sweeping, or water wash-down methods are first used to clean surfaces that can be safely accessed prior to using compressed air.

Dust accumulations in the area after vacuuming, sweeping, or water wash-down do not exceed the threshold dust accumulation.

Compressed air hoses are equipped with pressure relief nozzles limiting the discharge gauge pressure to 30 psi (207 kPa) in accordance with the OSHA requirements in 29 CFR 1910.242(b), “Hand and Portable Power Tools and Equipment, General.”

All electrical equipment potentially exposed to airborne dust in the area meets, as a minimum, the requirements of NFPA70, NEMA 12 as defined by NEMA 250; or the equivalent.

All ignition sources and hot surfaces capable of igniting a dust cloud or dust layer are shut down or removed from the area.

40.3.2.2.5

Housekeeping procedures shall be documented in accordance with the requirements of Sections 4.2 and 4.3 of NFPA 654. [654: 8.2.2.5]

40.3.2.3 Portable Vacuum Cleaners.

40.3.2.3.1 Portable vacuum cleaners that meet the following minimum requirements shall be permitted to be used to collect combustible particulate solids:

Materials of construction shall comply with 7.13.2 and 9.3.2 of NFPA 654.

Hoses shall be conductive or static dissipative.

All conductive components, including wands and attachments, shall be bonded and grounded.

Dust-laden air shall not pass through the fan or blower.

Electrical motors shall not be in the dust-laden air stream unless listed for Class II, Division 1 locations.

When liquids or wet material are picked up by the vacuum cleaner, paper filter elements shall not be used.

Vacuum cleaners used for metal dusts shall meet the requirements of NFPA 484.

40.3.2.3.2 In Class II electrically classified (hazardous) locations, vacuum cleaners shall be listed for the purpose and location or shall be a fixed-pipe suction system with remotely located exhauster and air-material separator installed in conformance with Section 7.13 of NFPA 654, and shall be suitable for the dust being collected. [654: 8.2.3.2]

40.3.2.3.3 Where flammable vapors or gases are present, vacuum cleaners shall be listed for Class I and Class II hazardous locations. [654: 8.2.3.3]

4.4 Ignition Sources.

4.4.1 Heat from Mechanical Sparks and Friction.
40.4.1.1 Risk Evaluation.
A documented risk evaluation acceptable to the AHJ shall be permitted to be conducted to determine the level of protection to be provided according to this chapter. [654: 9.1.1]

40.4.1.2 Foreign Materials.
40.4.1.2.1 Means shall be provided to prevent foreign material from entering the system when such foreign material presents an ignition hazard. [654: 9.1.2.1]

40.4.1.2.2 Floor sweepings shall not be returned to any machine. [654: 9.1.2.2]

40.4.1.2.3 Foreign materials, such as tramp metal, that are capable of igniting combustible material being processed shall be removed from the process stream by one of the following methods:
- Permanent magnetic separators or electromagnetic separators that indicate loss of power to the separators
- Pneumatic separators
- Grates or other separation devices

[654: 9.1.2.3]

40.4.1.3 Inherently Ignitible Process Streams.
40.4.1.3.1 Where the process is configured such that the pneumatic conveying, dust collection, or centralized vacuum cleaning system conveys materials that can act as an ignition source, means shall be provided to minimize the hazard. [654: 9.1.3.1]

40.4.1.3.2 The means used to minimize the ignition source hazard specified in 40.4.1.3.1 shall be permitted to include protection measures identified in 7.1.1 and Section 10.1 of NFPA 654, as appropriate. [654: 9.1.3.2]

40.4.1.4 Belt Drives.
Belt drives shall be designed to stall without the belt's slipping, or a safety device shall be provided to shutdown the equipment if slippage occurs. [654: 9.1.4]

40.4.1.5 Bearings.
40.4.1.5.1 Roller or ball bearings shall be used on all processing and transfer equipment. [654: 9.1.5.1]

40.4.1.5.2 Bushings shall be permitted to be used when a documented engineering evaluation shows that mechanical loads and speeds preclude ignition due to frictional heating. [654: 9.1.5.2]

40.4.1.5.3 Lubrication shall be performed in accordance with the manufacturer's recommendations. [654: 9.1.5.3]

40.4.1.6 Equipment.
Equipment with moving parts shall be installed and maintained so that true alignment is maintained and clearance is provided to minimize friction. [654: 9.1.6]

40.4.2 Electrical Equipment.
All electrical equipment and installations shall comply with the requirements of Section 6.6 of NFPA 654. [654: 9.2]

40.4.3 Static Electricity.
The requirements of 40.4.3.1 through 40.4.3.1.4 shall be applied retroactively. [654: 9.3]

40.4.3.1

For electrostatic hazard assessment purposes, MIE determination of dust clouds shall be based on a purely capacitive discharge circuit in accordance with ASTM E2019, Standard Test Method for Minimum Ignition Energy of a Dust Cloud in Air. [654: 9.3.1]

40.4.3.2 Conductive Components.

40.4.3.2.1

All system components shall be conductive. [654: 9.3.2.1]

40.4.3.2.2

Nonconductive system components shall be permitted where all of the following conditions are met:

- Hybrid mixtures are not present.
- Conductive dusts are not handled.
- The MIE of the material being handled is greater than 3 mJ.
- The nonconductive components do not result in isolation of conductive components from ground.
- The breakdown strength across nonconductive sheets, coatings, or membranes does not exceed 4 kV when used in high surface charging processes.

[654: 9.3.2.2]

40.4.3.2.3

Bonding and grounding with a resistance of less than $1.0 \times 10^6$ ohms to ground shall be provided for conductive components. [654: 9.3.2.3]

40.4.3.3

Where belt drives are used, the belts shall be electrically conductive and have a resistance of less than $1.0 \times 10^6$ ohms to ground. [654: 9.3.3]

40.4.3.4 Flexible Intermediate Bulk Containers (FIBCs).

FIBCs shall be permitted to be used for the handling and storage of combustible particulate solids in accordance with the requirements in 40.4.3.4.1 through 40.4.3.4.7. [654: 9.3.4]

40.4.3.4.1

Electrostatic ignition hazards associated with the particulate and objects surrounding or inside of the FIBC shall be included in the process hazard analysis required by Section 4.2 of NFPA 654. [654: 9.3.4.1]

40.4.3.4.2

Type A FIBCs shall be limited to use with noncombustible particulate solids or combustible particulate solids having MIE $>1000$ mJ. [654: 9.3.4.2]

40.4.3.4.2.1

Type A FIBCs shall not be used in locations where flammable vapors are present. [654: 9.3.4.2.1]

40.4.3.4.2.2

Type A FIBCs shall not be used with conductive particulate solids. [654: 9.3.4.2.2]

40.4.3.4.3

Type B FIBCs shall be permitted to be used where combustible dusts having MIE $>3$ mJ are present. [654: 9.3.4.3]

40.4.3.4.3.1

Type B FIBCs shall not be used in locations where flammable vapors are present. [654: 9.3.4.3.1]
40.4.3.4.2
Type B FIBCs shall not be used for conductive particulate solids. [654: 9.3.4.3.2]

40.4.3.4.4
Type C FIBCs shall be permitted to be used with combustible particulate solids and in locations where flammable vapors having MIE >0.14 mJ are present. [654: 9.3.4.4]

40.4.3.4.4.1
Conductive FIBC elements shall terminate in a grounding tab, and resistance from these elements to the tab shall be less than $10^8$ ohms. [654: 9.3.4.4.1]

40.4.3.4.4.2
Type C FIBCs shall be grounded during filling and emptying operations with a resistance to ground of less than 25 ohms. [654: 9.3.4.4.2]

40.4.3.4.4.3
Type C FIBCs shall be permitted to be used for conductive particulate solids. [654: 9.3.4.4.3]

40.4.3.4.5
Type D FIBCs shall be permitted to be used with combustible particulate solids and in locations where flammable vapor atmospheres having MIE >0.14 mJ are present. [654: 9.3.4.5]

40.4.3.4.5.1
Type D FIBCs shall not be permitted to be used for conductive particulate solids. [654: 9.3.4.5.1]

40.4.3.4.6
Type B, Type C, and Type D FIBCs shall be tested and verified as safe for their intended use by a recognized testing organization in accordance with the requirements and test procedures specified in IEC 61340-4-4, Electrostatics — Part 4.4: Standard Test Methods for Specific Applications — Electrostatic Classification of Flexible Intermediate Bulk Containers, before being used in hazardous environments. [654: 9.3.4.6]

40.4.3.4.6.1
Intended use shall include both the product being handled and the environment in which the FIBC will be used. [654: 9.3.4.6.1]

40.4.3.4.6.2
Materials used to construct inner baffles, other than mesh or net baffles, shall meet the requirements for the bag type in which they are to be used. [654: 9.3.4.6.2]

40.4.3.4.6.3
Documentation of test results shall be made available to the AHJ. [654: 9.3.4.6.3]

40.4.3.4.6.4
FIBCs that have not been tested and verified for type in accordance with IEC 61340-4-4, Electrostatics — Part 4.4: Standard Test Methods for Specific Applications — Electrostatic Classification of Flexible Intermediate Bulk Containers, shall not be used for combustible dusts or in flammable vapor atmospheres. [654: 9.3.4.6.4]

40.4.3.4.7
Deviations from the requirements in 40.4.3.4.1 through 40.4.3.4.6 for safe use of FIBCs shall be permitted upon expert review and a documented risk assessment acceptable to the AHJ. [654: 9.3.4.7]

40.4.3.5
Rigid Intermediate Bulk Containers (RIBC).

40.4.3.5.1
Conductive RIBCs shall be permitted to be used for dispensing into any flammable vapor, gas, dust, or hybrid atmospheres provided that the RIBC is electrically grounded. [654: 9.3.5.1]
40.4.3.5.2
Nonconductive RIBCs shall not be permitted to be used for applications, processes, or operations involving combustible particulate solids or where flammable vapors or gases are present unless a documented risk evaluation assessing the electrostatic hazards is acceptable to the AHJ. \[654: 9.3.5.2\]

40.4.3.6
Particulate solids shall not be manually dumped directly into vessels containing flammable atmospheres (gases at a flammable concentration with an oxidant) or where displacement could cause a flammable atmosphere external to the vessel. \[654: 9.3.6\]

40.4.3.7
Manual additions of solids through an open port or a manway into a vessel containing flammable atmospheres shall be permitted to be done in 50 lb (25 kg) batches or smaller, provided the requirements of 40.4.3.7.1 through 40.4.3.7.7 are satisfied. \[654: 9.3.7\]

40.4.3.7.1
Conductive or static-dissipative components of the container shall be grounded. \[654: 9.3.7.1\]

40.4.3.7.2
Direct emptying of powders from nonconductive plastic bags into a vessel that contains a flammable atmosphere shall be strictly prohibited. \[654: 9.3.7.2\]

40.4.3.7.3
The use of nonconductive liners in grounded conductive or static-dissipative outer packaging shall be permitted, provided that the liner thickness is less than 0.08 in. (2 mm) and the liner cannot become detached during emptying. \[654: 9.3.7.3\]

40.4.3.7.4
Loading chutes, receiving vessels, and auxiliary devices used for addition of bulk material shall be conductive and grounded. \[654: 9.3.7.4\]

40.4.3.7.5
Personnel in the vicinity of openings of vessels that contain flammable atmospheres shall be grounded. \[654: 9.3.7.5\]

40.4.3.7.6
Operators shall wear flame-resistant garments as specified in NFPA 2113 and any other personal protective equipment required for protection against flash fire hazards during charging operations. \[654: 9.3.7.6\]

40.4.3.7.7
A documented risk evaluation acceptable to the AHJ shall be conducted to determine additional engineering and administrative controls necessary to protect against ignition of the flammable atmosphere. \[654: 9.3.7.7\]

40.4.4 Cartridge-Actuated Tools.
The requirements of 40.4.4.1 through 40.4.4.3 shall be applied retroactively. \[654: 9.4\]

40.4.4.1
Cartridge-actuated tools shall not be used in areas where combustible material is produced, processed, or present unless all machinery is shut down and the area is cleaned and inspected to ensure the removal of all accumulations of combustible material. \[654: 9.4.1\]

40.4.4.2
Accepted lockout/tagout procedures shall be followed for the shutdown of machinery. \[654: 9.4.2\]

40.4.4.3
The use of cartridge-actuated tools shall be in accordance with 40.4.5.2. \[654: 9.4.3\]
40.4.4
An inspection shall be made after the work is completed to ensure that no cartridges or charges are left in the area where they can enter equipment or be accidentally discharged after operation of the dust-producing or handling machinery is resumed. [654: 9.4.4]

40.4.5 Open Flames and Sparks.
The requirements of 40.4.5.1 through 40.4.5.3 shall be applied retroactively. [654: 9.5]

40.4.5.1 Cutting and welding shall comply with the applicable requirements of NFPA 51B. [654: 9.5.1]

40.4.5.2 Grinding, chipping, and other operations that produce either sparks or open-flame ignition sources shall be controlled by a hot work permit system in accordance with NFPA 51B. [654: 9.5.2]

40.4.5.3 Smoking shall be permitted only in designated areas. [654: 9.5.3]

40.4.6 Process and Comfort Heating Systems.

40.4.6.1 In areas processing combustible dust, process and comfort heating shall be provided by indirect means. [654: 9.6.1]

40.4.6.2 Fired equipment shall be located outdoors or in a separate dust-free room or building. [654: 9.6.2]

40.4.6.3 Air for combustion shall be taken from a clean outside source. [654: 9.6.3]

40.4.6.4 Comfort air systems for processing areas containing combustible dust shall not be recirculated. [654: 9.6.4]

40.4.6.5 Recirculating systems shall be permitted to be used provided that all of the following criteria are met:

- Only fresh makeup air is heated.
- The return air is filtered to prevent accumulations of dust in the recirculating system.
- The exhaust flow is balanced with fresh air intake.

40.4.6.6 Comfort air shall not be permitted to flow from hazardous to nonhazardous areas. [654: 9.6.6]

40.4.7 Hot Surfaces.
In areas where a dust explosion hazard or dust flash fire hazard exists, the temperature of external surfaces, such as compressors; steam, water, or process piping; ducts; and process equipment shall be maintained below 80 percent (in degrees Celsius) of the lower of the dust surface ignition temperature or the dust-cloud ignition temperature. [654: 9.7]

40.4.8 Industrial Trucks.

40.4.8.1 Where used, industrial trucks shall be listed or approved for the electrical classification of the area, as determined by Section 6.5 of NFPA 654, and shall be used in accordance with NFPA 505. [654: 9.8.1]
40.4.8.2
Where industrial trucks, in accordance with NFPA 505 are not commercially available, a documented risk assessment acceptable to the AHJ shall be permitted to be used to specify the fire and explosion prevention features for the equipment used. \[654: 9.8.2\]

40.5 Fire Protection.

40.5.1 General.

Fire protection systems, where installed, shall be specifically designed to address building protection, process equipment, and the chemical and physical properties of the materials being processed. \[654: 10.1\]

40.5.2 System Requirements.

Fire protection systems required by this chapter shall comply with 40.5.2.1 through 40.5.2.10. \[654: 10.2\]

40.5.2.1 Fire-extinguishing agents shall be compatible with the conveyed materials. \[654: 10.2.1\]

40.5.2.2 Where fire detection systems are incorporated into pneumatic conveying, dust collection, or centralized vacuum cleaning systems, an analysis shall be conducted to identify safe interlocking requirements for air-moving devices and process operations. \[654: 10.2.2\]

40.5.2.3 Where fire-fighting water or wet product can accumulate in the system, vessel and pipe supports shall be designed to support the additional water weight. \[654: 10.2.3\]

40.5.2.4 Detection Systems.

40.5.2.4.1 Where fire detection systems are incorporated into the pneumatic conveying, dust collection, or centralized vacuum cleaning system, the fire detection systems shall be interlocked to shut down any active device feeding materials to the pneumatic conveying, dust collection, or centralized vacuum cleaning system, on actuation of the detection system. \[654: 10.2.4.1\]

40.5.2.4.2 Where spark or infrared detection and extinguishing systems are provided, the process shall be permitted to continue operating on activation of the detection system. \[654: 10.2.4.2\]

40.5.2.4.3 Where a spark or infrared detection system actuates a diverter valve that sends potentially burning material to a safe location, the process shall be permitted to continue operating on activation of the detection system. \[654: 10.2.4.3\]

40.5.2.5 Where the actuation of fire-extinguishing systems is achieved by means of electronic fire detection, the fire detection system, including control panels, detectors, and notification appliances, shall be designed, installed, and maintained in accordance with NFPA 72. \[654: 10.2.5\]

40.5.2.6 All fire detection initiating devices shall be connected to the fire detection control panel via Style D or E circuits as described in NFPA 72. \[654: 10.2.6\]

40.5.2.7 All fire detection notification appliances shall be connected to the fire detection control panel via Style Y or Z circuits as described in NFPA 72. \[654: 10.2.7\]

40.5.2.8 System Releasing Devices.

40.5.2.8.1 All fire-extinguishing system releasing devices, solenoids, or actuators shall be connected to the fire detection control panel via Style Z circuits as described in NFPA 72. \[654: 10.2.8.1\]
The supervision shall include the continuity of the extinguishing system releasing device, whether that
device is a solenoid coil, a detonator (explosive device) filament, or other such device. [654: 10.2.8.2]

All supervisory devices that monitor critical elements or functions in the fire detection and extinguishing
system shall be connected to the fire detection control panel via Style D or E circuits as described in
NFPA 72. [654: 10.2.9]

Abort Gates and Abort Dampers.

Abort gates or abort dampers shall be connected to the fire detection control panel via
Style Z circuits as described in NFPA 72. [654: 10.2.10.1]

The supervision shall include the continuity of the abort gate or abort damper releasing device, whether
that device is a solenoid coil, a detonator (explosive device) filament, or other such device.
[654: 10.2.10.2]

Fire Extinguishers.

Portable fire extinguishers shall be provided throughout all buildings in accordance with the
requirements of Section 13.6. [654: 10.3.1]

Personnel shall be trained to use portable fire extinguishers in a manner that minimizes the generation
of dust clouds during discharge. [654: 10.3.2]

Hoses, Nozzles, Standpipes, and Hydrants.

Standpipes and hose, where provided, shall comply with Section 13.2. [654: 10.4.1]

Portable spray hose nozzles that are listed or approved for use on Class C fires shall be provided in
areas that contain dust, to limit the potential for generating unnecessary airborne dust during fire-fighting
operations. [654: 10.4.2.1]

Straight-stream nozzles shall not be used on fires in areas where dust clouds can be generated.
[654: 10.4.2.2]

Straight-stream nozzles or combination nozzles shall be permitted to be used to reach fires in locations
that are otherwise inaccessible with the nozzles specified in 40.5.4.2.1. [654: 10.4.2.3]

Private outside protection, including outside hydrants and hoses, where provided, shall comply with
Section 13.3. [654: 10.4.3]

Automatic Sprinklers.

Where a process that handles combustible particulate solids uses flammable or combustible liquids, a
documented risk evaluation that is acceptable to the AHJ shall be used to determine the need for
automatic sprinkler protection in the enclosure in which the process is located. [654: 10.5.1]

Automatic sprinklers, where provided, shall be installed in accordance with Section 13.3. [654: 10.5.2]
40.5.5.3
Where automatic sprinklers are installed, dust accumulation on overhead surfaces shall be minimized to prevent an excessive number of sprinkler heads from opening in the event of a fire. [654: 10.5.3]

40.5.6 Spark/Ember Detection and Extinguishing Systems.
Spark/ember detection and extinguishing systems shall be designed, installed, and maintained in accordance with NFPA 69 and Section 13.7. [654: 10.6]

40.5.7 Special Fire Protection Systems.

40.5.7.1
Automatic extinguishing systems or special hazard extinguishing systems, where provided, shall be designed, installed, and maintained in accordance with the following standards, as applicable:

- NFPA 11, Standard for Low-, Medium-, and High-Expansion Foam
- NFPA 12, Standard on Carbon Dioxide Extinguishing Systems
- NFPA 12A, Standard on Halon 1301 Fire Extinguishing Systems
- NFPA 16, Standard for the Installation of Foam-Water Sprinkler and Foam-Water Spray Systems
- NFPA 17, Standard for Dry Chemical Extinguishing Systems
- NFPA 25, Standard for the Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems
- NFPA 750, Standard on Water Mist Fire Protection Systems
- NFPA 2001, Standard on Clean Agent Fire Extinguishing Systems

[654: 10.7.1]

40.5.7.2
The extinguishing systems shall be designed and used in a manner that minimizes the generation of dust clouds during their discharge. [654: 10.7.2]

40.5.8 Alarm Service.
Alarm service, if provided, shall comply with Section 13.7. [654: 10.8]

40.5.9 Impairments of Fire Protection and Explosion Prevention Systems.

40.5.9.1
Impairments shall include anything that interrupts the normal intended operation of the fire protection or explosion prevention system. [654: 10.9.1]

40.5.9.2
A written impairment procedure shall be followed for every impairment to the fire protection or explosion prevention system. [654: 10.9.2]

40.5.9.3
Impairments shall be limited in size and scope to the system or portion thereof being repaired, maintained, or modified. [654: 10.9.3]

40.5.9.4
Impairment notification procedures shall be implemented by management to notify plant personnel and the AHJ of existing impairments and their restoration. [654: 10.9.4]

40.6 Training and Procedures.

40.6.1 Employee Training.
The requirements of 40.6.2 and 40.6.3 shall be applied retroactively. [654: 11.1]

40.6.2 Plan.
40.6.2.1  Operating and maintenance procedures shall be developed. [654: 11.2.1]

40.6.2.2  Operating and maintenance procedures shall address personal protective equipment (PPE), including flame-resistant garments, in accordance with the workplace hazard assessment required by NFPA 2113. [654: 11.2.2]

40.6.2.3  A written emergency response plan shall be developed for preventing, preparing for, and responding to work-related emergencies including but not limited to fire and explosion. [654: 11.2.3]

40.6.2.4  The plans and procedures shall be reviewed annually and as required by process changes. [654: 11.2.4]

40.6.3  Initial and Refresher Training.

40.6.3.1  Initial and refresher training shall be provided to employees who are involved in operating, maintaining, and supervising facilities that handle combustible particulate solids. [654: 11.3.1]

40.6.3.2  Initial and refresher training shall ensure that all employees are knowledgeable about the following:

- Hazards of their workplace
- General orientation, including plant safety rules
- Process description
- Equipment operation, safe startup and shutdown, and response to upset conditions
- The necessity for proper functioning of related fire and explosion protection systems
- Equipment maintenance requirements and practices
- Housekeeping requirements
- Emergency response plans

[654: 11.3.2]

40.6.4  Certification.

The employer shall certify annually that the training and review required by 40.6.2 and 40.6.3 have been completed. [654: 11.4]

40.6.5  Contractors and Subcontractors.

40.6.5.1  Owner/operators shall ensure that the requirements of 40.6.5.1.1 through 40.6.5.5 are met. [654: 11.5.1]

40.6.5.1.1  Only qualified contractors possessing the requisite craft skills shall be employed for work involving the installation, repair, or modification of buildings (interior and exterior), machinery, and fire protection equipment. [654: 11.5.1.1]

40.6.5.1.2  Contractors involved in the commissioning, repair, or modification of explosion protection equipment shall be qualified as specified in Chapter 15 of NFPA 69. [654: 11.5.1.2]

40.6.5.2  Contractor Training.
40.6.5.2.1

Contractors operating owner/operator equipment shall be trained and qualified to operate the equipment and perform the work. [654: 11.5.2.1]

40.6.5.2.2

Written documentation shall be maintained detailing the training that was provided and who received it. [654: 11.5.2.2]

40.6.5.3

Contractors working on or near a given process shall be made aware of the potential hazards from and exposures to fire, explosion, or toxic releases. [654: 11.5.3]

40.6.5.4

Contractors shall be trained and required to comply with the facility’s safe work practices and policies, including but not limited to equipment lockout/tagout permitting, hot work permitting, fire system impairment handling, smoking, housekeeping, and use of personal protective equipment. [654: 11.5.4]

40.6.5.5

Contractors shall be trained on the facility’s emergency response and evacuation plan, including but not limited to emergency reporting procedures, safe egress points, and evacuation areas. [654: 11.5.5]

40.7 Inspection and Maintenance.

40.7.1 General Requirements.

The requirements of 40.7.1.1 through 40.7.1.3 shall be applied retroactively. [654: 12.1]

40.7.1.1

An inspection, testing, and maintenance program shall be developed and implemented to ensure that the fire and explosion protection systems and related process controls and equipment perform as designed. [654: 12.1.1]

40.7.1.2

The inspection, testing, and maintenance program shall include the following:

- Fire and explosion protection and prevention equipment in accordance with the applicable NFPA standards
- Dust control equipment
- Housekeeping
- Potential ignition sources
- Electrical, process, and mechanical equipment, including process interlocks
- Process changes
- Lubrication of bearings

[654: 12.1.2]

40.7.1.3

Records shall be kept of maintenance and repairs performed. [654: 12.1.3]

40.7.1.4

Existing facilities shall perform a dust hazards analysis (DHA) in accordance with Chapter 7 of NFPA 652.

40.7.2 Specific Requirements.

40.7.2.1 Maintenance of Material Feeding Devices.

40.7.2.1.1 Bearings shall be lubricated and checked for excessive wear on a periodic basis. [654: 12.2.1.1]
40.7.2.1.2
If the material has a tendency to adhere to the feeder or housing, the components shall be cleaned periodically to maintain good balance and minimize the probability of ignition. [654: 12.2.1.2]

40.7.2.2 Maintenance of Air-Moving Devices.

40.7.2.2.1
Fans and blowers shall be checked periodically for excessive heat and vibration. [654: 12.2.2.1]

40.7.2.2.2
Maintenance, other than the lubrication of external bearings, shall not be performed on fans or blowers while the unit is operating. [654: 12.2.2.2]

40.7.2.2.3
Bearings shall be lubricated and checked periodically for excessive wear. [654: 12.2.2.3]

40.7.2.2.4
If the material has a tendency to adhere to the rotor or housing, the components shall be cleaned periodically to maintain good balance and minimize the probability of ignition. [654: 12.2.2.4]

40.7.2.2.5
The surfaces of fan housings and other interior components shall be maintained free of rust. [654: 12.2.2.5]

40.7.2.2.6
Aluminum paint shall not be used on interior steel surfaces. [654: 12.2.2.6]

40.7.2.3 Maintenance of Air-Material Separators.

40.7.2.3.1 Means to Dislodge.

40.7.2.3.1.1
Air-material separation devices that are equipped with a means to dislodge particulates from the surface of filter media shall be inspected periodically as recommended in the manufacturers' instructions for signs of wear, friction, or clogging. [654: 12.2.3.1.1]

40.7.2.3.1.2
These devices shall be adjusted and lubricated as recommended in the manufacturers' instructions. [654: 12.2.3.1.2]

40.7.2.3.2
Air-material separators that recycle air (i.e., cyclones and filter media dust collectors) shall be maintained to comply with 6.1.3 of NFPA 654. [654: 12.2.3.2]

40.7.2.3.3
Filter media shall not be replaced with an alternative type unless a thorough evaluation of the fire hazards has been performed, documented, and reviewed by management. [654: 12.2.3.3]

40.7.2.4 Maintenance of Abort Gates and Abort Dampers.

Abort gates and abort dampers shall be adjusted and lubricated as recommended in the manufacturers' instructions. [654: 12.2.4]

40.7.2.5 Maintenance of Fire and Explosion Protection Systems.

40.7.2.5.1
All fire detection equipment monitoring systems shall be maintained in accordance with the requirements of 13.7.4.4. [654: 12.2.5.1]

40.7.2.5.2
All fire-extinguishing systems shall be maintained pursuant to the requirements established in the standard that governs the design and installation of the system. [654: 12.2.5.2]

40.7.2.5.3
All vents for the relief of pressure caused by deflagrations shall be maintained. [654: 12.2.5.3]
40.7.2.5.4

All explosion prevention systems and inerting systems shall be maintained pursuant to the requirements of NFPA 69. [654: 12.2.5.4]

Supplemental Information

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<tr>
<td>SR_23_-_Clean_Text.docx</td>
<td>Shows clean text for chapter 40 and associated annex material--For staff use.</td>
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</table>

Submitter Information Verification

Submitter Full Name: Janna Shapiro
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Street Address: 
City: 
State: 
Zip: 
Submittal Date: Tue Oct 11 14:30:27 EDT 2016

Committee Statement

Committee Statement: As NFPA 652 has become the umbrella dust control standard, the committee agrees that these changes are appropriate.

Response Message:

Public Comment No. 100-NFPA 1-2016 [Sections A.40.3.2.1.1, A.40.3.2.1.3, A.40.3.2.1.4, A.40.3.2...]
Public Comment No. 97-NFPA 1-2016 [Chapter 40]
A.40.4

A.40.4.1.5
Consideration should be given to the potential for overheating caused by dust entry into bearings. Bearings should be located outside the combustible dust stream, where they are less exposed to dust and more accessible for inspection and service. Where bearings are in contact with the particulate solids stream, sealed or purged bearings are preferred. [654:A.9.1.5]

A.40.5.1
The operating procedures should address both the normal operating conditions and the safe operating limits. Where possible, the basis for establishing the limits and the consequences of exceeding the limits should also be described. [652:A.9.3.1]

The operating procedures should address all aspects of the operation, including the following (as applicable):

(1) Normal startup
(2) Continuous operation
(3) Normal shutdown
(4) Emergency shutdown
(5) Restart after normal or emergency shutdown
(6) Anticipated process upset conditions
(7) System idling

[652:A.9.3.1]
For manual operations, the procedures and practices should describe techniques, procedural steps, and equipment that are intended to minimize or eliminate combustible dust hazards. [652:A.9.3.1]

Operating procedures and practices should be reviewed on a periodic basis, typically annually, to ensure they are current and accurate. [652:A.9.3.1]

A.40.5.2
Safe work practices include, but are not limited to, hot work, confined space entry, and lockout/tagout, and the use of personal protective equipment. (See NFPA 51B.) Consideration for extending the duration of the fire watch could be warranted based on characteristics of the material, equipment configuration, and conditions. For example, the PRB Coal Users' Group practice for hot work suggests fire watches could be warranted for 2 to 12 hours following the completion of hot work due to the exothermic chemical reaction of subbituminous coals. In addition to the hazards of combustible dust, safe work practices should address the hazards of mitigation systems such as inerting and suppression. [652:A.9.3.2]

A.40.6.1
Process interlocks and protection systems should be inspected, calibrated, and tested in the manner in which they are intended to operate, with written records maintained for review. In this context, "test" implies a nondestructive means of verifying that the system will operate as intended. For active explosion protection systems, this can involve the disconnection of final
elements (i.e., suppression discharge devices or fast-acting valve actuators) and the use of a simulated signal to verify the correct operation of the detection and control system. Testing can also include slow-stroke activation of fast acting valves to verify unrestricted travel. Some devices, such as explosion vent panels, suppression discharge devices, and some fast-acting valve actuators, cannot be functionally “tested” in a nondestructive manner, and so only periodic, preventive, and predictive inspection, maintenance, and replacement (if necessary) are applied. [652:A.9.4.1]

Inspection and maintenance requirements for explosion vents and other explosion protection systems are found in NFPA 68, and NFPA 69, respectively. [652:A.9.4.1]

A.40.6.2(5)

Process interlocks should be calibrated and tested in the manner in which they are intended to operate, with written test records maintained for review by management. Testing frequency should be determined in accordance with the AIChE Guidelines for Safe Automation of Chemical Processes. [654:A.12.1.2(5)] [652:A.9.4.2(5)]

A.40.6.4

Corrective actions should be expedited on high-risk hazards (those that could result in a fatality or serious injury). Where in-kind repairs cannot be promptly implemented, consideration should be given to providing alternate means of protection. [652:A.9.4.4]

A.40.6.5

See Section 9.10 for information regarding document retention. [652:A.9.4.5]

A.40.7.1

Safety of a process depends on the employees who operate it and the knowledge and understanding they have of the process. It is important to maintain an effective and ongoing training program for all employees involved. Operator response and action to correct adverse conditions, as indicated by instrumentation or other means, are only as good as the frequency and thoroughness of training provided. [652:A.9.5.1]

A.40.7.2

All plant personnel, including management; supervisors; and operating, housekeeping, and maintenance personnel should receive general awareness training for combustible dust hazards, commensurate with their job responsibilities, including training on locations where hazards can exist on site, appropriate measures to minimize hazards, and response to emergencies. [652:9.5.2]

A.40.7.2.1

Safe work habits are developed and do not occur naturally. The training program should provide enough background information regarding the hazards of the materials and the process so that the employees can understand why it is important to follow the prescribed procedures. Training should address the following:

1. The hazards of their working environment and procedures in case of emergencies, including fires, explosions, and hazardous materials releases
2. Operating, inspection, testing, and maintenance procedures applicable to their assigned work
3. Normal process procedures as well as emergency procedures and changes to procedures
4. Emergency response plans, including safe and proper evacuation of their work area and the permissible methods for fighting incipient fires in their work area
The necessity for proper functioning of related fire and explosion protection systems

Safe handling, use, storage, and disposal of hazardous materials used in the employees' work areas

The location and operation of fire protection equipment, manual pull stations and alarms, emergency phones, first-aid supplies, and safety equipment

Equipment operation, safe startup and shutdown, and response to upset conditions

The extent of this training should be based on the level of interaction the person is expected to have with the system. For example, operators need to be aware of the hazards presented by explosion suppression systems but might not need to know how to operate the suppression system (e.g., interfacing with the system control panel or locking out devices). Maintenance personnel, on the other hand, might need to know how and when to lock out the devices and how to return the system to its operational state.

Qualified contractors should have proper credentials, which include applicable American Society of Mechanical Engineers (ASME) stamps, professional licenses, and so forth.

It is suggested that annual meetings be conducted with regular contractors to review the facility's safe work practices and policies. Some points to cover include to whom the contractors would report at the facility, who at the facility can authorize hot work or fire protection impairments, and smoking and nonsmoking areas. The owner/operator does not necessarily need to provide the training to the contractor.

In addition to the combustible dust fire and explosion hazards, contractors should also be made aware of other potential process and occupational hazards. There can be combustible materials other than combustible dusts in the equipment or immediate vicinity where contractors might be working. Combustion of dusts can generate toxic products, and some combustible dusts are acutely toxic.

All plant personnel, including management, supervisors, and maintenance and operating personnel, should be trained to participate in plans for controlling plant emergencies. The emergency plan should contain the following elements:

(1) A signal or alarm system
(2) Identification of means of egress
(3) Minimization of effects on operating personnel and the community
(4) Minimization of property and equipment losses
(5) Interdepartmental and interplant cooperation
(6) Cooperation of outside agencies
(7) The release of accurate information to the public
Emergency drills should be performed annually by plant personnel. Malfunctions of the process should be simulated and emergency actions undertaken. Disaster drills that simulate a major catastrophic situation should be undertaken periodically with the cooperation and participation of public fire, police, and other local community emergency units and nearby cooperating plants.

Specialized training for public fire department(s) and industrial fire brigades can be warranted due to facility specific hazards where the methods to control and extinguish a fire can be outside of their normal arena of traditional fire fighting.

To thoroughly assess the risks, analyze the incident, and take any corrective steps necessary, investigations should be conducted promptly based on the nature of the incident and in coordination with the AHJ (as applicable).

The investigation should include root cause analysis and should include a review of existing control measures and underlying systemic factors. Appropriate corrective action should be taken to prevent recurrence and to assess and monitor the effectiveness of actions taken.

Such investigations should be carried out by trained persons (internal or external) and include participation of workers. All investigations should conclude with a report on the action taken to prevent recurrence.

Investigation reports should be reviewed with all affected personnel and their representatives (including contract employees where applicable) whose job tasks are relevant to the incident findings, and with the health and safety committee, to make any appropriate recommendations. Any recommendations from the safety and health committee should be communicated to the appropriate persons for corrective action, included in the management review, and considered for continual improvement activities.

A system should be established to promptly address and resolve the incident report findings and recommendations. Corrective actions resulting from investigations should be implemented in all areas where there is a risk of similar incidents and subsequently checked to avoid repetition of injuries and incidents that gave rise to the investigation.

Reports produced by external investigation agencies should be acted upon in the same manner as internal investigations.

Incident investigation reports should be made available to affected employees and their representatives at no cost.

Events where there are injuries, equipment damage, or significant business interruption are subject to investigation.

In addition to investigation of fires and explosions, it is also a good practice to investigate near misses (events that could have resulted in fires or explosions under different circumstances) and all activations of active fire and explosion mitigation systems. It is important to educate facility personnel on the concept of what a near miss is and to clearly communicate their responsibility for reporting both incidents and near misses. Near-miss events often indicate an underlying problem that should be corrected. See NFPA 654 for additional information. Barriers to reporting should be removed, as described in ANSI/AIHA Z10, *Occupational Health and Safety Management Systems*. Investigations should include workers and their representatives, as appropriate.
The term *affected personnel* is intended to include members of employee organizations such as safety committees and employee representatives of various types. [652:A.9.8.4]

**A.40.11.1**

It is essential to have thorough written documentation, as the slightest changes to procedures, processes, resources, staffing, and equipment, including equipment from suppliers, can have a dramatic impact on the overall hazard analysis. Change includes something as benign as process materials sourcing from a different manufacturer, the same raw material manufacturer using new methods to produce the product, or changes in formulation. These changes from a supplier’s end can impact the characteristics of the processes and materials. Individuals involved should include those involved in the process such as maintenance, engineering, and purchasing personnel, and all others as deemed necessary. Staffing and job tasks are not intended for shift changes, but for overall staff and their representative tasks. For reference, see the documentation form in ANSI/AIHA Z10, *Occupational Health and Safety Management Systems*. [652:A.9.9.1]

The following changes in material or process should warrant a management of change review per Section 9.9, and new samples should be collected and analyzed:

1. New process equipment is installed that presents new hazards.
2. New operating conditions for existing equipment create a new hazard.
3. A new material is used in the process.

[652:A.9.9.1]

**A.40.11.2(1)**

The proposed change and why it is needed should be described. It should include sufficient technical information to facilitate review by the approvers, address adverse effects that could occur, and describe how such effects would be mitigated by the proposed change. [652:A.9.2.(1)]

**A.40.11.2(2)**

Some fire and explosion protection systems introduce additional hazards into the process environment. These hazards can include, but are not limited to, energy in suppression canisters, asphyxiation hazards from inert gases, and mechanical laceration/amputation hazards from explosion isolation systems. While these are not fire or explosion hazards, they should be addressed as part of the management of change review per this document so that appropriate controls can be applied. [652:A.9.9.2(2)]

**A.40.11.3**

While implementation of the management of change procedure is not required for replacement in kind, it is critical that only qualified personnel are the ones who determine if the replacement is "in kind." These qualified personnel should be intimately familiar with the items listed in 9.9.2, as well as the broad scope of hazards associated with the particular process. [652:A.9.9.3]

Replacement "in kind" for raw materials. Care must be taken when substituting raw materials. There have been cases where a seemingly equivalent material substitution resulted in a large change in the process hazard. Not all safety properties of a material are characterized in, for example, an MSDS. Chemical composition might be identical, but quite different static ignition hazards due to bulk resistivity and charge relaxation rate can appreciably increase the hazard. Flowability differences can affect the hazard probability too. Differences in natural raw materials are generally less of a concern than manufactured materials in this regard.

**A.40.12**

The creation and retention of documentation is necessary in order to implement and periodically evaluate the effectiveness of the management systems presented in this standard. Documentation in any form (e.g., electronic) should remain legible and be readily identifiable and
accessible. The documentation should be protected against damage, deterioration, or loss, and retained for the applicable period specified in this standard. [652:A.9.10]

A.40.12.1(3)

Incident investigation reports should be maintained for review during cyclical hazards evaluation reviews at least until the changes are incorporated in the dust hazard analysis and for compliance with other regulatory requirements. [652:A.9.10.1(3)]

A.40.12.1(5)

Process and technology information includes process performance parameters, properties of the materials being handled, and documents such as design drawings, design codes and standards used as the basis for both the process and the equipment, equipment manufacturers' operating and maintenance manuals, standard operating procedures, and safety systems operation. [652:A.9.10.1(5)]

A.40.12.1(6)

Management of change documents should be retained until the changes are incorporated into the next dust hazards analysis. [652:A.9.10.1(6)]

A.40.12.1(8)

Contractor records typically include information such as the contract documentation with scope of work and necessary insurance coverage, the contractor's safety programs, records demonstrating the contractor's safety performance, qualifications and certifications necessary for the work to be done, periodic evaluations of the contractor's work performance, and records demonstrating that the employees of the contractor have been trained to safely perform the assigned work. [652:A.9.10.1(8)]

A.40.14

A.40.14 Effective employee participation is an essential element of the Occupational Health and Safety Management System (OHSMS) to achieve continuous improvement in risk reduction, as described in ANSI/AIHA Z10-2012, Occupational Health and Safety Management Systems. The OHSMS ensures that employees and their authorized representatives are involved, informed, and trained on all aspects of health associated with their work, including emergency arrangements. Employee participation includes items such as, but not limited to, the following:

1. Involving employees and their authorized representatives, where they exist, in establishing, maintaining, and evaluating the OSHMS
2. An occupational health and safety committee
3. Access to safety and health information
4. Risk assessment, implementation, and review of risk control measures
5. Incident and near-miss investigations
6. Inspections and audits
7. Reporting unsafe conditions, tools, equipment, and practices
8. Mentoring of new employees, apprentices, and for onsite orientation
9. Identifying hazards with strong emphasis on high-risk jobs and the application of the hierarchy of controls
10. In accordance with established and maintained procedures, appropriate arrangements to ensure that concerns, ideas, and input that employees and their representatives share are received, considered, and responded to
(11) Employees removing themselves from work situations that they have reasonable justification to believe present an imminent and serious danger to their safety or health

[652:A.9.12]

Employees who justifiably take those actions by notifying their supervisor should be protected from discrimination by removing those barriers as outlined in the OSHMS. [652:A.9.12]

Where this standard and annex refer to employees and their representatives (where representatives exist), the intention is that they should be consulted as the primary means to achieve appropriate participation in the development and implementation of all aspects of the OHSMS. In some instances, it might be appropriate to involve all employees and all representatives. [652:A.9.12]

Employee participation is a key component of an OHSMS. When employees and their representatives are engaged and their contributions are taken seriously, they tend to be more satisfied and committed to the OHSMS, and the system is more effective. Engaging employees and their representatives in dialogue with management and each other about safety and health can lead to improved relationships, better overall communication, improved compliance, and reduced rates of injury, illness, and death. The improved morale translates to greater safety and health results. [652:A.9.12]

Employees and their representatives need to be trained about how the OHSMS works and to evaluate it periodically to determine whether improvements need to be made. The information needs to be presented in a form and language that employees and their representatives easily understand.

(See also A.40.10.4.)

[652:A.9.12]
45.1.3
Chapter 45 shall not apply to biomass feedstock regulated by Chapter 31.

Submitter Information Verification

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Submittal Date: Wed Oct 12 14:01:42 EDT 2016

Committee Statement

Committee Statement: This revision is part of a group of changes to provide requirements addressing the exterior storage of biomass feedstock utilized for biomass to ethanol manufacturing facilities. The general requirements for the storage of agricultural products does not appropriately address the safety of biomass outside storage at biomass to ethanol facilities. A new section 31.3.10 is being added via a separate revision.

Response Message:
Prior to performing mobile or temporary cooking operations, workers shall be trained in emergency response procedures, including the following:

1. Proper use of portable fire extinguishers and extinguishing systems
2. Proper method of shutting off fuel sources
3. Proper procedure for notifying the local fire department
4. Proper refueling
5. How to perform leak detection
6. Fuel properties

Supplemental Information

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Submitter Information Verification

Submitter Full Name: Janna Shapiro
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Submittal Date: Tue Oct 11 15:24:42 EDT 2016

Committee Statement

Committee Statement: The new annex language provides guidance for one of several methods of leak detection.
Response Message:
Public Comment No. 19-NFPA 1-2016 [New Section after A.50.6.1.2.2]
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.
Flammable liquids shall not be stored inside mobile cooking vehicles or in temporary cooking areas unless stored in accordance with NFPA 30.
50.7.2.1 General.
Mobile cooking operations and equipment shall comply with 50.7.1 and 50.7.2 of NFPA 96.

Submitter Information Verification

<table>
<thead>
<tr>
<th>Submitter Full Name:</th>
<th>Janna Shapiro</th>
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<tbody>
<tr>
<td>Organization:</td>
<td>National Fire Protection Assoc</td>
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<td>Street Address:</td>
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Committee Statement

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<tr>
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<th>This is an editorial correction.</th>
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<td>Response Message:</td>
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Public Comment No. 44-NFPA 1-2016 [Section No. 50.7.2.1]
50.7.2.3
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.

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Submittal Date: Tue Oct 11 15:03:14 EDT 2016

Committee Statement

Committee Statement: The committee determined that identification of the location of the main shutoff valve is important for employees as well as first responders.
Response Message: [Public Comment No. 46-NFPA 1-2016 [New Section after 50.6.1.2.5.1]]
50.7.2.3* Leak Detection.

50.7.2.3.1 Gas systems shall be inspected prior to each use by a worker trained in accordance with 50.7.1.8.

50.7.2.3.2 Leak detection testing shall be documented and made available to the AHJ on request in accordance with 50.7.2.3.4.

50.7.2.3.3 Where a gas detection system has been installed, it shall be tested every month.

50.7.2.3.4* Leak detection shall be performed every time a new connection or a change in a cylinder is made to any gas system. 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.

Supplemental Information

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Submitter Information Verification

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Submittal Date: Tue Oct 11 15:14:40 EDT 2016

Committee Statement

Committee Statement: The addition of the certification process for the LP system will provide the owner and AHJ with a confidence level that the LP gas system is safe for operation. The criteria found in the certification...
should not be specified in the mandatory text because the list might not be all encompassing. It is therefore included as annex material.

**Response Message:**

Public Comment No. 38-NFPA 1-2016 [Section No. 50.7.2.3.2]
Public Comment No. 30-NFPA 1-2016 [Section No. 50.7.2.3]
A.50.7.2.3.4
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. 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.
50.7.2.4.8.1
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.

Submitter Information Verification

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Submittal Date: Tue Oct 11 14:58:47 EDT 2016

Committee Statement

Committee Statement: The committee recognizes that in transit, containing the flammable/combustible liquid to its vessel is necessary.
Response Message:

Public Comment No. 42-NFPA 1-2016 [Section No. 50.6.1.2.4]
Chapter 52  Stationary Storage Battery Energy Storage Systems

52.1 General.

52.1.1 Energy storage systems shall comply with Chapter 52.

52.1.2 Permits.

Permits, where required, shall comply with Section 1.12.

52.1.2.1 Prior to installation, plans shall be submitted and approved by the AHJ.

52.2 Lead-Acid and Nickel-Cadmium Batteries.

52.2.1 General.

Stationary storage 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 for flooded lead-acid, nickel-cadmium, and valve-regulated lead–acid (VRLA) batteries or 1000 lb (454 kg) for lithium-ion and lithium metal polymer batteries used for facility standby power, emergency power, or uninterrupted power supplies shall be in accordance with Chapter Section 52.2 and Table 52.2.1.

Table 52.2.1 Battery Requirements

<table>
<thead>
<tr>
<th>Requirement</th>
<th>Nonrecombinant Batteries</th>
<th>Recombinant Batteries</th>
<th>Other</th>
</tr>
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<tbody>
<tr>
<td></td>
<td>Flooded Lead-Acid</td>
<td>Flooded Nickel-Cadmium (Ni-Cd)</td>
<td>Valve-Regulated Lead–Acid (VRLA)</td>
</tr>
<tr>
<td>Safety caps</td>
<td>Venting caps</td>
<td>Venting caps</td>
<td>Self-resealing flame-arresting caps</td>
</tr>
<tr>
<td>Thermal runaway management</td>
<td>Not required</td>
<td>Not required</td>
<td>Required</td>
</tr>
<tr>
<td>Spill control</td>
<td>Required</td>
<td>Required</td>
<td>Not required</td>
</tr>
<tr>
<td>Neutralization</td>
<td>Required</td>
<td>Required</td>
<td>Required</td>
</tr>
<tr>
<td>Ventilation</td>
<td>Required</td>
<td>Required</td>
<td>Required</td>
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<tr>
<td>Signage</td>
<td>Required</td>
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<td>Seismic control</td>
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<td>Fire detection</td>
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52.2.2 Safety Features.

52.2.2.1 Safety Venting.

Batteries shall be provided with safety venting caps as follows in per 52.2.2.1.1 through and 52.2.2.1.2.

52.2.2.1.1 Nonrecombinant Batteries.

Vented lead-acid, and nickel-cadmium, or other types of nonrecombinant batteries shall be provided with safety venting caps.

52.2.2.1.2 Recombinant Batteries.

VRLA or other types of sealed, recombinant batteries shall be equipped with self-resealing flame-arresting safety vents.
52.2.2.1.3
Lithium-ion and lithium metal polymer batteries shall not require safety venting caps.

52.2.2.2 Thermal Runaway.
VRLA, lithium-ion, and lithium metal polymer battery systems shall be provided with a listed device or other approved method to preclude, detect, and control thermal runaway.

52.2.2.3 Location and Occupancy Separation.

52.2.2.3.1
Battery systems shall be permitted in the same room as the equipment that they support.

52.2.2.3.2
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.

52.2.2.3.3
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.

52.2.2.3.4
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.

52.2.2.4 Spill Control.

52.2.2.4.1
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.

52.2.2.4.2*
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.

52.2.2.4.3
VRLA, lithium-ion, lithium metal polymer, or other types of sealed batteries with immobilized electrolyte shall not require spill control.

52.2.2.5 Neutralization.

52.2.2.5.1*
An approved method to neutralize spilled electrolyte shall be provided.

52.2.2.5.2
For nonrecombinant batteries and VRLA batteries, the method shall be capable of neutralizing a spill from the largest battery to a pH between 7.0 and 9.0.

52.2.2.6* 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.

52.2.2.6.1

Lithium-ion and lithium metal polymer batteries shall not require ventilation.

52.2.2.7 Environment.

The battery environment shall be controlled or analyzed to maintain temperature in a safe operating range for the specific battery technology used.

52.2.2.8 Signs.

52.2.2.8.1 Doors or accesses into the following shall be provided with approved signs:

1. Battery storage buildings
2. Rooms containing stationary storage battery systems
3. Other areas containing stationary storage battery systems

52.2.2.8.2 For rooms that contain Valve-Regulated Lead-Acid (VRLA), Lithium-Ion, or Lithium Metal Polymer 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

52.2.2.8.3 For rooms that contain Flooded Lead-Acid or Flooded Nickel-Cadmium (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

52.2.2.8.4 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.

52.2.2.8.5 Signs shall be provided within battery cabinets to indicate the relevant electrical, chemical, and fire hazard.

52.2.2.9 Seismic Protection.

In seismically active areas, battery systems shall be seismically braced in accordance with the building code.

52.2.2.10 Smoke Detection.

An approved automatic smoke detection system shall be installed in such areas and rooms containing stationary battery storage systems in accordance with NFPA 72.
52.2.2.10.1
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.

52.2.2.10.2
Normally unoccupied, stand-alone telecommunications structures with a gross floor area of less than $1,500 \text{ ft}^2 \ (140 \text{ m}^2)$ shall not be required to have the detection as indicated in 52.2.2.10.

52.3* Additional Battery Technologies.
52.3.1 General.
Energy storage systems having a capacity greater than the quantities listed in Table 52.3.1 shall be in accordance with Section 52.3, and where used as a legally required emergency or standby power system, shall also comply with 11.7.3.

Table 52.3.1 Energy Storage System Threshold Quantities

<table>
<thead>
<tr>
<th>Type</th>
<th>Capacity a</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lithium batteries, all types</td>
<td>20 KWh (18.0 Mega joules)</td>
</tr>
<tr>
<td>Sodium batteries, all types</td>
<td>20 KWh (18.0 Mega joules) c</td>
</tr>
<tr>
<td>Flow batteries b</td>
<td>20 KWh (18.0 Mega joules)</td>
</tr>
<tr>
<td>Other battery technologies</td>
<td>10 KWh (10.8 Mega joules)</td>
</tr>
<tr>
<td>Capacitors</td>
<td>70 KWh (25.2 Mega joules)</td>
</tr>
</tbody>
</table>

Notes:

a For batteries and capacitors rated in Amp-Hours, KWh should equal rated voltage times amp-hour rating divided by 1000.

b Includes vanadium, zinc-bromine, polysulfide-bromide, and other flowing electrolyte-type technologies.

c Or 70 KWh (25.2 Mega joules) for sodium-ion technologies.

52.3.2* Stationary Storage Battery Systems.
52.3.2.1 Location and Occupancy Separation.
Stationary storage battery systems shall be located and constructed in accordance with this section.

52.3.2.1.1
Stationary storage 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.

52.3.2.1.2 Location.

52.3.2.1.2.1
Stationary storage battery systems shall not be located in areas where the floor is located more than 75 ft (22,860 mm) above the lowest level of fire department vehicle access, or where the floor level is more than 30 ft (9144 mm) below the finished floor of the lowest level of exit discharge, unless otherwise permitted by 52.3.2.1.2.

52.3.2.1.2.2
Installations on noncombustible rooftops of buildings exceeding 75 ft (22,860 mm) in height that do not obstruct fire department rooftop operations shall be permitted when approved by the AHJ.

52.3.2.1.3 Separation.
Rooms containing stationary storage battery systems shall be located in high-hazard occupancies, or shall be separated from other areas of the building as stated in 52.3.2.1.3.1 and 52.3.2.1.3.2. Stationary storage battery systems shall be allowed to be in the same room with the equipment they support.
52.3.2.1.3.1
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, stationary storage battery systems shall be located in a room separated from other portions of the building by a minimum of a 1-hour fire barrier.

52.3.2.1.3.2
In assembly, educational, detention, and correction facilities; health care, ambulatory health care, and day care centers; and residential board and care and residential occupancies, stationary storage battery systems shall be located in a room separated from other portions of the building by a minimum of a 2-hour fire barrier.

52.3.2.1.4 Outdoor Installations.
Stationary storage battery systems located outdoors shall comply with this paragraph, in addition to all applicable requirements of Section 52.3.

52.3.2.1.4.1
Installations in outdoor enclosures or containers that are occupied for servicing, testing, maintenance, and other functions shall be treated as stationary storage battery system rooms.

52.3.2.1.4.2
Battery arrays in noncombustible containers shall not be required to be spaced 3 ft (914 mm) from the container walls.

52.3.2.1.4.3
Stationary storage battery systems located outdoors shall be separated by a minimum 5 ft (1524 mm) from the following:

(1) Lot lines
(2) Public ways
(3) Buildings
(4) Stored combustible materials
(5) Hazardous materials
(6) High-piled stock
(7) Other exposure hazards

52.3.2.1.4.4
The AHJ shall be permitted to authorize smaller separation distances if large-scale fire and fault condition testing conducted or witnessed and reported by an approved testing laboratory is provided showing that a fire involving the system will not adversely impact occupant egress from adjacent buildings, or adversely impact adjacent stored materials or structures.

52.3.2.1.4.5 Means of Egress.

52.3.2.1.4.5.1
Stationary storage battery systems located outdoors shall be separated from any means of egress as required by the AHJ to ensure safe egress under fire conditions, but in no case less than 10 ft (3048 mm).

52.3.2.1.4.5.2
The AHJ shall be permitted to authorize smaller separation distances if large-scale fire and fault condition testing conducted or witnessed and reported by an approved testing laboratory is provided showing that a fire involving the system will not adversely impact occupant egress.

52.3.2.1.4.6 Security of Areas.
Outdoor areas in which stationary storage battery systems are located shall be secured against unauthorized entry in an approved manner.
52.3.2.2 Maximum Allowable Quantities.

52.3.2.2.1 Fire areas within buildings containing stationary storage battery systems exceeding the maximum allowable quantities in Table 52.3.2.2.1 shall comply with all applicable ordinary-hazard and high-hazard requirements as identified in 6.2.2 of NFPA 101 and the building code.

Table 52.3.2.2.1

<table>
<thead>
<tr>
<th>Type</th>
<th>Maximum Allowable Quantities a</th>
<th>Hazard Classification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lithium batteries, all types</td>
<td>600 KWh</td>
<td>High hazard c</td>
</tr>
<tr>
<td>Sodium batteries, all types</td>
<td>600 KWh</td>
<td>High hazard c</td>
</tr>
<tr>
<td>Flow batteries b</td>
<td>600 KWh</td>
<td>High hazard c</td>
</tr>
<tr>
<td>Other battery technologies</td>
<td>200 KWh</td>
<td>High hazard c</td>
</tr>
</tbody>
</table>

Notes:

a  For batteries rated in amp-hHours, KWh should equal rated voltage times amp-hour rating divided by 1000.

b  Includes vanadium, zinc-bromine, polysulfide-bromide, and other flowing electrolyte-type technologies.

c  Can be permitted to be ordinary hazard classification if approved by the AHJ based on (1) a hazard mitigation analysis conducted in accordance with 52.3.2.4 and (2) large-scale fire and fault condition testing conducted or witnessed and reported by an approved testing laboratory that shows that a fire involving the stationary storage battery system is contained within the room for a duration equal to the fire resistance rating of the room separation required in 52.3.2.1.3.1 or 52.3.2.1.3.2, as applicable.

52.3.2.2.2 Where approved by the AHJ, areas containing stationary storage battery systems that exceed the amounts in Table 52.3.2.2.1 shall be permitted to be treated as a ordinary-hazard and not a high-hazard classification based on a hazardous mitigation analysis in accordance with 52.3.2.4 and large-scale fire and fault condition testing conducted or witnessed and reported by an approved testing laboratory.

52.3.2.2.3 Where areas within buildings contain a combination of energy system technologies, the total aggregate quantities shall be determined based on the sum of percentages of each type divided by the maximum allowable quantity of each type. If the sum of the percentages exceeds 100 percent, the area shall be treated as a high-hazard classification in accordance with Table 52.3.2.2.1.

52.3.2.3* Battery Arrays.

52.3.2.3.1 Battery arrays shall comply with 52.3.2.3.2 and 52.3.2.3.3 unless otherwise permitted by 52.3.2.3.4 or 52.3.2.3.5.

52.3.2.3.2 Storage batteries, prepackaged stationary storage battery systems, and pre-engineered stationary storage battery systems shall be segregated into arrays not exceeding 50 KWh (180 Mega joules) each.

52.3.2.3.3 Each array shall be spaced a minimum 3 ft (914 mm) from other arrays and from walls in the storage room or area. The storage arrangements shall comply with the egress provisions in NFPA 101.

52.3.2.3.4 Listed pre-engineered stationary storage battery systems and prepackaged stationary storage battery systems shall not exceed 250 KWh (900 Mega joules) each.
52.3.2.3.5
The AHJ shall be permitted to approve listed pre-engineered and prepackaged battery arrays with larger capacities or smaller battery array spacing if large-scale fire and fault condition testing conducted or witnessed and reported by an approved testing laboratory is provided showing that a fire involving one array will not propagate to an adjacent array, and be contained within the room for a duration equal to the fire resistance rating of the room separation required by 52.3.2.1.3.

52.3.2.4  Hazard Mitigation Analysis.
A failure mode and effects analysis (FMEA) or other approved hazard mitigation analysis shall be provided to the AHJ when any of the following conditions are present:

(1) Battery technologies not specifically identified in Table 52.3.1 are provided.
(2) More than one stationary storage battery technology is provided in a room or indoor area where there is a potential for adverse interaction between technologies.
(3) When allowed as a basis for increasing maximum allowable quantities as specified in Table 52.3.2.2.1.

52.3.2.4.1  The analysis shall evaluate the consequences of the following failure modes, and others deemed necessary by the AHJ. Only single failure modes shall be considered for each mode:

(1) Thermal runaway condition in a single module or array
(2) Failure of a battery management system
(3) Failure of a required ventilation system
(4) Voltage surges on the primary electric supply
(5) Short circuits on the load side of the stationary battery storage system
(6) Failure of the smoke detection, fire suppression, or gas detection system

52.3.2.4.2  The AHJ shall be permitted to approve the hazardous mitigation analysis provided the consequences of the FMEA demonstrate the following:

(1) Fires or explosions will be contained within unoccupied stationary storage battery system rooms for the minimum duration of the fire resistance rated specified in 52.3.2.1.3.1 or 52.3.2.1.3.2, as applicable
(2) Fires and explosions in stationary storage battery system cabinets in occupied work centers allow occupants to safely evacuate
(3) Toxic and highly toxic gases released during charging, discharging, and normal operation shall not exceed the permissible exposure limit (PEL)
(4) Toxic and highly toxic gases released during fires and other fault conditions shall not reach concentrations in access of IDLH level in the building or adjacent means of egress routes during the time deemed necessary to evacuate from that area
(5) Flammable gases released from batteries during charging, discharging, and normal operation shall not exceed 25 percent of the lower flammable limit (LFL)

52.3.2.4.3  Construction, equipment, and systems that are required for the stationary storage battery system to comply with the hazardous mitigation analysis shall be installed, maintained, and tested in accordance with nationally recognized standards and specified design parameters.

52.3.2.5  Listings.
Storage batteries shall be listed in accordance with UL 1973, *Standard for Batteries for Use in Light Electric Rail (LER) Applications and Stationary Applications*. Prepackaged and pre-engineered stationary storage battery systems shall be listed in accordance with UL 9540, *Outline of Investigation for Energy Storage Systems and Equipment*.

### 52.3.2.5.1 Prepackaged and Pre-engineered Systems

Prepackaged and pre-engineered stationary storage battery systems shall be installed in accordance with their listing and the manufacturer’s instructions.

### 52.3.2.6 Environment

The storage battery environment shall be controlled to maintain temperatures and conditions within the battery manufacturer’s specifications.

### 52.3.2.6.1 Battery Management System

An approved battery management system shall be provided for battery technologies for monitoring and balancing cell voltages, currents, and temperatures within the manufacturer’s specifications. The system shall transmit an alarm signal to an approved location if potentially hazardous temperatures or other conditions including short circuits, overvoltage (i.e., overcharge) or under voltage (i.e., over discharge) are detected.

### 52.3.2.6.2 Battery Chargers

Battery chargers shall be compatible with the battery manufacturer’s electrical ratings and charging specifications. Battery chargers shall be listed in accordance with the UL 1564, *Standard for Industrial Battery Chargers*, or provided as part of a listed pre-engineered or prepackaged stationary storage battery system.

### 52.3.2.6.3 Vehicle Impact Protection

Vehicle impact protection shall be provided where stationary storage battery systems are subject to impact by motor vehicles.

### 52.3.2.6.4 Combustible Storage

Combustible materials not related to the stationary storage battery system shall not be stored in battery rooms, cabinets, or enclosures.

#### 52.3.2.6.4.1

Combustible materials in occupied work centers shall comply with Section 10.18 and shall not be stored within 3 ft (915 mm) of battery cabinets.

### 52.3.2.6.5 Signage

#### 52.3.2.6.5.1

Approved signage shall be provided on doors or in approved locations near entrances to stationary battery storage system rooms.

#### 52.3.2.6.5.2

New signage installations shall require the following items:

1. Hazard identification markings in accordance with NFPA 704.
2. “This room contains energized battery systems,” or the equivalent.
3. Identification of the type(s) of batteries present
4. AUTHORIZED PERSONNEL ONLY
5. Technology-specific markings, if required in 52.3.2.11
52.3.2.6.3
Where the battery storage system disconnecting means is not within sight of the main service disconnect, placards or directories shall be installed at the locations of the main service disconnect to indicate the location of all battery storage disconnecting means in accordance with NFPA 70.

52.3.2.6.4
Existing stationary storage battery systems shall be permitted to include the signage required at the time it was installed.

52.3.2.6.5
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.

52.3.2.6.6
Signs shall be provided within battery cabinets to indicate the relevant electrical, chemical, and fire hazard.

52.3.2.6.7
Fire command centers in buildings containing stationary storage battery systems shall include signage or readily available documentation that describes the location of stationary storage battery systems, the types of batteries present, operating voltages, and location of electrical disconnects.

52.3.2.6.6 Seismic Protection.
Battery systems shall be seismically braced in accordance with the building code.

52.3.2.6.7 Safety Caps.
Vented batteries shall be provided with flame-arresting safety caps.

52.3.2.6.8* Mixed Battery Systems.
Different types of batteries shall not be installed in the same room or cabinet if there is a potential for unsafe interaction between them, as determined by the AHJ.

52.3.2.7 Suppression And Detection.

52.3.2.7.1 Fire suppression.
Rooms containing stationary storage battery systems shall be protected by an automatic sprinkler system installed in accordance with Section 13.3.

52.3.2.7.1.1 Commodity classifications for specific technologies of storage batteries shall be in accordance with Chapter 5 of NFPA 13.

52.3.2.7.1.2 If the storage battery types are not specifically addressed in Chapter 5 of NFPA 13, the AHJ shall be permitted to approve the fire suppression system based on full-scale fire and fault condition testing conducted or witnessed and reported by an approved laboratory.

52.3.2.7.2 Smoke Detection.
An approved automatic smoke detection system shall be installed in rooms containing stationary battery storage systems in accordance with NFPA 72, and 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.

52.3.2.8* Ventilation.
Where required by **52.3.2.11**, 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 flammable gas to 25 percent of the lower flammable limit (LFL) 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. Mechanical ventilation shall be provided at a rate of not less than $1 \text{ ft}^3 / \text{min} \times \text{ft}^2 (5.1 \text{ L/sec/m}^2)$ of floor area of the room or cabinet. The ventilation can be either continuous, or activated by a gas detection system in accordance with **52.3.2.8.2**.

**52.3.2.8.1**

Required mechanical ventilation systems for rooms and cabinets containing storage batteries shall be supervised by an approved central, proprietary, or remote station service or shall initiate an audible and visual signal at an approved constantly attended on-site location.

**52.3.2.8.2**

Where required by **52.3.2.8(2)**, rooms containing stationary storage battery systems shall be protected by an approved continuous gas detection system.

**52.3.2.8.2.1**

The gas detection system shall be designed to activate when the level of flammable gas exceeds 25 percent of the lower flammable limit (LFL).

**52.3.2.8.2.2**

Activation of the gas detection system shall result in activation of the mechanical ventilation system, which shall remain on until the flammable gas detected is less than 25 percent of the LFL.

**52.3.2.8.2.3**

The gas detection system shall include a minimum two hours of standby power.

**52.3.2.8.2.4**

Failure of the gas detection system shall annunciate a trouble signal at an approved central, proprietary, or remote station service, or when approved at a constantly attended on-site location.

**52.3.2.9**  *Spill Control and Neutralization.*

Where required by **52.3.2.11**, approved methods and materials shall be provided for the control and neutralization of spills of electrolyte or other hazardous materials in rooms containing stationary storage batteries as follows:

1. For batteries with free-flowing electrolyte, the method and materials shall be capable of neutralizing a spill of the total capacity from the largest cell or block to a pH between 5.0 and 9.0.
2. For batteries with immobilized electrolyte, the method and materials shall be capable of neutralizing a spill of 3.0 percent of the capacity of the largest cell or block in the room to a pH between 5.0 and 9.0.

**52.3.2.10**  *Thermal Runaway.*

Where required by **52.3.2.11**, a listed device or other approved method shall be provided to preclude, detect, and control thermal runaway.

**52.3.2.11**  *Battery-Specific Protection*

Stationary storage battery systems shall comply with **52.3.2** through **52.3.2.10** and this section, as applicable.

**52.3.2.11.1**  *Lithium Batteries.*

Stationary storage battery systems utilizing lithium batteries shall be provided with thermal runaway protection in accordance with **52.3.2.10**.
52.3.2.11 Sodium Batteries.
Stationary storage battery systems utilizing sodium batteries shall comply with the following:
(1) Ventilation shall be provided in accordance with 52.3.2.8.
(2) Spill control and neutralization shall be in accordance with 52.3.2.9.
(3) Thermal runaway protection shall be provided for in accordance with 52.3.2.10.
(4) A hazard mitigation analysis shall be provided for systems that utilize sodium sulfur batteries, or other sulfur-type battery systems that operate above ambient temperatures.
(5) The signage required in 52.3.2.6.5 shall include, where applicable, “Water Reactive Hazard — Apply No Water.”

52.3.2.11.3 Flow Batteries.
Stationary storage battery systems utilizing flow batteries shall comply with the following:
(1) Ventilation shall be provided in accordance with 52.3.2.8.
(2) Spill control and neutralization shall be in accordance with 52.3.2.9.

52.3.2.11.4 Other Battery Types.
Stationary storage battery systems utilizing battery technologies other than those described in 52.3.2.11.1 through 52.3.2.11.1 shall comply with the following:
(1) Ventilation shall be provided in accordance with 52.3.2.8 where flammable, toxic or highly toxic gases could be present during charging, discharging, and normal system use.
(2) Spill control and neutralization shall be in accordance with 52.3.2.9 where the batteries contain electrolytes that could be released from the batteries.
(3) Thermal runaway protection shall be provided in accordance with 52.3.2.10.
(4) The signage required in 52.3.2.6.5 shall also identify any potential hazards associated with the batteries.

52.3.2.12 Testing, Maintenance, and Repairs.
52.3.2.12.1 Stationary storage batteries and associated equipment and systems shall be tested and maintained in accordance with the manufacturer’s instructions.
52.3.2.12.2 Any storage batteries or system components used to replace existing units shall be compatible with the battery charger, battery management systems, other storage batteries, and other safety systems.

52.3.3 Capacitor Energy Storage Systems.
52.3.3.1 Capacity.
Stationary capacitor energy storage systems having capacities greater than those described in Table 52.3.3.1 shall comply with 52.3.3.
52.3.3.2 Location and Occupancy Separation.
Stationary capacitor energy storage systems shall be located and constructed as required for stationary storage battery system in accordance with 52.3.2.1 through 52.3.2.1.4.3.
52.3.3.3 Maximum Allowable Quantities.
Fire areas within buildings containing capacitor energy storage systems exceeding 600 KWh (2160 mJ) shall comply with all applicable ordinary-hazard and high-hazard requirements as identified in 6.2.2 of NFPA 101 and the building code.
52.3.3.4 Capacitor Arrays.
52.3.3.1
Capacitors, prepackaged stationary capacitor energy storage systems, and pre-engineered capacitor energy storage systems shall be segregated into arrays not exceeding 50 KWh (180 Mega joules) each.

52.3.3.2
Each array shall be spaced a minimum 3 ft (914 mm) from other arrays and from walls in the storage room or area. The storage arrangements shall comply with the egress provisions in NFPA 101.

52.3.3.5
Listings.
Capacitors shall be listed in accordance with UL 1973, Standard for Batteries for Use in Light Electric Rail (LER) Applications and Stationary Applications. Prepackaged and pre-engineered capacitor energy systems shall be listed in accordance with UL 9540, Outline of Investigation for Energy Storage Systems and Equipment.

52.3.3.5.1
*Prepackaged and Pre-engineered Systems.*
Prepackaged and pre-engineered capacitor energy storage systems shall be installed in accordance with their listing and the manufacturer’s instructions.

52.3.3.5.2
Environment.
The environment surrounding the capacitors shall be controlled to maintain temperatures and conditions within the manufacturer’s specifications.

52.3.3.6
Chargers.
Capacitor chargers shall be compatible with the capacitor manufacturer’s electrical ratings and charging specifications, and shall be listed in accordance with the UL 1564, Standard for Industrial Battery Chargers, or provided as part of a listed pre-engineered or prepackaged capacitor energy storage system.

52.3.3.7
Vehicle Impact Protection.
Vehicle impact protection shall be provided where capacitor energy storage systems are subject to impact by motor vehicles.

52.3.3.8
Combustible Storage.

52.3.3.8.1
Combustible materials not related to the capacitor energy storage system shall not be stored in capacitor rooms, cabinets, or enclosures.

52.3.3.8.2
Combustible materials in occupied work centers shall comply with Section 10.18 and shall not be stored within 3 ft (915 mm) of capacitor cabinets.

52.3.3.9
Signage.
Approved signage shall be provided on doors or in approved locations near entrances to capacitor energy storage systems, and shall include the following:

1. Hazard identification markings in accordance with NFPA 704.
2. “This room contains energized capacitor systems," or the equivalent
3. Identification of the type(s) of capacitors present
4. AUTHORIZED PERSONNEL ONLY

52.3.3.9.1
Where the capacitor energy storage system disconnecting means is not within sight of the main service disconnect, placards or directories shall be installed at the locations of the main service disconnect to indicate the location of all capacitor energy storage system disconnecting means in accordance with NFPA 70.
52.3.3.9.2 Capacitor 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.

52.3.3.9.3 Signs shall be provided within capacitor cabinets to indicate the relevant electrical, chemical, and fire hazard.

52.3.3.9.4 Fire command centers in buildings containing capacitor energy storage systems shall include signage or readily available documentation that describes the location of the systems, the types of capacitors present, operating voltages, and location of electrical disconnects.

52.3.3.10 Seismic Protection. Capacitor energy storage systems shall be seismically braced in accordance with the building code.

52.3.3.11 Testing, Maintenance, and Repairs.

52.3.3.11.1 Capacitor energy storage systems and associated equipment and systems shall be tested and maintained in accordance with the manufacturer’s instructions.

52.3.3.11.2 Capacitors or system components used to replace existing units shall be compatible with the capacitor charger, other capacitors, and other safety systems.

52.3 Permits.

52.3.1 Permits, where required, shall comply with Section 1.12.

52.3.2 Prior to installation, plans shall be submitted and approved by the AHJ.

Supplemental Information

<table>
<thead>
<tr>
<th>File Name</th>
<th>Description</th>
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<tbody>
<tr>
<td>Chapter_52_rewrite.docx</td>
<td>For staff use.</td>
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<tr>
<td>SR-65_Chapter_52_Annex_A.docx</td>
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Submitter Information Verification

Submitter Full Name: Janna Shapiro
Organization: National Fire Protection Assoc
Street Address:
City:
State:
Zip:

Committee Statement

Committee Statement:
The committee recognizes established battery technologies and new technologies. This rewrite reflects existing and new applications of these energy storage systems.

The 1500 square foot threshold for small, unoccupied structures as stated in 52.2.2.10.1 was recently established in model building codes.
<table>
<thead>
<tr>
<th>Public Comment No. 94-NFPA 1-2016 [Sections 52.3.5.2, 52.3.5.3]</th>
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<tr>
<td>Public Comment No. 95-NFPA 1-2016 [Section No. 52.3.6.1]</td>
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<td>Public Comment No. 96-NFPA 1-2016 [Section No. 52.3.8.2]</td>
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<td>Public Comment No. 102-NFPA 1-2016 [Section No. 52.3.6 [Excluding any Sub-Sections]]</td>
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<td>Public Comment No. 101-NFPA 1-2016 [Section No. 52.3.6 [Excluding any Sub-Sections]]</td>
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<td>Public Comment No. 93-NFPA 1-2016 [Section No. 52.3.4.3]</td>
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<td>Public Comment No. 89-NFPA 1-2016 [Section No. 52.1]</td>
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<td>Public Comment No. 103-NFPA 1-2016 [New Section after 52.1]</td>
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<tr>
<td>Public Comment No. 98-NFPA 1-2016 [Section No. 52.3.10]</td>
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<td>Public Comment No. 90-NFPA 1-2016 [Chapter 52]</td>
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<tr>
<td>Public Comment No. 92-NFPA 1-2016 [Section No. 52.3.2]</td>
</tr>
</tbody>
</table>
A.52.2
The requirements in Chapter 52, Section 52.2 supersede all the hazardous material designations, permits, and requirements in Chapter 60.

A.52.2.2.4.2
Methods of achieving this protection can include, but are not limited to, the following:

1. Liquidtight sloped or recessed floors in indoor locations or similar areas in outdoor locations
2. Liquidtight floors in indoor locations or similar areas in outdoor locations provided with liquidtight raised or recessed sills or dikes
3. Sumps and collection systems
4. Spill containment systems such as that described in A.52.2.5.1

A.52.2.2.5.1
One method to determine compliance with the neutralization requirements of this subsection is found in Underwriters Laboratories Subject 2436 Outline of Investigation for Spill Containment for Stationary Lead Acid Battery Systems. Subject 2436 investigates the liquid tightness, level of electrolyte absorption, pH neutralization capability, and flame spread resistance of spill containment systems. One method to determine compliance with the neutralization requirements of this subsection is found in Underwriters Laboratories Subject 2436, Outline of Investigation for Spill Containment for Stationary Lead Acid Battery Systems. Subject 2436 investigates the liquid tightness, level of electrolyte absorption, pH neutralization capability, and flame spread resistance of spill containment systems.

A.52.2.6
Information on battery room ventilation can be found in IEEE 1635/ASHRAE 21, Guide to Battery Room Ventilation and Thermal Management. Information on battery room ventilation can be found in IEEE 1635/ASHRAE 21, Guide to Battery Room Ventilation and Thermal Management.

A.52.3
The requirements in Section 52.3 supersede all the hazardous material designations, permits, and requirements in Chapter 60.

A.52.3.2
This section covers stationary battery systems that are typically used for facility standby power, emergency power, uninterrupted power supplies, or load shedding/load balancing applications. Stationary storage battery systems that exceed the amounts specified in Table 52.3.1 pose potential hazards that are significant enough to require compliance with the requirements in Chapter 52. It is not the intent of Chapter 52 to regulate equipment with integral standby power systems below the amounts in Table 52.3.1, such as emergency lighting units, fire alarm control units, and other appliances and equipment.

A.52.3.2.3
A stationary battery array is an arrangement of individual stationary storage batteries in close proximity to each other, mounted on storage racks or in modules, battery cabinets, or other enclosures.

A.52.3.2.5.1
A prepackaged stationary storage battery system is designed and investigated as a single unit, assembled in a factory, and shipped to the site. A pre-engineered stationary storage battery system is designed and investigated as a single unit, but is shipped in modular form for assembly at the site.

**A.52.3.2.6.8**

This section is intended to address unique situations where the installation of different types of batteries in the same room or cabinet could create a situation where there is unacceptable chemical, thermal, or other interaction between them, or where the surrounding environment is not within the battery manufacturers’ specifications. The AHJ has the option to require a hazard mitigation analysis, conducted in accordance with 52.3.2.4, to identify hazards and potential solutions that will mitigate the hazards.

**A.52.3.2.8**

Information on battery room ventilation can be found in IEEE 1635/ASHRAE 21, *Guide to Battery Room Ventilation and Thermal Management*.

**A.52.3.2.9**

Methods of achieving this protection can include, but are not limited to, the following:

1. Liquidtight sloped or recessed floors in indoor locations or similar areas in outdoor locations
2. Liquidtight floors in indoor locations or similar areas in outdoor locations provided with liquidtight raised or recessed sills or dikes
3. Sumps and collection systems

In

**A.52.3.3.5.1**

A prepackaged capacitor energy system is designed and investigated as a single unit, assembled in a factory, and shipped to the site. A pre-engineered capacitor energy system is designed and investigated as a single unit, but is shipped in modular form for assembly at the site.
53.3.1.1 General.
Refrigeration systems shall be operated and maintained in a safe and operable condition, free from accumulations of oil, dirt, waste, excessive corrosion, other debris, or leaks, and in accordance with ASHRAE 15, *Safety Standard for Refrigeration Systems*, and the mechanical code. Ammonia refrigerator systems shall be operated and maintained in accordance with ANSI/IIAR 7, *Developing Operating Procedures for Closed-Circuit Ammonia Mechanical Refrigerating Systems*.
Chapter 55 Reserved Cleaning and Purging of Flammable Gas Piping Systems

Reserved

55.1 Application.

Cleaning and purging activities for new and existing flammable gas piping found in electric generating plants and in industrial, institutional, and commercial applications shall comply with NFPA 56.

Submittal Information Verification

Submitter Full Name: Janna Shapiro
Organization: National Fire Protection Assoc
Street Address:
City:
State:
Zip:
Submittal Date: Tue Oct 11 14:19:41 EDT 2016

Committee Statement

Committee Statement: The technical committee agrees that it is important to reference NFPA 56 to address fire and explosion prevention during cleaning and purging activities.

Response Message:

Public Comment No. 5-NFPA 1-2016 [Global Input]
63.9 Insulated Liquid Carbon Dioxide Systems.

Insulated liquid carbon dioxide systems shall comply with Chapter 13 of NFPA 55.

63.9.1 General.

The storage, use, and handling of liquid carbon dioxide in insulated systems shall be in accordance with the provisions of Chapter 13 and Chapters 1 through 7 of NFPA 55, as applicable.

63.9.2 Permits.

63.9.2.1 For other than vehicles equipped for and using compressed gas as a fuel for propelling the vehicle, an operational permit shall be required for liquid carbon dioxide systems in excess of 100 lb (45.4 kg) of carbon dioxide.

63.9.2.2 A construction permit shall be required for the installation of, or modification to, a liquid carbon dioxide (CO\textsubscript{2}) system where the quantity exceeds the amount listed in 63.9.2.

63.9.2.3 The following information shall be provided to the authority having jurisdiction with the application for permit:

1. Total aggregate quantity of liquid CO\textsubscript{2} in pounds or cubic feet at normal temperature and pressure
2. Location and total volume of the room where the liquid CO\textsubscript{2} will be located and whether the room is at or below grade
3. Location of containers relative to equipment, building openings, and means of egress
4. Manufacturer’s specifications and pressure rating, including cut sheets, of all piping and/or tubing to be used
5. A piping and instrumentation diagram that shows piping support and remote fill connections
6. Details of container venting, including, but not limited to, vent line size, material, and termination location
7. Alarm and detection system and equipment, if applicable
8. Seismic support for containers

63.9.3 Pressure Relief Devices.

Containers used for liquid carbon dioxide shall be equipped with pressure relief devices piped from the uppermost part of the containers and communicating with the vapor space. [55: 13.3.1]

63.9.4 Physical Protection.

63.9.4.1 Pressure relief devices shall be located to minimize tampering, damage, and obstruction to flow. [55: 13.3.1.1.1]

63.9.4.2 The inlet and outlet of the relief devices shall not be blocked by a valve or plug during normal operation. [55: 13.3.1.1.2]

63.9.5 Vent Pipe Systems.
Pressure relief devices shall be piped to the outdoors where the discharge will not impinge on the structure, personnel, or means of egress and will not create a hazardous concentration of carbon dioxide. [55: 13.3.1.2]

63.9.5.1
Pressure relief devices from portable DOT 4L containers that are not a component of a stationary system shall not be required to meet the requirements of 63.9.5. [55: 13.3.1.2.1]

63.9.5.2
Vent piping systems serving pressure relief devices shall be protected from water intrusion to prevent moisture or solid carbon dioxide from collecting and freezing and interfering with the operation of the pressure relief device. [55: 13.3.1.2.2]

63.9.5.3
Vent piping systems serving pressure relief devices shall be designed to prevent backflow restrictions exceeding 10 percent backpressure on the pressure relief device under full flow conditions. [55: 13.3.1.2.3]

63.9.6 Pressure and Level Indicators.

63.9.6.1
Cylinders, containers, and tanks shall be provided with a pressure gauge and a level gauge or device for indicating the quantity of liquid carbon dioxide. [55: 13.3.2.1]

63.9.6.2
These devices shall be designed for the temperatures and pressures associated with liquid carbon dioxide service. [55: 13.3.2.2]

63.9.6.3
Where cylinders, containers, and tanks are in locations remote from the filling connection, a means to determine when the containers have been filled to their design capacity shall be provided and shall be verifiable from the filling connection. [55: 13.3.2.3]

63.9.7 Piping Systems.

63.9.7.1
Carbon dioxide piping shall be located and supported to protect against damage from strain on piping and fittings; the effects of expansion, contraction, and vibration; mechanical damage; and heat sources. [55: 13.3.3.1]

63.9.7.2
Piping, tubing, and hoses and fittings shall be designed to a bursting pressure of at least four times the system design pressure. [55: 13.3.3.2]

63.9.7.3 Materials of Construction.
Materials of construction shall be employed for potential exposure to a temperature of −109.3°F (−78.5°C). [55: 13.3.4]

63.9.7.4 Operating Instructions.
Operating instructions shall account for potential exposure of personnel to extremely low temperatures in accordance with 63.9.12. [55: 13.5]

63.9.8 Safety Measures.

63.9.8.1
Rooms or areas inside assembly, business, educational, institutional, and residential occupancies containing a liquid carbon dioxide (CO₂) system shall comply with the safety measures in 63.9.9.1.

63.9.8.2
The provisions of 63.9.9.1 shall not apply to liquid carbon dioxide (CO₂) systems located above grade in outdoor areas with enclosure walls obstructing on no more than 75 percent of the perimeter at ground level.

63.9.8.3 Gas Detection System.
63.9.8.3.1
A continuous gas detection system shall be provided in the room or area where container systems are filled and used, and in areas where the heavier-than-air gas can congregate.

63.9.8.3.2
Carbon dioxide (CO$_2$) sensors shall be provided within 12 in. (305 mm) of the floor in the area where the gas is most likely to accumulate or leaks are most likely to occur.

63.9.8.3.3
The system shall be designed to detect and notify at a low-level alarm and high-level alarm.

63.9.8.4
The threshold for activation of the low-level alarm shall not exceed a carbon dioxide concentration of 5,000 ppm TWA (9,000 mg/m$^3$). When carbon dioxide is detected at the low-level alarm, the system shall activate a signal at a normally attended location within the building.

63.9.8.5
The threshold for activation of the high-level alarm shall not exceed a carbon dioxide concentration of 30,000 ppm (54,000 mg/m$^3$). When carbon dioxide is detected at the high-level alarm, the system shall activate an audible and visual alarm in an approved location.

63.9.9 Signage.

63.9.9.1
Hazard identification signs shall be posted at the entrance to the room and confined to the area where liquid carbon dioxide containers are located. The sign shall be a minimum 8 in. (200 mm) wide and 6 in. (150 mm) high and indicate:

**CAUTION – CARBON DIOXIDE GAS**
Ventilate the area before entering.

A high carbon dioxide (CO$_2$) gas concentration in this area can cause asphyxiation.

63.9.10 Performance Design Option.
63.9.10  Carbon dioxide (CO₂) systems shall not be required to be provided with a gas detection system where a complete discharge of the stored carbon dioxide cannot result in a concentration exceeding 5,000 ppm in the room where the container is located or the area where the carbon dioxide is likely to congregate. The maximum concentration (ppm) shall be determined as follows:

1. Calculate the volume (scf) of CO₂ gas at standard temperature and pressure that is contained in the storage containers as follows:
   a. To convert pounds of liquid to volume (scf) of CO₂ gas, multiply the pounds by 8.741.
   b. To convert gallons of liquid to volume (scf) of CO₂ gas, multiply the gallons by 74.04.

2. Calculate the volume of the room containing the CO₂ containers, or the area where the CO₂ is likely to congregate, in cubic feet as follows:
   a. The volume of the room or area shall be based on a height limitation of 5 ft (1524 mm) or the ceiling, whichever is less.
   b. The boundary of the area shall be to walls or partitions 5 ft (1524 mm) or more in height that obstruct gas dispersion at the floor level.
   c. All doors in the boundary walls shall be considered closed.
   d. CO₂ shall be assumed to congregate in basements, pits, or lower floors where openings are present between the containers and the lower floor.

3. Divide the volume of CO₂ gas by the volume of the room. If the result does not exceed 0.005 (5,000 ppm), the design meets the performance option criteria.

63.9.11  Seismic and Structural Design.

63.9.11.1  Liquid carbon dioxide system containers and piping shall comply with the seismic design requirements in accordance with the building code and shall not exceed the floor loading limitation of the building.

63.9.11.2  Container foundations or floors in multistoried buildings shall be designed to support the weight of the system at its full capacity in accordance with the building code.

63.9.12  Small Insulated Liquid Carbon Dioxide Outdoor Systems.

63.9.12.1  Container systems located in enclosed spaces shall be in accordance with 63.9.1 for indoor systems.

63.9.12.2  Aboveground outdoor locations shall not be required to be provided with a gas detection and alarm system in accordance with 63.9.1, where the system is unenclosed.

63.9.12.3  To be considered unenclosed, enclosures constructed to limit access or otherwise provide a visual or architectural barrier for the installation shall be constructed in accordance with the requirements in Section 6.6 for weather protection or with the following:

1. The enclosure shall be constructed without a roof or overhead cover.

2. Supports and walls shall not obstruct more than three sides nor more than 75 percent of the perimeter of the storage or use area, with 25 percent of the perimeter being open to the atmosphere.

[55: 13.7.1.1]
Enclosures that do not meet the requirements of 63.9.14.2 shall be permitted when constructed in accordance with the following:

1. The enclosure shall be constructed without a roof or overhead cover.
2. Continuous mechanical exhaust ventilation shall be provided.

Where mechanical exhaust ventilation is provided, it shall be in accordance with the following:

1. The exhaust system shall be installed in accordance with the requirements of the mechanical code.
2. The exhaust system shall be designed to consider the density of the potential vapors released with exhaust taken from a point within 12 in. (305 mm) of the floor.
3. The location of both the exhaust and the inlet air openings shall be designed to provide air movement across all portions of the enclosure to prevent the accumulation of vapors.
4. The rate of exhaust ventilation shall be not less than 1 scf/min/ft$^2$ (0.028 Nm$^3$ /min/m$^2$) of floor area within the enclosure.

Large Indoor Insulated Liquid Carbon Dioxide Systems. (Reserved)

Large Outdoor Insulated Liquid Carbon Dioxide Systems.

Location.

Outdoor stationary large insulated liquid carbon dioxide systems shall be located in accordance with Table 63.9.14.1.

<table>
<thead>
<tr>
<th>Exposure</th>
<th>Minimum Distance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Buildings, regardless of construction type</td>
<td>2 ft 0.6 m</td>
</tr>
<tr>
<td>Wall openings other than building exits</td>
<td>2 ft 0.6 m</td>
</tr>
<tr>
<td>Air intakes</td>
<td>10 ft 3.1 m</td>
</tr>
<tr>
<td>Property lines</td>
<td>5 ft 1.5 m</td>
</tr>
<tr>
<td>Places of public assembly (assembly occupancies)</td>
<td>50 ft 15 m</td>
</tr>
<tr>
<td>Nonambulatory patient areas</td>
<td>50 ft 15 m</td>
</tr>
<tr>
<td>Combustible materials, (e.g., paper, leaves, weeds, dry grass, debris)</td>
<td>15 ft 4.5 m</td>
</tr>
<tr>
<td>Incompatible hazardous materials</td>
<td>20 ft 6.1 m</td>
</tr>
<tr>
<td>Building exits</td>
<td>10 ft 3.1 m</td>
</tr>
</tbody>
</table>

Point-of-Fill Connections.

Point-of-fill connections serving stationary containers filled by mobile transport equipment shall not be positioned closer to exposures than the minimum distances in Table 63.9.14.1.

Fire Barriers.

A 2-hour fire barrier wall shall be permitted in lieu of the distances specified by Table 63.9.14.1 when in accordance with the provisions of 63.9.15.4 through 63.9.15.8.

The fire barrier wall shall be without openings or penetrations.
63.9.14.3.1.1
Penetrations of the fire barrier wall by conduit or piping shall be permitted provided that the penetration is protected with a firestop system in accordance with the Building Code. [55: 13.9.2.1.1]

63.9.14.3.2
The fire barrier wall shall be either an independent structure or the exterior wall of the building adjacent to the storage system. [55: 13.9.2.2]

63.9.14.3.3
The fire barrier wall shall be located not less than 5 ft (1.5 m) from any exposure. [55: 13.9.2.3]

63.9.14.3.4
The fire barrier wall shall not have more than two sides at approximately 90 degree (1.57 rad) directions or not more than three sides with connecting angles of approximately 135 degrees (2.36 rad). [55: 13.9.2.4]

Submitter Information Verification

Submitter Full Name: Janna Shapiro
Organization: National Fire Protection Assoc
Street Address:
City:
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Submittal Date: Tue Oct 11 15:42:18 EDT 2016

Committee Statement

Committee Statement: The technical committee recognized the need for guidance on the use of CO2, as it has become more prevalent in restaurants, mercantile, and other non-industrial facilities.

Response Message:
A.34.10.4.1

Pallets staged outdoors at pallet manufacturing and recycling facilities should not be defined as idle (i.e., not active or not in use) considering that these facilities stage work-in-process pallets in an active management environment according to the following:

1. Pallets are the primary business activity at these manufacturing and recycling facilities.
2. Pallet inventories are organized in a specific manner based on size and quality.
3. Pallet inventories are rotated on a routine basis.
4. Personnel are a frequent presence in the staging area during hours of operation.

Combustible pallets listed and labeled to ANSI/FM 4996, *Classification of Pallets and Other Material Handling Products as Equivalent to Wood Pallets*, or to UL 2335, *Standard for Fire Tests of Storage Pallets*, should be treated as wood pallets.

Submitter Information Verification

Submitter Full Name: Kristin Bigda
Organization: National Fire Protection Assoc

Committee Statement

Committee Statement: Revision adds the appropriate references for fires tests for listing of combustible pallets. The committee does not accept the language "for determining sprinkler protection" as submitted as it is not applicable to outdoor storage.

Response Message:

Public Comment No. 68-NFPA 1-2016 [Section No. A.34.10.4.1]
Annex F  Fire Fighter Breathing-Air Replenishment Systems

*This annex is not a part of the requirements of this NFPA document unless specifically adopted by the AHJ.*

**F.1  General.**

Where required by the AHJ, fire fighter breathing-air replenishment systems shall comply with Appendix F of the *Uniform Plumbing Code*.

---

**Submitter Information Verification**

**Submitter Full Name:** Kristin Bigda  
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**State:**  
**Zip:**  
**Submittal Date:** Wed Oct 12 13:28:00 EDT 2016

**Committee Statement**

**Committee Statement:** New Annex provides necessary guidance for those jurisdictions using fire fighter air replenishment systems. The systems are not mandated by the Code, rather the Annex is provided solely to provide assistance to those AHJs needing to enforce them.

**Response Message:**

Public Comment No. 2-NFPA 1-2016 [Global Input]
G.1.1 NFPA Publications.
National Fire Protection Association, 1 Batterymarch Park, Quincy, MA 02169-7471.


NFPA 1035, Standard on Fire and Life Safety Educator, Public Information Officer, Youth Firesetter Intervention Specialist, and Youth Firesetter Program Manager Professional Qualifications, 2016 edition.


NFPA 2113, Standard on Selection, Care, Use, and Maintenance of Flame-Resistant Garments for Protection of Industrial Personnel Against Short-Duration Thermal Exposures, 2015 edition.
SFPE Engineering Guide.

Submitter Information Verification

Submitter Full Name: Kristin Bigda
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City: 
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Submittal Date: Wed Nov 09 21:28:36 EST 2016

Committee Statement

Committee Statement: Reference update.
Response Message:
G.1.1 NFPA Publications.
National Fire Protection Association, 1 Batterymarch Park, Quincy, MA 02169-7471.
NFPA 77, Recommended Practice on Static Electricity, 2014 edition.


NFPA 1035, Standard on Fire and Life Safety Educator, Public Information Officer, Youth Firesetter Intervention Specialist, and Youth Firesetter Program Manager Professional Qualifications, 2016 edition.


NFPA 2113, Standard on Selection, Care, Use, and Maintenance of Flame-Resistant Garments for Protection of Industrial Personnel Against Short-Duration Thermal Exposures, 2015 edition.
SFPE Engineering Guide.

Submitter Information Verification

Submitter Full Name: Kristin Bigda
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Street Address:
City:
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Submittal Date: Fri Nov 18 13:59:44 EST 2016

Committee Statement

Committee Statement: Reference update.
Response Message:
Second Revision No. 74-NFPA 1-2016 [Section No. F.1.2.2]

**G.1.2.2 ANSI Publications.**

- American National Standards Institute, Inc., 25 West 43rd Street, 4th Floor, New York, NY 10036.
  - ANSI/ISA-61241-10 (12.10.05), *Electrical Apparatus for Use in Zone 20, Zone 21, and Zone 22 Hazardous (Classified) Locations — Classification of Zone 20, Zone 21, and Zone 22 Hazardous (Classified) Locations*, 2004.

**Submitter Information Verification**

- **Submitter Full Name:** Kristin Bigda
- **Organization:** National Fire Protection Assoc
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- **City:**
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- **Zip:**
- **Submittal Date:** Thu Oct 13 13:50:34 EDT 2016

**Committee Statement**

- **Committee Statement:** Reference update.
- **Response Message:**
G.1.2.3 API Publications.

American Petroleum Institute, 1220 L Street NW, Washington, DC 20005-4070.

“An Engineering Analysis of the Effects of Oxygenated Fuels on Marketing Vapor Recovery Equipment,”
September 1990.

API Specification 12R1, Setting, Maintenance, Inspection, Operation, and Repair of Tanks in Production


API RP 500, Recommended Practice for Classification of Locations for Electrical Installations at
Petroleum Facilities Classified as Class I, Division I and Division 2, 3rd edition, 2012.

ANSI/API RP 505, Recommended Practice for Classification of Locations for Electrical Installations at
Petroleum Facilities Classified as Class I, Zone 0, and Zone 2, 2002.

API 620, Recommended Rules for the Design and Construction of Large, Welded, Low-Pressure Storage


API RP 1632, Cathodic Protection of Underground Petroleum Storage Tanks and Piping Systems, 3rd

API 2003, Protection Against Ignition Arising Out of Static, Lightning, and Stray Currents, 7th edition,
2008.


API RP 2016, Guidelines and Procedures for Entering and Cleaning Petroleum Storage Tanks, 1st edition,
reaffirmed 2006.

API 2218, Fireproofing Practices in Petroleum and Petrochemical Processing Plants, 2nd 3rd edition,
1999 2013.


API Standard 2610, Design, Construction, Operation, Maintenance, and Inspection of Terminal & Tank

“An Engineering Analysis of the Effects of Oxygenated Fuels on Marketing Vapor Recovery Equipment,”
September 1990.


Submitter Information Verification

Submitter Full Name: Kristin Bigda
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Street Address:
City:
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Committee Statement

Committee Statement: Reference update.
Response Message:

Public Comment No. 40-NFPA 1-2016 [Chapter F]
Second Revision No. 76-NFPA 1-2016 [ Section No. F.1.2.5 ]

G.1.2.5 ASME Publications.
American Society of Mechanical Engineers, Two Park Avenue, New York, NY 10016-5990.
Boiler and Pressure Vessel Code, 2015.

Submitter Information Verification

Submitter Full Name: Kristin Bigda
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Street Address:
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Submittal Date: Thu Oct 13 14:17:48 EDT 2016

Committee Statement

Committee Statement: Reference update.
Response Message:
G.1.2.6 ASTM Publications.


ASTM E2174, Standard Practice for On-Site Inspection of Installed Fire Stops, 2010ae1.


Submitter Full Name: Kristin Bigda
Organization: National Fire Protection Assoc

Committee Statement

Committee Statement: Reference update.
Response Message:
Public Comment No. 52-NFPA 1-2016 [Section No. F.1.2.6]
Second Revision No. 78-NFPA 1-2016 [ Section No. F.1.2.7 ]

G.1.2.7 AWS Publications.
American Welding Society, 550 NW LeJeune Road 8669 N.W. 36 Street #130, Miami, FL 33126-6672.

Submitter Information Verification

Submitter Full Name: Kristin Bigda
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State:
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Submittal Date: Fri Oct 14 12:43:07 EDT 2016

Committee Statement

Committee Statement: Reference update.
Response Message:
Second Revision No. 87-NFPA 1-2016 [ New Section after F.1.2.11 ]

Submitter Information Verification

Submitter Full Name: Kristin Bigda
Organization: National Fire Protection Assoc
Street Address:
City:
State:
Zip:
Submittal Date: Tue Oct 18 09:29:43 EDT 2016

Committee Statement

Committee Statement: Reference update.
Response Message:
G.1.2.11  FAA Publications.
Federal Aviation Administration, U.S. Department of Transportation, 800 Independence Avenue, SW, Washington, DC 20591.

Submitter Information Verification

Submitter Full Name: Kristin Bigda
Organization: National Fire Protection Assoc
Street Address: 
City: 
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Submittal Date: Fri Oct 14 12:54:18 EDT 2016

Committee Statement

Committee Statement: Reference update.
Second Revision No. 82-NFPA 1-2016 [ New Section after F.1.2.16 ]

G.1.2.19 NACE Publications.
NACE International, 15835 Park Ten Place, Houston, Texas 77084.

Submitter Information Verification

Submitter Full Name: Kristin Bigda
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Street Address:
City:
State:
Zip:

Committee Statement

Committee Statement: Reference update.
Response Message:
Second Revision No. 80-NFPA 1-2016 [Section No. F.1.2.17]

G.1.2.20 PEI Publications.

Petroleum Equipment Institute, P.O. Box 2380, Tulsa, OK 74101-2380.


Submitter Information Verification

Submitter Full Name: Kristin Bigda
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Street Address:
City:
State:
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Submittal Date: Fri Oct 14 13:02:40 EDT 2016

Committee Statement

Committee Statement: Reference update.
Response Message:
Second Revision No. 81-NFPA 1-2016 [ Section No. F.1.2.20 ]

G.1.2.23 STI Publications.

Steel Tank Institute, 570 Oakwood Road, Lake Zurich, IL 60047.


STI RP 01-69, Recommended Practice for Control of External Corrosion of Underground or Submerged Metallic Piping Systems.


STI R 931, Double Wall AST Installation and Testing Instructions, 2011.

STI RP R011, Recommended Practice for Anchoring of Steel Underground Storage Tanks, 2006.


Submitter Information Verification

Submitter Full Name: Kristin Bigda
Organization: National Fire Protection Assoc
Street Address:
City:
State:
Zip:
Submittal Date: Fri Oct 14 13:08:56 EDT 2016

Committee Statement

Committee Statement: Reference update.
Response Message:
G.1.2.25 UL Publications.
Underwriters Laboratories Inc., 333 Pfingsten Road, Northbrook, IL 60062-2096.


UL 87A, Standard for Power-Operated Dispensing Devices for Gasoline and Gasoline/Ethanol Blends with Nominal Ethanol Concentrations Up to 85 Percent (E0-E85), 2015.


ANSI/UL 263, Standard for Power-Operated Dispensing Devices for Gasoline and Gasoline/Ethanol Blends with Nominal Ethanol Concentrations Up to 85 Percent (E0-E85), 2015.


ANSI/UL 2085, Standard for Protected Aboveground Tanks for Flammable and Combustible Liquids.

Submitter Information Verification

Submitter Full Name: Kristin Bigda
Organization: National Fire Protection Assoc
Street Address: 
City: 
State: 
Zip: 
Submital Date: Fri Oct 14 13:33:38 EDT 2016

Committee Statement

Committee Statement: Reference update.
Response Message:
G.2 References for Extracts.
The following documents are listed here to provide reference information, including title and edition, for extracts given throughout the nonmandatory sections of this code as indicated by a reference in brackets [ ] following a section or paragraph. These documents are not a part of the requirements of this document unless also listed in Chapter 2 for other reasons.


Submitter Information Verification

Submitter Full Name: Kristin Bigda
Organization: National Fire Protection Assoc
Street Address:
City: 
State: 
Zip: 
Submittal Date: Tue Nov 22 10:37:56 EST 2016

Committee Statement

Committee Statement: Reference update.
Response Message: